Asthma in Missouri:

Southwest Area

UNIVERSITY OF MISSOURI,
DEPARTMENT OF CHILD HEALTH
ASTHMA READY© COMMUNITIES

FOCUS ON INNOVATION AND CONTINUOUS IMPROVEMENT

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UNIVERSITY OF MISSOURI
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Cover photo: Roaring River Spring by Joseph Sparks

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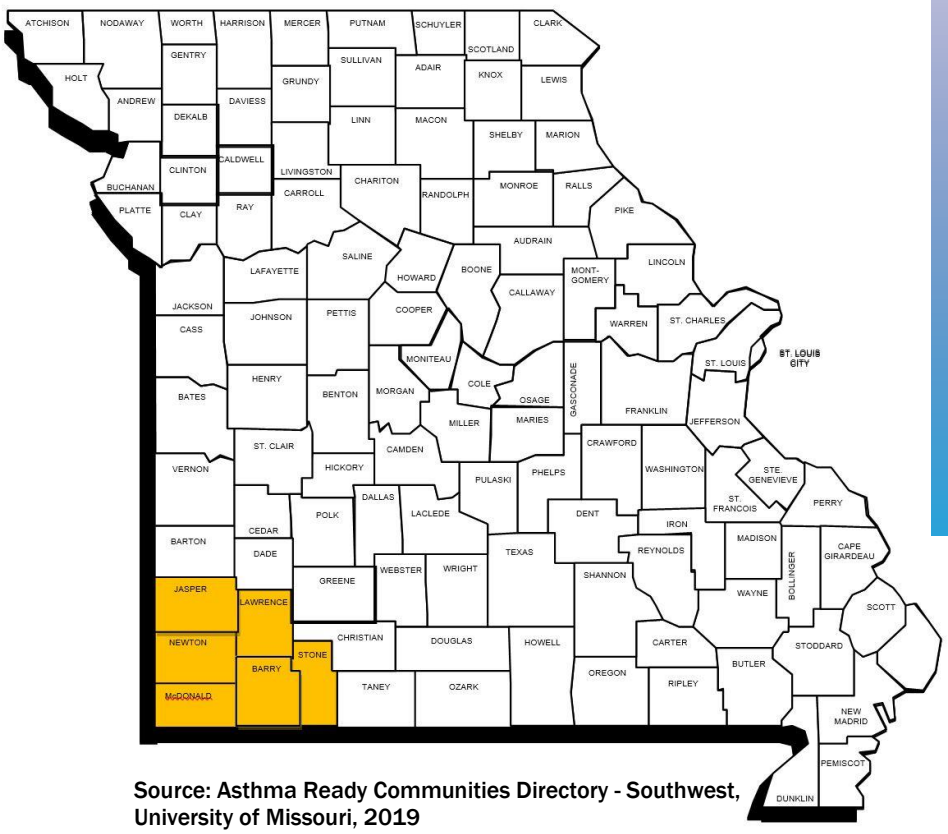
Abstract

Asthma is a serious respiratory condition affecting one-half million people in Missouri including more than 120,000 children. According to the Behavioral Risk Factor Surveillance System, the prevalence of asthma among children and teens aged 0 to 17 years in Missouri was 8.7% in 2017, with the southwest region prevalence (4.8%) almost one-half that of the state (-45%). However, many of the children within the southwest six counties (i.e., Barry, Jasper, Lawrence, McDonald, Newton, and Stone) have persistent and/or uncontrolled asthma resulting in substantial morbidity and costs.

To inform and guide geographic distribution of interventions, analysis of Medicaid administrative claims data indicated areas in Missouri including the southwest counties where children are experiencing persistent asthma and population-based panel reports indicated a substantial proportion have uncontrolled asthma. Of the 18,032 total asthma emergency department (ED) visits that occurred among individuals living in the southwest six-counties (2004-2015), almost one-third (32.7%, 5,896) were among children 0 to 17 years of age. For the same 12-year period, there were a total of 3,315 asthma hospitalizations for people from the six counties with 26.4% (874) among children. In 2015, inpatient hospital charges for asthma in the southwest area totaled $4.9 million and children aged 0 to 17 years accounted for about $411,000. Medicaid accounted for the largest pay source followed by commercial insurance. In the southwest area, approximately 70% of the hospital charges were expected from Medicaid versus 66% for the state. While asthma morbidity continues, there have been significant declines over time in this area with asthma ED visits and hospitalizations rates cut by about one-half among children (2004-2015). For those aged 0 to 19 the asthma hospital admissions rates by month for the southwest area indicated two peak periods: 1) March and 2) October. Also shown was a substantial low plateau in asthma hospital admissions in this area for children and teens for the months of May - July.

The southwest six-county area has 31 public school districts as well as private schools, a college, a university, and alternative and vocational schools. The most populous school districts are Joplin Schools in Jasper County (7,714 students), followed by Carthage R-IX (5,063 students) also in Jasper County, and Neosho School District (4,664 students) in Newton County. The southwest school districts combined have more than 50,000 total students representing approximately 6% of the enrollment in public schools in Missouri. The health care system in the southwest area includes primary care providers, hospitals, clinics, community health centers, public health, mental health services, schools, Medicaid and care management services, and community partners. There are many churches and community resources also available.

Figure 1. Southwest counties, Missouri, 2019



Source: Asthma Ready Communities Directory - Southwest, University of Missouri, 2019

Asthma in Missouri Six Counties in Southwest Missouri

- **Barry**
- **Jasper**
- **Lawrence**
- **McDonald**
- **Newton**
- **Stone**

Southwest Area

Asthma is a chronic respiratory condition that affects millions of adults and children in the United States,[1] In Missouri, more than one-half million people are living with asthma including an estimated 440,000 adults and 120,000 children (2017).[2] This report explores the burden of asthma and community resources in six counties that comprise the southwest area of Missouri: Barry, Jasper, Lawrence, McDonald, Newton, and Stone (Figure 1).

- ***Barry County***: Monett is the largest city in the county and Cassville is the county seat. One in five of the population is 0 to 17 years of age and the Hispanic population percentage is more than twice that of the state (Table 1). It has Roaring River State Park and Mark Twain National Forest which comprises 11% of Missouri's forest.

- ***Jasper County*** has the largest population of the six counties. Joplin is the largest city in the county and is located in southern Jasper County and northern Newton County.

Table 1. Characteristics and select indicators for the southwest six counties and Missouri, 2018 *

Characteristic	*Barry*	*Jasper*	*Lawrence*	*McDonald*	*Newton*	*Stone*	*Missouri*
Total pop.	35,886	120.636	38,359	23,078	58,266	31,749	6,126,452
	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Age [y] / Sex							
0 - 17	22.7	25.0	25.2	25.8	23.7	16.4	22.5
18 - 64	56.7	59.4	56.5	58.9	58.2	52.6	60.6
≥ 65	20.6	15.6	18.3	15.3	18.1	31.0	16.9
Female	49.4	51.2	50.4	49.5	50.1	51.0	50.9
Education							
≥ Bachelor's degree [a,b]	12.8	22.7	15.9	12.7	19.4	18.4	28.2
Race							
White	93.9	90.8	95.6	87.0	90.4	96.6	83.0
African American	0.6	2.4	0.6	2.2	1.0	0.4	11.8
American Indian / Alaska Native	1.3	1.8	1.2	3.1	2.6	0.9	0.6
Asian	2.1	1.3	0.6	1.5	1.5	0.4	2.1
Other race	2.1	3.7	2.0	6.2	4.5	1.7	2.5
Hispanic / Latino	10.0	8.3	7.7	11.7	5.6	2.4	4.3
			Indicators				
No health insurance < age 65	17.5	14.2	13.6	20.3	15.9	14.6	11.2
Persons in poverty	18.8	16.6	15.5	17.9	16.0	13.4	13.2
Households without a computer [b]	21.2	16.1	17.8	24.5	18.5	15.1	14.4

* Southwest counties: Barry, Jasper, Lawrence, McDonald, Newton, and Stone.
[y] *Years*
[a] *Persons age 25 years+*
[b] *2013-2017*
Source: U.S. Census Bureau. Quick Facts

- ***Lawrence County*** is located in an area of the Ozarks and the county seat is Mount Vernon. Approximately one-fourth of the population is 0 to 17 years of age and one in five adults have a bachelor's degree or higher education.

- ***McDonald County*** is part of the Fayetteville-Springdale-Rodgers, AR-MO metropolitan area and the county seat is Pineville. Approximately one-fourth of its population is 0 to 17 years of age and has the largest population of American Indian / Alaska Native and Hispanic / Latino populations of the six-county area and greater than the state. It also has the highest prevalence of no health insurance among those aged < 65 years, persons in poverty, and households without a computer compared to the other counties and Missouri.

- ***Newton County*** is part of the Joplin, MO metropolitan statistical area and the county seat is Neosho. About one-fifth of its population is 0 to 17 years of age and has the second largest percentage of American Indian / Alaska Native population of the counties.

- ***Stone County*** is part of the Branson, MO micropolitan statistical area and the county seat is Galena. Compared to the other counties and Missouri, it has a low percentage of children 0 to 17 years of age and is the least diverse.

In general, the population in the six-county southwest area is predominately white (> 90% in each county with the exception of McDonald County); have median household incomes ranging from $40,638 (Barry County) to $46,723 (Newton County) compared to $51,542 in the state; and considerable proportions of the populations are without health insurance and living in poverty.

Asthma Prevalence

According to the Behavioral Risk Factor Surveillance System's (BRFSS) expanded southwest region comprising 20 counties, the prevalence of current asthma among adults (10.6%) is similar to the state prevalence (9.6%) in 2015 (Table 2).[3] However, among children aged 0 to 17 years, the prevalence of current asthma in the BRFSS southwest region was 45% lower than the state rate (4.8% v 8.7%, respectively).

Table 2. Prevalence of current asthma among children aged 0-17 and adults aged ≥ 18 years, Southwest Region and Missouri, 2015

	Adult % 95% Confidence Interval	Child % 95% Confidence Interval
Southwest Region	10.6 7.0 - 14.3	4.8 0.1 - 9.6
Missouri	9.6 8.6 - 10.6	8.7 6.7 - 10.6

Source: Missouri Department of Health and Senior Services. Behavioral Risk Factor Surveillance System.

Asthma Control

Asthma currently affects an estimated 25 million people in the United States (7.7% adults and 7.5% of children) (2018). While asthma occurs among all population groups, it is particularly a health issue among children and teens and is more common among African-Americans and in households with lower incomes and education. While asthma cannot be cured, the goal is optimal control. Well controlled asthma results in increased productivity and low morbidity and overall health costs.

Approximately 55% of children with asthma in Missouri are uncontrolled.[4] This leads to frequent symptoms and urgent asthma attacks resulting in impairment (e.g., interference with sleep and normal activity), absenteeism from school, and a disproportionate share of emergency department (ED) visits and hospitalizations. More than one-third of Missouri asthma ED visits (42.2%) and hospitalizations (31.5%) occurred among children 17 and younger in 2015.

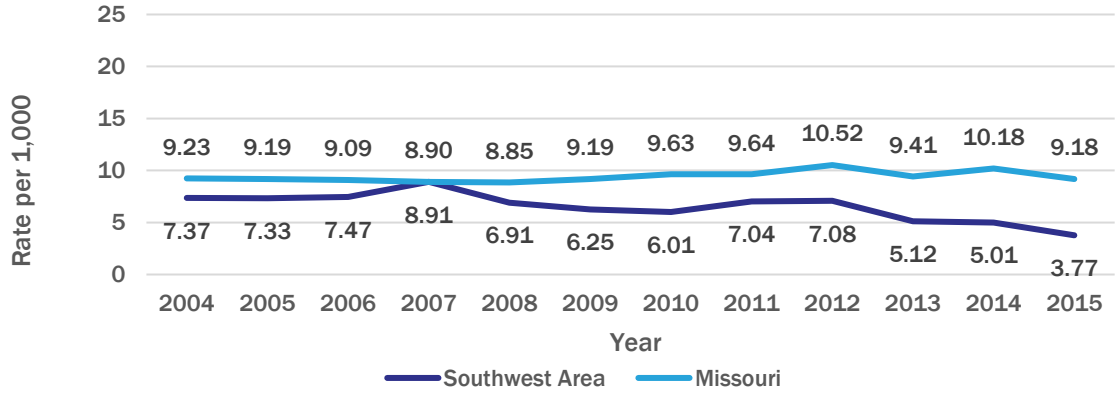
More than one-half of children with asthma in Missouri have uncontrolled asthma

Centers for Disease Control and Prevention, 2012-2014 [4]

Emergency Department Visits

Of the 18,032 total asthma emergency department (ED) visits that occurred among individuals living in the southwest six counties (2004-2015), 32.7% (5,896) were among children 0 to 17 years of age. However, the asthma ED visit rates among children in the southwest area were consistently below that for Missouri (Figure 2) with the exception of 2007. In addition, while the asthma ED visit rates among this age group have remained relatively stable in Missouri, there has been a significant decrease in the southwest area comparing 2004 and 2015, (7.37, 95% CI 6.76 - 7.99 v 3.77, 95% CI 3.34 - 4.24 per 1,000 children) (-48.8%).

Figure 2. Asthma emergency department visit rates among children aged 0 to 17 years, Southwest Area and Missouri, 2004-2015

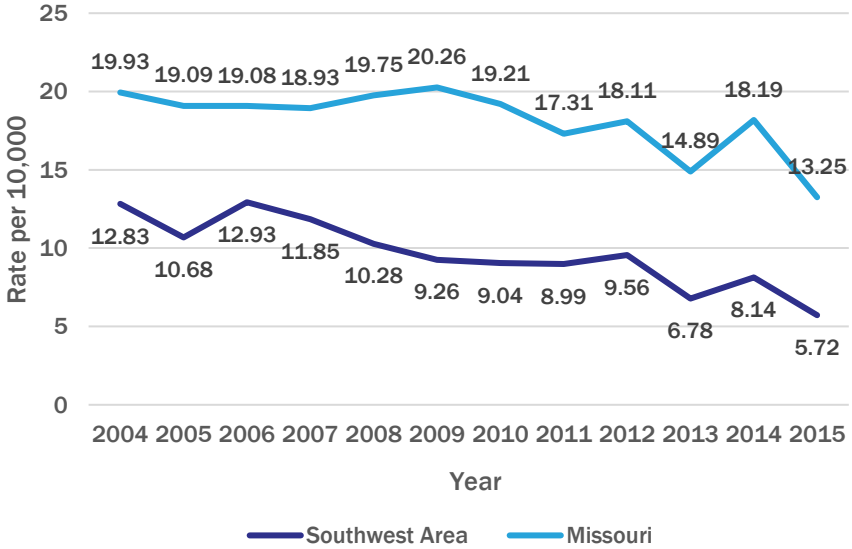


Southwest Area Counties: Barry, Jasper, Lawremce. McDonald, Newton, and Stone.
Source: Missouri Department of Health and Senior Services. Missouri Public Health Information Management System (MOPHIMS), Emergency Room Missouri Information for Community Assessment (MICA).

Hospitalizations

For the same 12-year period (2004-2015), there were a total of 3,315 asthma hospitalizations for people living in the southwest six-county area with 26.4% (874) among children 0 to 17 years of age. In Missouri, there was a statistically significant annual average decline of 2.5% in asthma hospitalizations among children 0 to 17 years of age 2004-2015 (Figure 3). The southwest area also showed a significant decline in asthma hospitalizations among children comparing 2004 to 2015 (12.83, 95% CI 10.38 – 15.68 v 5.72, 95% CI 4.12 – 7.73) (-55.4%).

Figure 3. Rate of asthma hospitalizations among children aged 0 to 17 years, Southwest Area and Missouri, 2004-2015

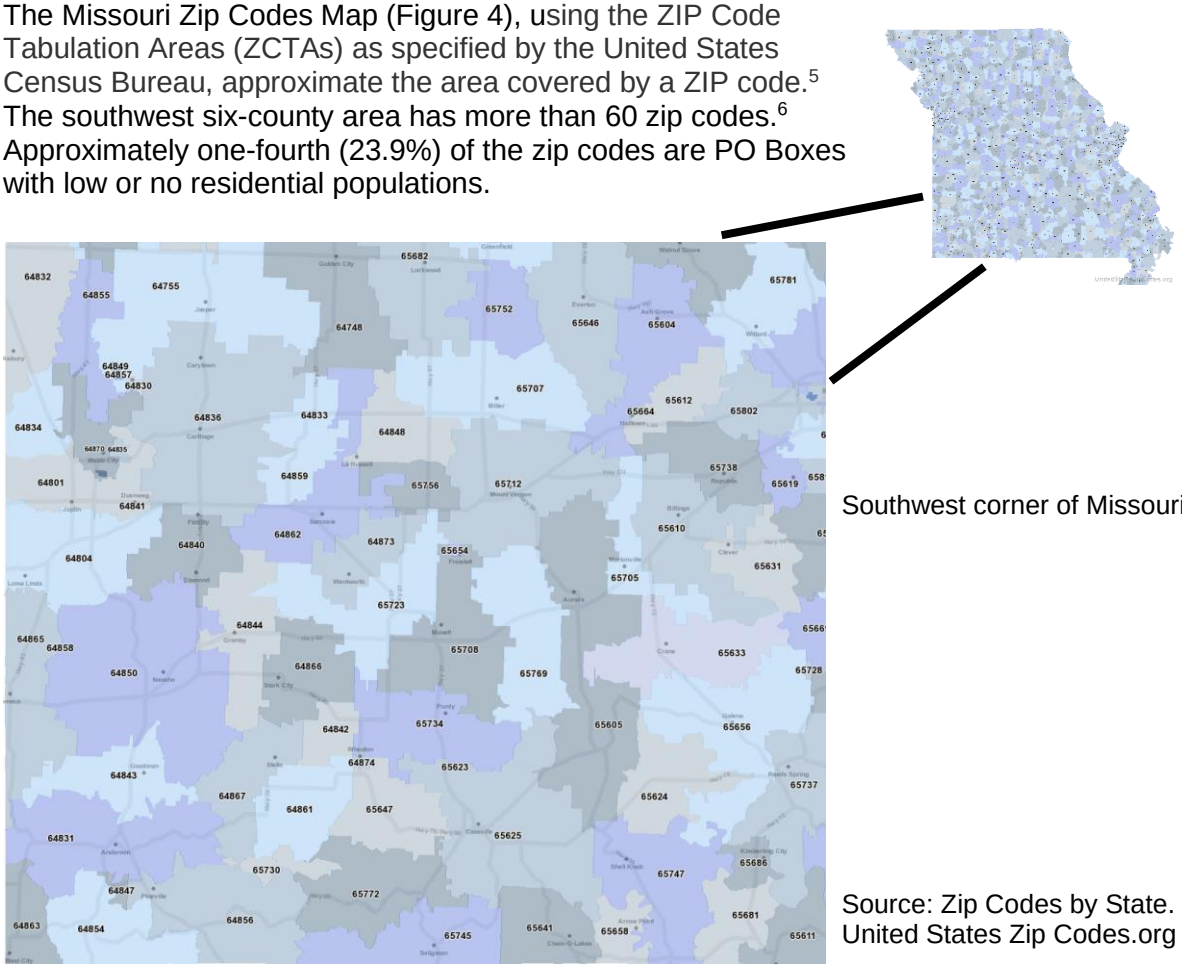


Southwest Area Counties: Barry, Jasper, Lawremce. McDonald, Newton, and Stone.
Source: Missouri Department of Health and Senior Services. Missouri Public Health Information Management System (MOPHIMS), Emergency Room Missouri Information for Community Assessment (MICA).

Zip Codes

Figure 4. Missouri Zip Codes, 2019

The Missouri Zip Codes Map (Figure 4), using the ZIP Code Tabulation Areas (ZCTAs) as specified by the United States Census Bureau, approximate the area covered by a ZIP code.[5] The southwest six-county area has more than 60 zip codes.[6] Approximately one-fourth (23.9%) of the zip codes are PO Boxes with low or no residential populations.



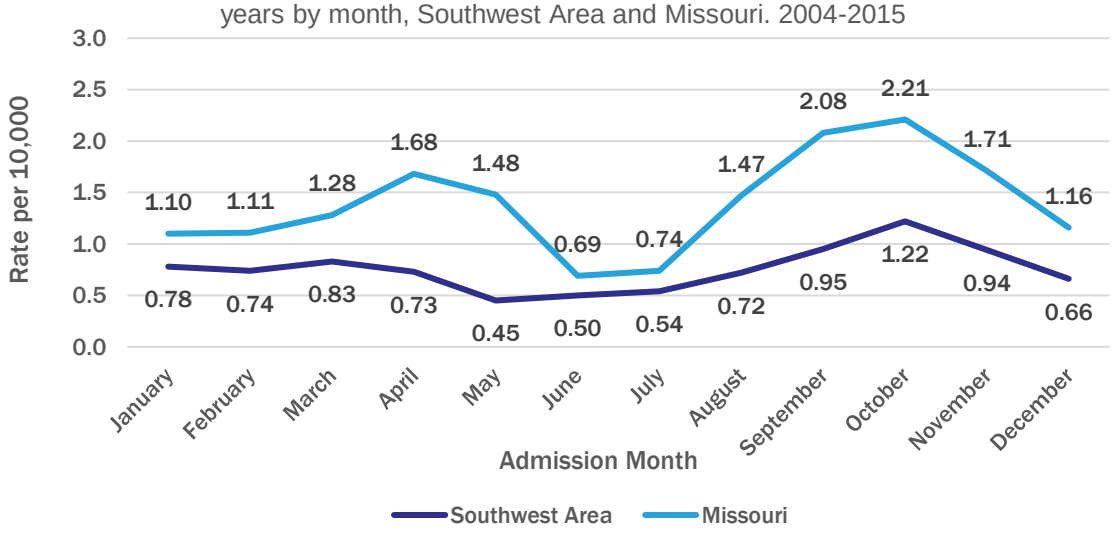
Southwest corner of Missouri

Source: Zip Codes by State. United States Zip Codes.org

Asthma Seasonality

Asthma ED visits and hospitalizations have seasonal patterns. For children and teens aged 0 to 19, the asthma hospital admissions rates by month for the southwest area and Missouri show a bimodal distribution indicating two peak periods (Figure 5). For the southwest area, the peak months are March and October, and for Missouri the months are April and September through October. Also shown are the substantial low plateaus in asthma hospital admissions for children and teens May through July in the southwest area and June and July in Missouri.

Figure 5. Asthma inpatient hospital admission rates for children aged 0 to 19 years by month, Southwest Area and Missouri. 2004-2015



Southwest Region Counties: Barry, Jasper, Lawremce. McDonald, Newton, and Stone.
Source: Missouri Department of Health and Senior Services. Missouri Public Health Information Management System (MOPHIMS), Environmental Public Health Tracking.

In 2015, inpatient hospital charges for asthma in Missouri totaled $105 million with $4.9 million for the southwest six county area or almost 5% of the state's asthma charges. Among children and teens aged 0 to 17 with asthma as the primary diagnosis in Missouri, charges totaled $20.8 million and children / teens from the southwest six-county area accounted for about 2% ($411,000) of these charges. Medicaid accounted for the largest pay source followed by commercial insurance for asthma hospital charges for both the southwest area and Missouri. In the southwest area for children aged 0 to 17 years, 70% of the charges were expected from Medicaid versus 66% for the state. As these data show, much of the asthma burden is on children and families enrolled in Medicaid.

Interventions

To focus interventions in areas of greatest need, a population risk framework along with a health care delivery and communication system were developed. This system guides intervention deployment, provides healthcare referrals and access, and provides information for process and outcomes evaluation. Through an outcomes focused collaborative, Medicaid administrative claims data using risk indicator algorithms, are used to generate de-identified population-based panel risk reports and maps to identify and provide care to children with uncontrolled asthma in Missouri. Risk indicators such as frequent asthma acute care visits (i.e., emergency visits and hospitalizations) and medication overuse (i.e., short acting beta agonists or systemic oral steroids) or underuse (low control medication use) are used. This information is translated and provided to providers, school nurses, and care managers as an asthma population panel report

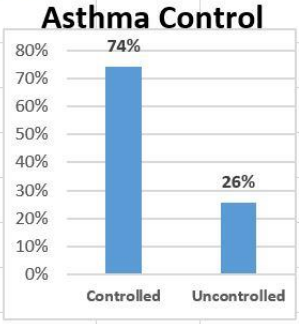
for children enrolled in MO HealthNet to inform care management and practices (Figure 6). The asthma risk panel report for children, teens and young adults (< 21 years) in the southwest region indicates that slightly more than one-fourth (26.0%) had uncontrolled asthma and a large proportion sought care through ED visits (23%).

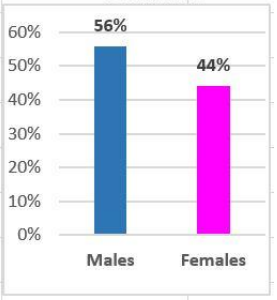
Figure 6. **Asthma Dash Board Southwest Region**

Data Range Between 8/1/18 and 7/31/2019

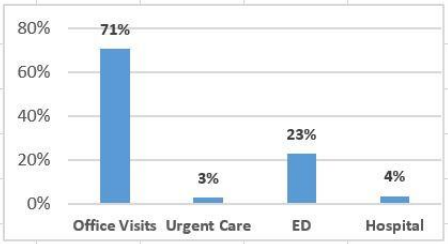
WHO ARE MY ASTHMA PATIENTS?

Ages	
Under 21	3348
Total Pts w/Asthma	3348
Patients at risk for exacerbation per MIPS 398 (2 or more ACD's):	231





WHERE ARE THEY GETTING CARE?



POPte Score = 71%

Proportion of
Outpatient +
Preventive Visits to
Total
Encounters

0% means all asthma care is taking place in the emergency room or hospital. **100%** is a perfect score, where all asthma care is provided with outpatient or preventive encounters.

WHAT MEDICATIONS ARE THEY TAKING?

ICS	Percentage of all asthma patients who filled at least 1 ICS	25%
	Mean possession rate for patients who filled at least 1 ICS	30%
	Mean possession rate for patients w/uncontrolled asthma	15%
	Mean possession rate for all patients	8%
OCS	Total oral steroid bursts filled for all patients	2298
	Average OCS bursts per patient	0.69
	Number of patients with at least 2 OCS bursts	499

WHAT OPPORTUNITIES FOR CARE AM I MISSING?

Missed office visits based on 2 visits/yr for all patients		3263
Missed office visits based on 2/yr for controlled & 4/yr for uncontrolled		4989
Based on control, number of patient needing return visits in:	30-60 days:	201
	60-90 days:	75
	90-120 days:	3042
Missed opportunity to bill 94664 inhaler training for each patient just once a year		3278

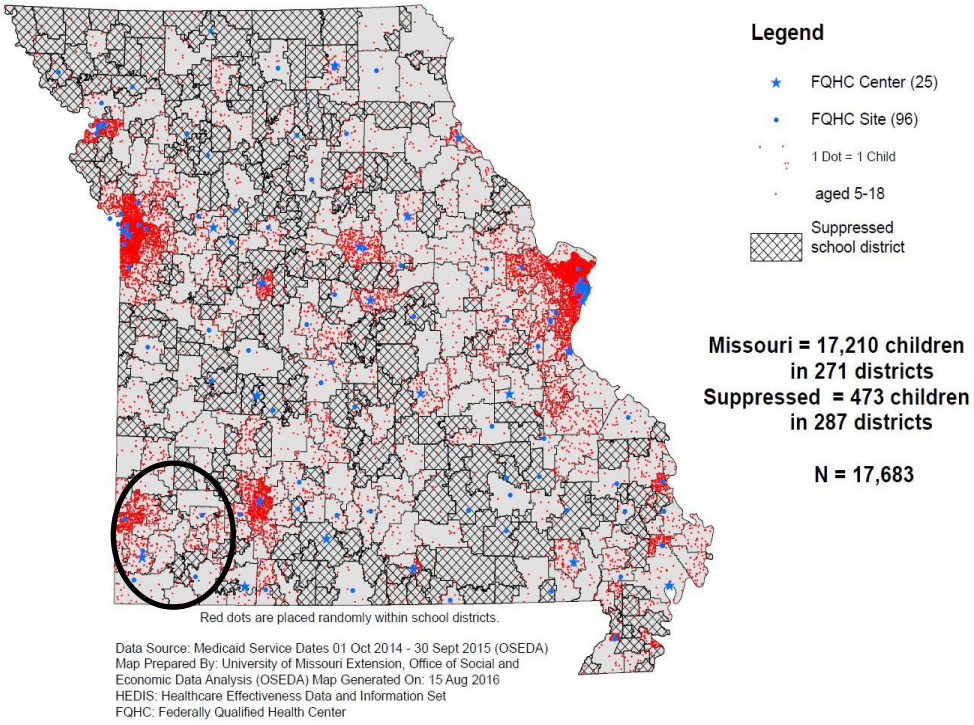
WHAT OTHER SERVICES CAN I OFFER?

Number of patients who are eligible for Health Home Enrollment	949
Number of patients who are eligible for a Home Environmental Assessment	154

MIPS=Merit-Based Incentive Payment System, ACD=Acute Care Day, ICS=Inhaled Corticosteroid, OCS=Oral Corticosteroid

The map (Figure 7) shows several concentrated areas of children with persistent asthma enrolled in MO HealthNet (Medicaid) including in the southwest area. Persistent asthma was defined by the Healthcare Effectiveness Data and Information Set (HEDIS) as having 1 asthma inpatient admission or emergency department visit or 4 asthma medication dispensing events, or 4 outpatient asthma visits and at least 2 asthma medication dispensing events.

Figure 7. Children with Medicaid with HEDIS persistent asthma by school district, Missouri, 2014-2015



Applying the data and implementing evidence-based practices and community-wide interventions in the southwest region are showing results as demonstrated in the decline of asthma ED and hospitalizations among children and teens. Legacy interventions such as the Childhood Asthma Linkages in Missouri (CALM) project,[7] early childhood initiative,[8] and asthma care professional development[9,10] and current interventions (collaborative learning combined with health system, primary care, and community initiatives, particularly schools), are contributing to advances in the long-term outcomes of asthma control. Collaborative learning participants include MD/DOs, RN/NPs, RTs, LPNs, MAs, CHWs, PhDs, students, and others. The Asthma Ready Communities (ARC) data contained almost 500 activity records based on zip codes for the southwest area (Table 3). Other interventions and initiatives such as primary care health homes, home environmental assessments, and asthma panel risk reports also support and contribute to improving asthma outcomes and reducing costs.

Table 3. Key interventions to reduce pediatric asthma risk and improve control, Southwest MO*, 2007-2020

Intervention	Percent of participation records
Becoming an Asthma Educator & Care Manager	**32.6**
Extension for Community Healthcare Outcomes (ECHO)	**23.5**
• Impact Asthma – *Essentials*	21.3
• Asthma Care Accelerator – *Quality Improvement / Maintenance of Certification (QI/MOC)*	2.0
• Asthma Care & Education - *Community*	0.2
Asthma Ready Clinic Training I and II	**16.2**
Childhood Asthma Linkages in Missouri 2	**11.5**
Teaming Up for Asthma Control	**7.3**
Additional support – asthma care & education programs and site visits, EPR3 guidelines, and counseling for asthma risk reduction	**4.9**
Asthma Empowerment	**3.8**
Asthma Academy	
Asthma Day	
ARC designation	
Programs – *Acting on Behalf of My Child* and Asthma Care Everyday	
Community Health Worker education and training	
Presentations	**0.2**

Source: University of Missouri, Asthma Ready Communities (ARC). Southwest activity records = 494.

*Counties include Barry, Jasper, Lawrence, McDonald, Newton, and Stone.

Community Agencies

There are many community resources available in the southwest area. Information on these sources is available through the following:

- Directory of Community Resources by the Southwest Missouri Minority Health Alliance https://health.mo.gov/living/families/minorityhealth/pdf/SWResourceDirectory.pdf [11]
- The Lawrence, McDonald, Barry County Assistance Program. https://www.needhelppayingbills.com/html/lawrence-_mcdonald-_barry_coun.html [12]
- The Independent Living Center. Southwest Missouri Area Agency Resource Directory, 2014. https://ilcenter.org/document-uploads/agency-directory.pdf [13]
- Joplin Area Resource Guide, 2019 by the Alliance. https://www.theallianceofswmo.org/2015-joplin-area-resource-guide/ [14]

Linking acute care with community agencies such as churches and schools can have a substantial impact on improving asthma control among children and teens while lowering overall health care costs. [9,15]

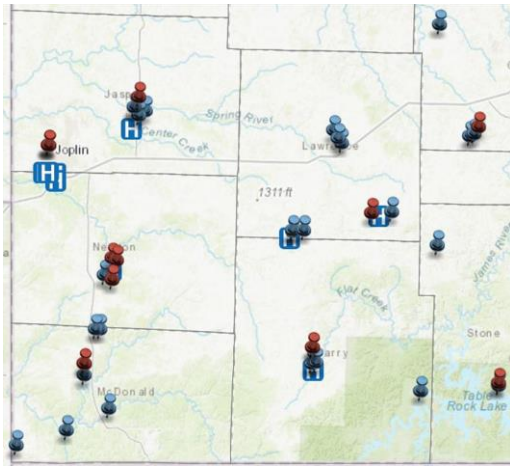
Churches

Three counties (Barry, Jasper, and Lawrence) of the six counties in the southwest area have 20.1 to 40.0 percent of the population affiliated with some type of religion.[16] The other three counties (Newton, McDonald and Stone) have less than 20.1 percent of the population affiliated with a religion. The southwest area includes Southern Baptist, Methodist, Presbyterian, Catholic, Jehovah Witnesses, Christian, non-denominational, and other churches and religious organizations.

Health Systems

The health care system is comprised of primary care providers, hospitals, clinics, community health centers, public health, mental health services, school nurses, Medicaid and care management services, and community partners. Health systems include Landmark, Mercy, Family Practice, Access Family Care, Cox, and Ozarks Community hospitals and clinics. The southwest area hospitals federally qualified health centers, and rural health clinics are shown in Figure 8.

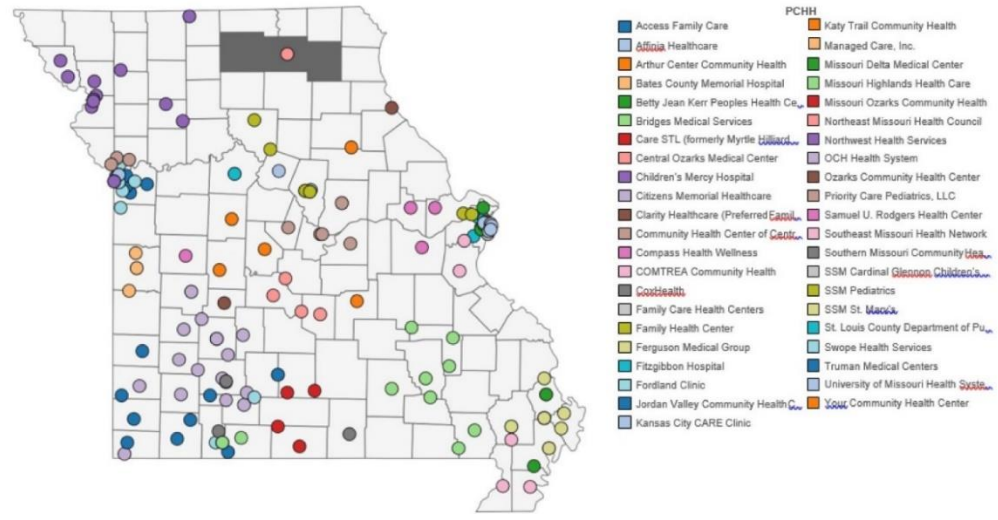
Figure 8. Hospitals. federally qualified health centers, and rural health clinics, Missouri



Source: Missouri Department of Health and Senior Services, Rural Health and Primary Care.

There are several MO HealthNet Division Primary Care Health Home providers in the southwest area (Figure 9).[17] The county health departments in each of the six counties, are active public health agencies, promote prevention and environmental health, operate clinics, and offer many other health resources.

Figure 9. MHD Primary Care Health Home Locations
February 2019

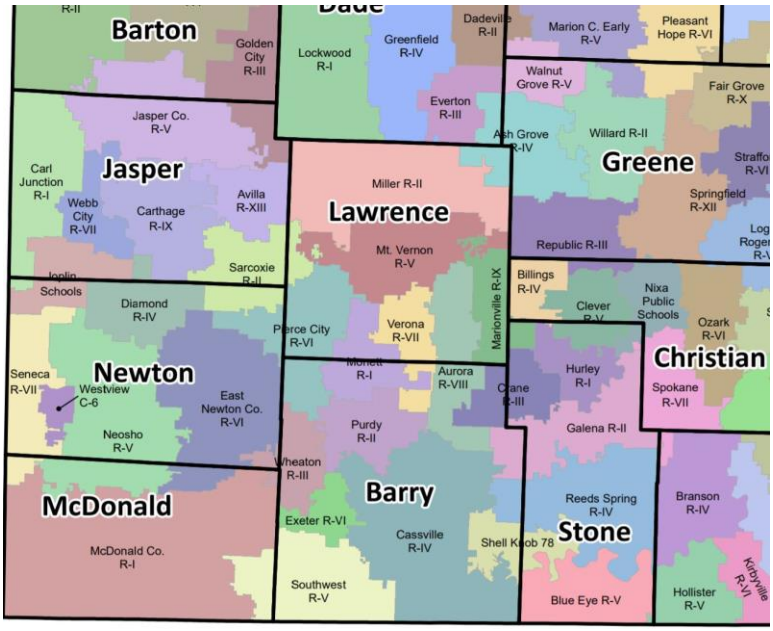


Source: Missouri Primary Care Association. Missouri Primary Care Health Home Initiative.

Schools

There are 31 school districts in the southwest six-county area (2019).[18] Several of the school districts cross county boundaries (Figure 10).[19] These school districts combined have more than 50,000 total students representing approximately 6% of the enrollment in public schools in Missouri.[20] The most populous school district in the southwest six county area is Joplin Schools in Jasper County (7,714 students), followed by Carthage R-IX (5,063 students) also in Jasper County, and Neosho School District (4,664 students) in Newton County (Table 3).

Figure 10. Southwest Area school districts by county, Missouri, 2019-20



Source: Missouri Department of Elementary and Secondary Education, Office of Geospatial Information.

Table 4. Number and percent of total students in southwest six-county area by number of students, Missouri, 2018-19

Southwest School District		Number	Percent of Total
County	All Six SW Districts	50,466	100.0
Jasper	Joplin Schools	7,714	15.3
Jasper	Carthage R-IX	5,063	10.0
Newton	Neosho School District	4,664	9.2
Jasper	Webb City R-VII	4,566	9.1
McDonald	McDonald R-1	3,800	7.5
Jasper	Carl Junction R-1	3,335	6.6
Barry	Monett R-1	2,443	4.8
Barry	Cassville R-IV	1,901	3.8
Lawrence	Aurora R-VII	1,899	3.8
Stone	Reeds Spring R-IV	1,815	3.6
Newton	Seneca R-VII	1,493	3.0
Lawrence	Mt. Vernon R-V	1,483	2.9
Newton	East Newton Co R-VI	1,361	2.7
Lawrence	Marionville R-IX	796	1.6
Newton	Diamond R-IV	790	1.6
Barry	Southwest R-V	776	1.5
Jasper	Sarcoxie	755	1.5
Lawrence	Pierce City R-VI	737	1.5
Barry	Purdy R-II	629	1.2
Stone	Crane R-III	593	1.2
Lawrence	Miller R-II	573	1.1
Stone	Blue Eye R-V	554	1.1
Stone	Galena R-II	492	1.0
Jasper	Jasper Co R-V	466	0.9
Barry	Wheaton R-III	434	0.9
Lawrence	Verona R-VII	405	0.8
Barry	Exeter R-VI	296	0.6
Stone	Hurley R-1	203	0.4
Barry	Shell Knob	148	0.3
Jasper	Avilla R-XIII	136	0.3
Newton	Westview C-6	126	0.2

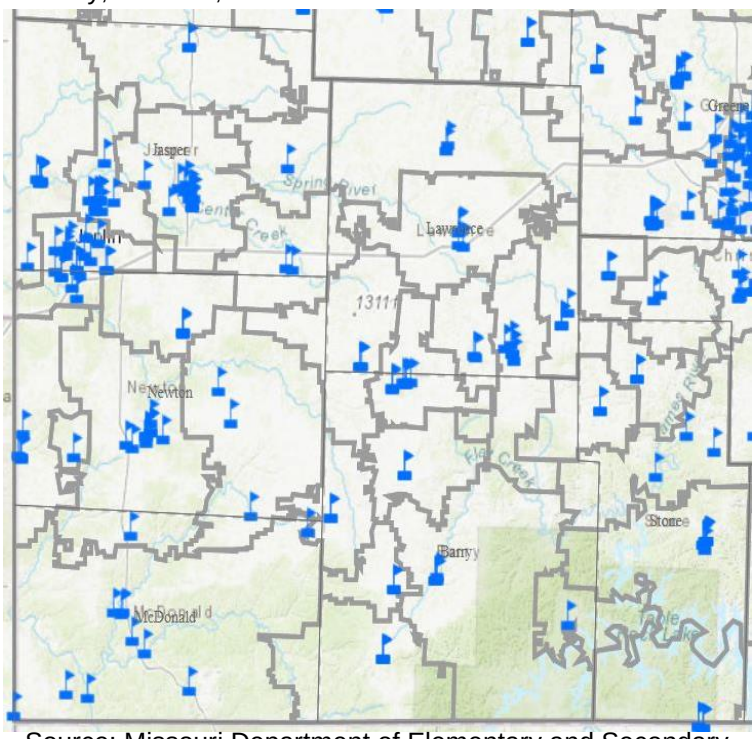
Source: Missouri Department of Elementary and Secondary Education. School Directory.

12 school districts have 79.6% of total SW public student population

There are 80 elementary schools, 22 middle/Jr high schools, and 29 high schools in the six-county southwest area (Figure 11).[8] This area also has about 20 private schools (Figure 12)[16], Crowder College in Neosho, Missouri Southern State University in Joplin, and three alternative and vocational schools in Stone County.

Several of the six-county public school districts are similar to the state on selected indicators from the Missouri Assessment Program data including students receiving free and reduced lunches (59.8% Southwest Area v 50.0% Missouri). The proportion of children receiving free and reduced lunch among the southwest area school districts range from 35.0 percent (Carl Junction R-I in Jasper County) to 80.4 percent (Galena R-II in Stone County) (2019).

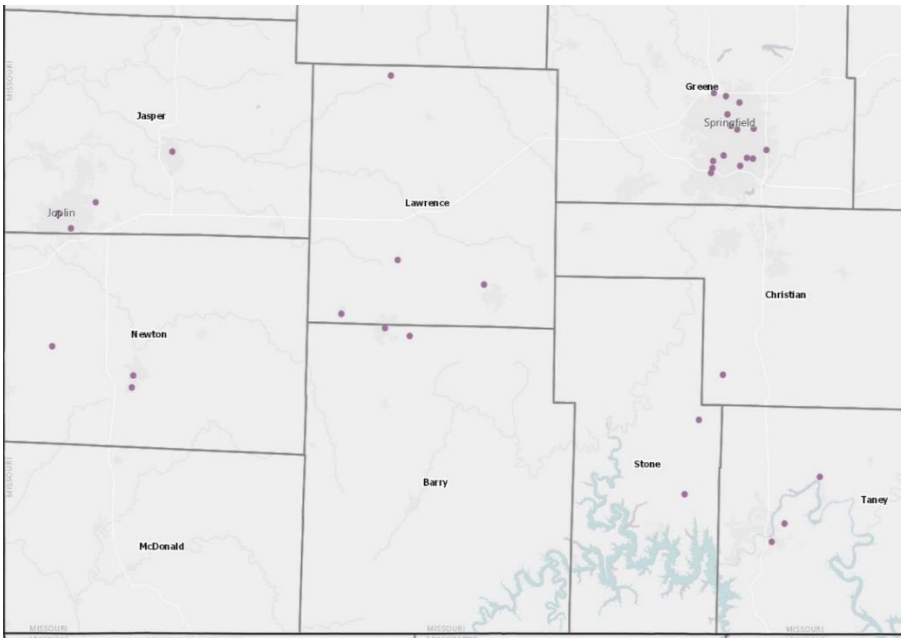
Figure 11. Public schools in the southwest area by county, Missouri, 2019



Source: Missouri Department of Elementary and Secondary Education.

Figure 12. Private schools in the southwest area by county, Missouri

Source: University of Missouri. Center for Applied Research and Engagement Systems (CARES)



The combined impact of simultaneously supporting local clinicians, school nurses, and care managers while implementing effective interventions and linking with community resources in areas with known asthma burden will likely have substantial impact and significantly improve population-level asthma control.

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References

[1] Centers for Disease Control and Prevention (CDC). 2018 National Health Interview Survey Data. Atlanta, Ga: National Center for Environmental Health, Asthma and Community Health Branch. https://www.cdc.gov/nchs/fastats/asthma.htm

[2] Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System. Retrieved November 15, 2019, from https://www.cdc.gov/asthma/brfss/default.htm

[3] Missouri Department of Health and Senior Services. Behavioral Risk Factor Surveillance System 2015 Data Report. Retrieved November 15, 2019, from https://health.mo.gov/data/brfss/2015datareport.pdf

[4] CDC. Uncontrolled asthma among children, 2012-2014. Behavioral Risk Factor Surveillance System (BRFSS)—Child Asthma Call-back Survey Data, 2012-2014. Retrieved November 15, 2019, from https://www.cdc.gov/asthma/asthma_stats/uncontrolled-asthma-children.htm

[5] United States Zip Codes.org. Zip Code Maps by State. Retrieved December 23, 2019, from https://www.unitedstateszipcodes.org/printable-zip-code-maps/

[6] Datasheer, LLC. US Zip Codes Database. Retrieved December 23, 2019, from https://www.zip-codes.com/about.asp

[7] Missouri Foundation for Health. Childhood Asthma Linkages in Missouri (CALM). Retrieved 3/20/2020, from https://mffh.org/wp-content/uploads/2016/04/CALM-infographic-report-FINAL.pdf

[8] Homan S, Gaddy P, Yun S, Armbrecht E, Francisco B, Rood T. Changing the trajectory of asthma morbidity through an early childhood asthma initiative in Missouri. Missouri Department of Health & Senior Services and Asthma Ready Communities, University of Missouri Health Care, Columbia, MO http://asthmaready.org/wp-content/uploads/2013/10/AAE-ECI-Asthma-Morbidity.pdf

[9] Francisco B, Rood T, Nevel R, Foreman P, Homan S. (2017). Teaming Up for Asthma Control: EPR-3 Compliant School Program in Missouri is Effective and Cost-Efficient. Prev Chronic Dis 14:170003. DOI: http://dx.doi.org/10.5888/pcd14.170003

[10] University of Missouri. Asthma Ready Communities© http://asthmaready.org/

[11] Missouri Department of Health and Senior Services. Office of Minority Health, 2013. Retrieved January 2, 2020 from https://health.mo.gov/living/families/minorityhealth/pdf/SWResourceDirectory.pdf

[12] Lawrence, McDonald, Barry County Assistance Program. Retrieved January 2 2020, from https://www.needhelppayingbills.com/html/lawrence-_mcdonald-_barry_coun.html

[13] The Independent Living Center. Southwest Missouri Area Agency Resource Directory, 2014. Retrieved January 2, 2020, from https://ilcenter.org/document-uploads/agency-directory.pdf

[14] The Alliance. Joplin Area Resource Guide, 2019. Retrieved January 2, 2020, from https://www.theallianceofswmo.org/2015-joplin-area-resource-guide/

[15] Rasberry CN, Cheung K, Buckley R, et al. Indicators of asthma control among students in a rural, school-based asthma management program. J Asthma 2014;51(8):876-885.

[16] University of Missouri, Center for Applied Research and Engagement Systems (CARES). Retrieved January 2, 2020 from https://engagementnetwork.org/map-room/

[17] Missouri Primary Care Association. Missouri Primary Health Home Initiative. Retrieved January 7, 2020, from https://dss.mo.gov/mhd/cs/health-homes/pdf/pchh-new-provider-orientation.pdf

[18] Missouri Department of Elementary and Secondary Education. School Directory by County, 2019. Retrieved December 23, 2019 from https://dese.mo.gov/school-directory

[19] Missouri Department of Elementary and Secondary Education. 2019-20 Missouri School Districts. Office of Geospatial Information. Retrieved December 30, 2019, from https://apps.dese.mo.gov/MCDS/home.aspx

[20] Missouri Department of Elementary and Secondary Education. 2018 – 2019 Statistics of Missouri Public Schools. Retrieved December 30, 2019, from https://dese.mo.gov/school-directory