SEPTEMBER 2017

POLICY BRIEF

Overdose Deaths, Hospital Visits and Unfilled Jobs: The Opioid Crisis in Missouri and Kansas

Mat Reidhead, MA
Vice President of Research and Analytics
Hospital Industry Data Institute

Leslie Porth, Ph.D.
Senior Vice President of Strategic Quality Initiatives
Missouri Hospital Association

Karen Braman, RPH, MS
Senior Vice President of Healthcare Strategy and Policy
Kansas Hospital Association

Executive Summary

Recent reporting suggests that the opioid epidemic is constraining the U.S. labor market. Many employers are reporting increased difficulty in matching eligible workers with open positions, particularly in rural areas and the manufacturing sector. Two factors driving the shortage are the continued post-recession absence of prime-age males from the labor market, and the inability of job applicants to pass routine drug screens. **A 2016 survey of prime-age men 25 to 54 who were not in the labor force — defined as not employed or looking for work — found that 47 percent had taken a pain medication on the previous day, and among those, nearly two-thirds had taken a prescription pain medication.**[1]

What is the relationship between unemployment and opioid utilization in Missouri and Kansas, and is the opioid crisis contributing to a decreased employable workforce or worker productivity? The aim of this policy brief is to identify linkages between unemployment and opioid dependence at the county level in Missouri and Kansas using state and national datasets.

This research is intended to help health care providers, policymakers and business leaders identify areas in Missouri and Kansas that are at greater risk of experiencing a disproportionate burden of the ongoing opioid epidemic in terms of labor market conditions, drug-related deaths, oversupply of prescription opioids and opioid-related hospital utilization. These data and information are intended to help direct scarce resources to geographic areas of greatest need.

UNEMPLOYMENT

The official unemployment calculation that elected officials commonly point out as evidence of full economic recovery fails to account for individuals who are unemployed and not actively seeking employment — those who have dropped out of the labor force altogether. The Bureau of Labor Statistics' U-6 measure of labor force underutilization accounts for these individuals who are deemed marginally attached to the labor market, and presents a more nuanced reflection of true economic recovery.[2]

During the 12 months leading up to the great recession in 2007, the official unemployment rate was 4.6 percent, while the U-6 was 8.3 percent. **During the most recent 12 months ending in July 2017, the official unemployment rate was again at 4.6 percent, however the U-6 was 9.1 percent — 10 percent higher than its pre-recession levels.** In addition, the U-6 measure is disproportionately populated by certain demographic groups, such as prime-age males, leading many to speculate that for every individual in this cohort classified as unemployed in the official accounting, there are another three who are out of work and no longer looking.[3]

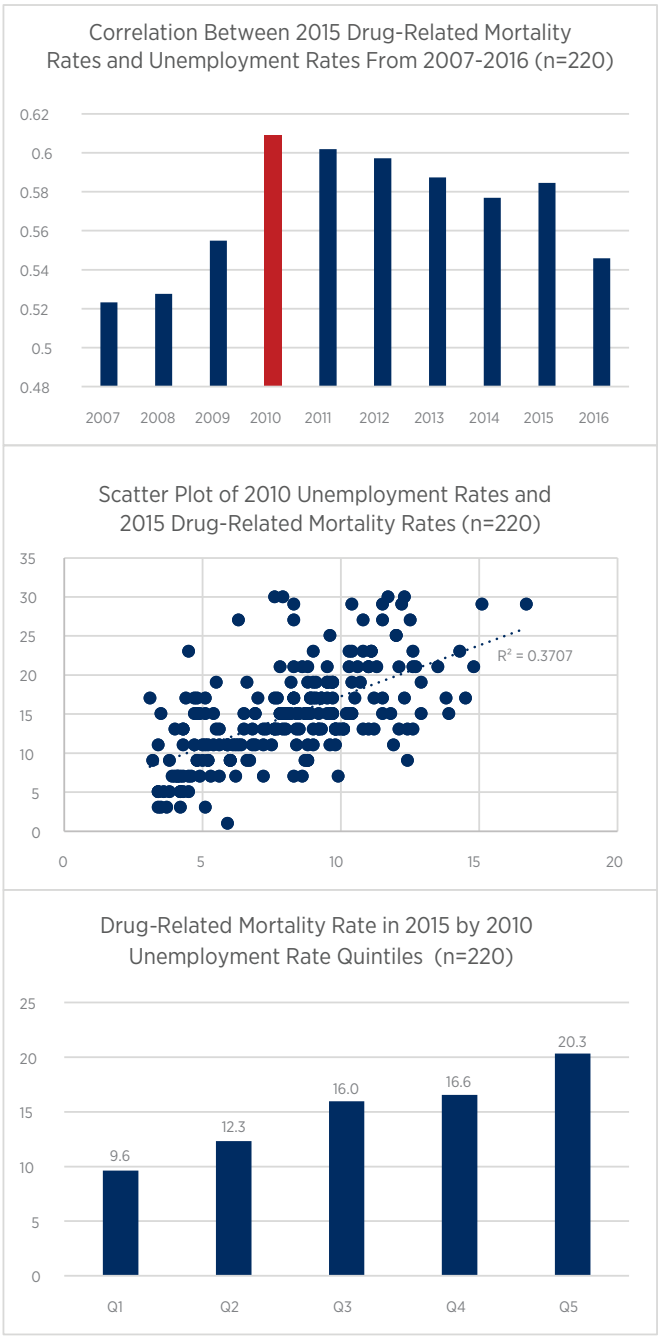
2016 UNEMPLOYMENT AT A GLANCE			
	Official Rate	U-6 Rate	Ratio of U-6 to Official
Kansas	4.2	8.2	1.95
Missouri	4.6	7.8	1.70
U.S.	4.9	9.6	1.98

WORKFORCE AND OPIOID CONNECTION

The societal effects of the opioid epidemic are ubiquitous across age, race, socioeconomic status and rural-urban continua. Despite the broad impact of opioid misuse on differing populations, the effect on vulnerable populations may be exacerbated by inadequate systems needed for productive, healthy lives. Recent empirical evidence has shed additional light on the relationship between the opioid epidemic and its impact on mortality rates, with aggregate economic conditions in the labor market. In their March 2017 study, Princeton economists Anne Case and Sir Angus Deaton formally tied drug-related "deaths of despair" among non-Hispanic whites in the U.S. to a cumulative deprivation that begins with fewer and less stable labor market opportunities. This results in poorer outcomes in marriage and family, and culminates in worsened physical and emotional well-being and premature death.[4]

The association between opioid dependence and economic insecurity appears to be supported by Missouri and Kansas data, where at the county level, unemployment appears to be a contributing indicator of downstream drug-related mortality rates. The top panel in Figure 1 shows that the highest association between drug-related mortality in 2015 and unemployment over the previous decade was observed in 2010.

Figure 1: Relationship Between Unemployment and Drug-Related Mortality Rates at the County Level in Missouri and Kansas



Source: Authors' analysis of unemployment data from the U.S. Bureau of Labor Statistics and drug-related mortality data from the Centers for Disease Control and Prevention, National Center for Health Statistics

The middle panel shows a strong positive association between unemployment in 2010 and drug deaths in 2015, while the bottom panel reveals that the highest unemployment counties in Missouri and Kansas during 2010 have age-adjusted mortality rates for drugs that are more than double the rate in low-unemployment counties.

More recent anecdotal evidence raises questions on the order of causality between opioid use and labor market conditions, or may point to a cyclical relationship between the two. Potential workers form dependence during periods with limited employment opportunities, and then are forced to remain unemployed when jobs become available as a result of the dependence. Or, a worker is injured — on the job or during recreation — and must suspend or alter work hours and duties. A cascade of pain, medication and reduced productivity may contribute to opioid dependency and eventual loss of employment.

Whatever the underlying mechanism might be, manufacturers are beginning to report shortages in the blue-collar labor market as a result of large portions of candidates being unable to pass mandatory drug screens. This squeeze on the supply of the blue-collar labor pool is most acute in rural areas because of smaller workforces and a disproportionate impact of opioid dependence in these communities. In addition to large increases in the rate of positive drug screens following an accident in the workplace, which creates new vacancies and increases the demand for labor, the rate of positive tests for illegal drugs is at a 12-year high in the U.S.[5] The growing difficulty of pairing this demand with a drug-free labor pool is a phenomenon that also has been noted in the Federal Reserve Bank's recent Beige Book surveys.[6]

In her July 2017 testimony before the Senate Banking Committee, Federal Reserve Chair Janet Yellen acknowledged that the pervasiveness of the epidemic is holding back the U.S. labor market, but the order of causality was unclear. She testified, **"I don't know if it's causal or if it's a symptom of long-running economic maladies that have affected these communities and particularly affected workers who have seen their job opportunities decline."**[7] Although the official unemployment rate in the U.S. has recovered to pre-recession levels, the number of discouraged workers who have dropped out of the labor force altogether has increased significantly, and among certain demographic cohorts in particular. Among all developed countries, only Italy had a lower rate of labor force participation among prime-age males than the U.S. in 2015.[1] During the great recession and recovery, the relative percentage of this cohort in the U.S. that dropped out of the labor force increased by 25 percent.[8]

IDENTIFYING HIGH-RISK AREAS IN MISSOURI AND KANSAS

To identify linkages between unemployment and opioid dependence at the county level, data were gleaned from four unique sources. The model developed to identify high-risk counties followed the causal framework that two health factors — unemployment and the supply of prescription pain medications — can help to explain two adverse health outcomes at the county level — hospitalizations for opioid overdose and drug-related mortality rates.

Ten years of unemployment rate data for Missouri and Kansas counties were gathered from the U.S. Bureau of Labor Statistics, Local Area Unemployment Statistics Program.[16] The official unemployment measure was used because the U-6 measure is not available at the county level. To identify the extent to which unemployment serves as a leading indicator of opioid dependence and associated outcomes, the rate of unemployment at the county level for each year was evaluated for association with the most recent year of the three opioid-related measures using pairwise correlation. This revealed that the 2010 unemployment rates for 220 Missouri and Kansas counties shared the strongest linear association with drug-related deaths in 2015, Morphine Milligram Equivalents prescribed per capita in 2015, and opioid-related inpatient hospitalizations and emergency department visits per 1,000 between 2012 and 2016. This suggests that unemployment may be a leading indicator of opioid dependence. For this reason, subsequent analyses drew from the 2010 unemployment rate data as opposed to more recent years.

Data on the supply of prescription opioids across counties during 2015 were obtained from the U.S. Centers for Disease Control and Prevention by request from the authors.[17] Reported at the county level in units of MME per capita, the estimates were derived by a 2017 CDC analysis of retail prescription data in the U.S. between 2006 and 2015. For 10 sparsely populated counties with insufficient MME data (six were in Kansas and four were in Missouri), subsequent analyses used values estimated with parameters of a stepwise linear regression ($R^2 = 0.23$).

SEVEN DRUG-RELATED DEATHS EVERY HOUR IN THE U.S.

Awareness of opioid dependence disorder has risen in the U.S. at a rate parallel to the ongoing epidemic itself. Indexed web searches for the term "opioid epidemic" increased from zero to 100 between July 2014 and August 2017, indicating a 100-fold increase in the popularity of the issue inside of a three-year span.[9] Despite the increased awareness of opioid misuse and prescribing patterns that often result in addiction and substitution with illicit opioids, overdose deaths in the U.S. continue to soar.

Preliminary estimates of death certificates in 2016 suggest that more than 62,000 Americans died from a drug overdose last year — that's more than 170 per day, or seven deaths every hour.[10] These estimates would mark a 19 percent increase in the number of drug-related overdose deaths during 2015 and a 33 percent increase over the 47,000 drug-related overdose deaths recorded in the U.S. during 2014.[11] Additionally, emerging evidence suggests that the actual mortality rates in the U.S. for opioids and heroin are 24 and 22 percent higher than officially reported.[12] The same study found that the rate of underreporting opioid deaths in Missouri was 15th largest in the nation, while the rate of underreporting in Kansas was 19th largest.[13]

In Kansas between 2013 and 2015, overdose deaths for prescription opioids increased by 28 percent, while heroin deaths increased by 71 percent during the same period.[14] **Missouri experienced 908 opioid and heroin-related overdose deaths in 2016 — this was a 35 percent increase in just one year.**[15]

The average estimated MME per capita for these 10 counties was 395, while the average for the remaining 210 counties with complete data was 637 MME per capita.

Drug poisoning mortality rates at the county level were obtained from the CDC's National Center for Health Statistics.[18] The measure presents model-based age-adjusted death rates for drug poisoning because observed rates based on death certificate data are widely unavailable at the county level. The estimates are derived from a multilevel empirical Bayesian approach that uses information from counties with known mortality rates to predict rates in smaller counties with unknown drug-related mortality rates.[19] The average of the confidence intervals reported by the CDC were used to inform this analysis.

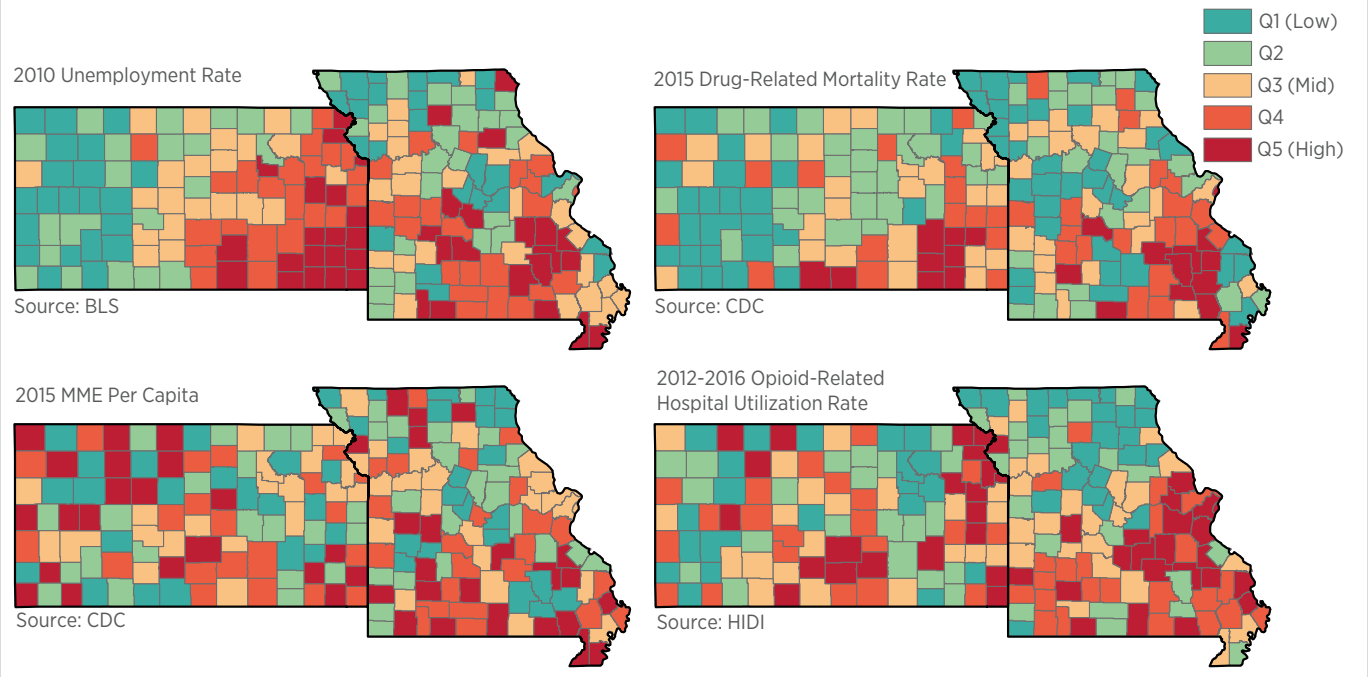
Opioid-related hospital utilization data from the Hospital Industry Data Institute were pooled across five years at the county level using hospital discharge records for residents of Missouri and Kansas. Arrays of diagnosis codes in any position on the discharge record were used to identify the number of hospital inpatient and emergency department encounters for both prescription and illicit opioids for residents of each county between fiscal years 2012 and 2016 (Oct. 1, 2011 to Sept. 30, 2016).[20] While the vast majority of opioid-related hospitalizations were due to prescription opioids, illicit opioid use was included due to the high substitution rate in addicted individuals. It is estimated that three out of four heroin users began abusing prescription opioids before their heroin use.[21] These counts were calculated at the county level as rates per 1,000 total residents using 2011-2015 population data from the U.S. Census Bureau. Because of differences in the availability of emergency department data across Kansas hospitals, subsequent modeling was conducted independently for each state. **In Missouri, the range of county-level hospital utilization for opioid misuse during 2012-2016 was 19.5 per 1,000 residents in Phelps County to 1.5 per 1,000 in Clark County. For Kansas, the range was 4.2 per 1,000 in Cherokee County to 0.5 in Riley County.**

Preliminary analysis across all 220 counties revealed modest degrees of linear association among each of the four measures evaluated: 2010 unemployment, 2015 MME per capita, 2015 drug-related mortality and 2012-2016 opioid-related hospital utilization. Table 1 includes a pairwise correlation matrix for these variables, and Figure 2 shows the geographic distribution of each measure across all counties in Missouri and Kansas. While all of the measures shared a statistically significant degree of positive linear association, the relationship was modest in some cases, particularly between the 2015 MME per capita variable and other measures (Table 1). Despite this moderate association, the MME variable was retained in this analysis because it is the only data source available across both states that measures opioid prescribing patterns at the county level, an important dimension of the opioid epidemic.

ESTIMATING OPIOID DEPENDENCE RISK IN MISSOURI AND KANSAS COUNTIES

Principal component analysis is a statistical technique that is useful in identifying outlying units, such as counties, across multiple variables contained in different dimensions.

Figure 2: Geographic Relationship Between Quintiles of Variables Used in Principal Component Analysis of Opioid Dependence Risk in Missouri and Kansas Counties



Sources: U.S. Bureau of Labor Statistics, 2010 Unemployment Rates. U.S. Centers for Disease Control and Prevention, Morphine Milligram Equivalents Per Capita (Guy, et al. 2017). U.S. Centers for Disease Control and Prevention, 2015 Age-Adjusted Death Rates for Drug Poisoning (Rossen, et al. 2017. Hospital Industry Data Institute, 2012-2016 Inpatient and Emergency Department Encounters for Opioid Misuse per 1,000 Residents.

Table 1: Pearson Correlation Matrix for Measures Used to Evaluate Opioid Dependence Risk in Missouri and Kansas Counties (n=220, P-values in italics)

	2010 UNEMPLOYMENT RATE	2015 MME PER CAPITA	2015 DRUG-RELATED MORTALITY RATE	2012-2016 OPIOID-RELATED HOSPITAL VISIT RATE
2010 Unemployment Rate	1.000 -	0.136 *0.044*	0.609 *<.0001*	0.534 *<.0001*
2015 MME Per Capita	0.136 *0.044*	1.000 -	0.188 *0.005*	0.325 *<.0001*
2015 Drug-Related Mortality Rate	0.609 *<.0001*	0.188 *0.005*	1.000 -	0.452 *<.0001*
2012-2016 Opioid-Related Hospital Visit Rate	0.534 *<.0001*	0.325 *<.0001*	0.452 *<.0001*	1.000 -

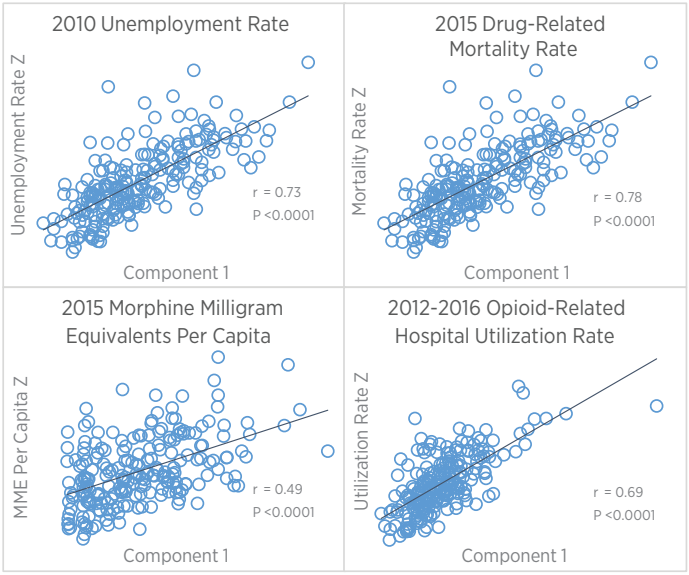
The approach is designed to convert numerous correlated variables into a smaller number of uncorrelated components, where the first component explains the maximum amount of variation between the original variables as possible. The approach is useful in detecting outliers in multivariate data sets by condensing the number of dimensions across multiple variables into a smaller set of data, without losing important information on the underlying variation.[22]

To identify possible outliers among Missouri and Kansas counties with respect to the four measures analyzed, two individual PCA models were fit to the data generated for each state. Before conducting the PCA, each of the input variables — 2010 unemployment rates, 2015 MME per capita, 2015 drug-related mortality rates and 2012-2016 opioid-related hospital utilization rates — were standardized using simple Z-scores which indicate the number of standard deviations each county lies from the mean within each state. Z-transformation results in a mean of zero and standard deviation of one across observations within each state. The first principal component was used from each model to identify potential opioid dependence risk at the county level. In Missouri, the first component accounted for 49 percent of the total variation across the four measures evaluated for 115 counties (Eigenvalue = 1.96; Component 2 Eigenvalue = 0.94). For Kansas, the first component score accounted for 45 percent of the total variation across 105 counties (Eigenvalue = 1.78; Component 2 Eigenvalue =1.12).

RESULTS

The linear association between the first component score for each county and the four model input variables was substantially improved compared to the pairwise correlation between the four unadjusted variables, as shown in Table 1. Figure 3 displays the relationship in scatterplots between the first component of each PCA model and each of the four standardized model input variables for all 220 Missouri and Kansas counties. The strongest linear association is observed between the first component scores and drug-related mortality rates (Pearson's correlation coefficient r = 0.78, P <0.0001). The weakest association was again observed in

Figure 3: Relationship Between Principal Component and Standardized Z-Scores of Variables Used in PCA Model of Opioid Dependence Risk in Missouri and Kansas Counties (n = 220)



the standardized score for MME per capita, which was retained as the sole indicator of variation in opioid prescribing patterns between counties. Each of the model input variables shared a strong statistically significant linear association with the first component score.

Combining each of the Z-scores for unemployment, MME per capita, drug-related deaths and hospital utilization for opioids at the county level, produced a much more pronounced relationship with the first component score of the PCA models for Missouri and Kansas counties. Figure 4 reveals a scatterplot of the mean value of the four Z-scores used in the PCA models against the first component scores for each county in Missouri and Kansas. The PCA models reduced the variation across the four dimensions of the included measures related to opioid dependence risk so that the first component score of the models shares near perfect collinearity with the combined Z-scores

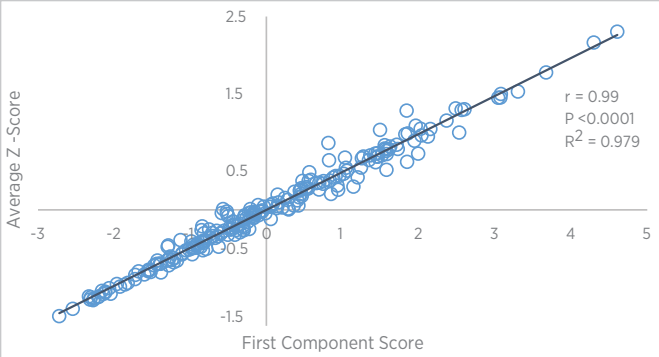
of each variable. In addition, in univariate terms, the first component score explained 97.9 percent of the variation across counties in the mean levels of the four indicators of opioid dependence risk evaluated by the models (Figure 4).

Mapping the first component score of the PCA models at the county level revealed large geographically contiguous portions of each state that are at high risk of excess burden related to opioid dependence. The model also revealed high risk in urban and suburban areas; however, the majority of high-risk counties were in rural areas (Figure 5).

In order, the top-five highest risk counties in Missouri were Iron, St. Francois, Phelps, St. Louis City and Dent. Four of the top five were found to be in the state's rural lead belt, adjacently southwest of the St. Louis metropolitan area.

The top-five highest risk counties in Kansas were Cherokee, Wilson, Atchison, Greenwood and Sedgwick. Two of the top five share a border with Missouri, the only state in the nation without a prescription drug monitoring program, while the other three counties are in close proximity to Wichita, the most populous city in Kansas, which has not been sheltered by the opioid epidemic, according to local media.[23] In response, the health care community in Wichita has made a concerted effort to address the opioid epidemic throughout the last several years, with promising results. So far in 2017, opioid-related death rates have dropped from 160 deaths in 2014 to 36 deaths.[24]

Figure 4: Relationship Between Principal Component (Component 1) and the Mean Standardized Z-Scores of Variables Used in PCA Model of Opioid Dependence Risk in Missouri and Kansas Counties (n=220)

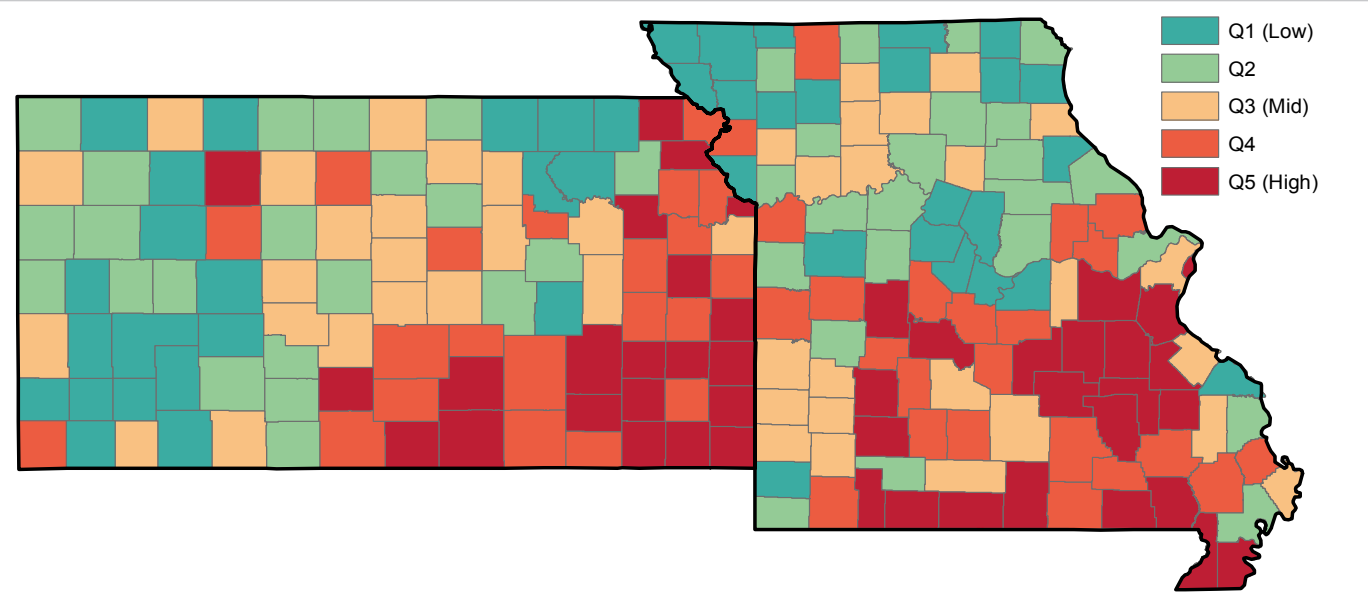


CONCLUSION

The implications of this research are significant. Alliances and partnerships among health care providers and payers, business leaders and policy makers, and patients and caregivers, are needed to identify community-based solutions and broader policy changes. For example, increased utilization of the PDMP in Kansas; education regarding alternative therapies to treat injury and pain; increased awareness and utilization of opioid prescribing guidelines; and work and vocational rehabilitation programs, must be aware of the risk and prevalence of opioid dependence among injured workers.

In Missouri, there is a multifaceted strategy to reduce opioids focused on research and changes to both practice and policy. Concurrent to statewide PDMP advocacy, Missouri hospitals have supported county ordinances to join the St. Louis County Health Department PDMP. Today, more than 70 percent of

Figure 5: Opioid Dependence Risk in Missouri and Kansas Counties Estimated With Principal Component Analysis of Unemployment, Drug-Related Mortality, Morphine Milligram Equivalents Prescribed Per Capita and Hospital Utilization for Opioid Misuse (component 1 shown in map)



Source: Authors' analysis of data from the U.S. Bureau of Labor Statistics, U.S. Centers for Disease Control and Prevention and Hospital Industry Data Institute.

the population resides, and nearly 80 percent of providers practice, in counties participating in the St. Louis County PDMP. In addition, voluntary emergency department opioid prescribing guidelines have been adopted by 90 percent of Missouri hospitals, educational videos have been developed for physicians, a comprehensive opioid toolkit is available, and MHA is a partner in the new grant for state targeted response.

Scarce resources must be strategically allocated for workforce development, vocational rehabilitation and substance-use disorder treatment. Services to be covered by federal funds recently made available to states through the 21st Century Cures Act should be evaluated for effectiveness and targeted to areas in most need.[25] In Missouri and Kansas, there are identified counties and regions with a higher incidence of opioid-related consequences, including unemployment, overdose and death.

---

1 Krueger, A. (2016, October 4). *Where have all the workers gone?* Paper prepared for the Boston Federal Reserve Bank's 60th economic conference. Retrieved from https://drive.google.com/file/d/0B7m8wQD_ckP4VmZPOXpza3h4X0E/preview

2 U.S. Department of Labor, Bureau of Labor Statistics. *Economic News Release. Table A-15. Alternative measures of labor underutilization.* Retrieved from https://www.bls.gov/news.release/empsit.t15.htm

3 Stelzer, I. (2017, July 29). *The opioid crisis is creating a labor crisis.* Retrieved from https://www.hudson.org/research/13802-the-opioid-crisis-is-creating-a-labor-crisis

4 Case, A. & Deaton, A. (2017, March). *Mortality and morbidity in the 21st century.* Retrieved from https://www.brookings.edu/wp-content/uploads/2017/03/6_casedeaton.pdf

5 Brancaccio, D. (2017, August 10). 08/10/2017: Employers aren't finding enough workers who can pass a drug test. National Public Radio. *Marketplace Morning Report*. Retrieved from https://www.marketplace.org/2017/08/10/economy/mid-day-update/08102017-mdu

6 Schwartz, N. (2017, July 24). Economy needs workers, but drug tests take a toll. *The New York Times.* Retrieved from https://www.nytimes.com/2017/07/24/business/economy/drug-test-labor-hiring.html

7 Smialek, J. (2017, July 13). Yellen says opioid use is tied to declining labor participation. *Bloomberg Politics.* Retrieved from https://www.bloomberg.com/news/articles/2017-07-13/yellen-says-opioid-use-is-tied-to-declining-labor-participation

8 From Krueger, 2016. The weighted percentage of males ages 25-54 not in the labor force in 2007 was 9.2%, by 2016 it was 11.5%, a relative difference of 24.8%.

9 Google Trends. Retrieved from https://trends.google.com/trends/explore?date=2014-07-16%202017-08-16&geo=US&q=opioid%20epidemic

10 Katz, J. (2017, June 5). Drug deaths in America are rising faster than ever. *The New York Times.* Retrieved from https://www.nytimes.com/interactive/2017/06/05/upshot/opioid-epidemic-drug-overdose-deaths-are-rising-faster-than-ever.html?_r=0

11 Rudd, R., Seth, P., David, F. & Scholl, L. (2016, December 30). Increases in drug and opioid-involved overdose deaths — United States, 2010–2015. *Morbidity and Mortality Weekly Report; 65:1445-1452.* Retrieved from https://www.cdc.gov/mmwr/volumes/65/wr/mm655051e1.htm

12 Ruhm, J. (2017). Geographic variation in opioid and heroin involved drug poisoning mortality rates. *American Journal of Preventive Medicine.* Retrieved from http://www.ajpmonline.org/article/S0749-3797(17)30313-6/pdf

13 Marso, A. (2017, August 21). Opioid overdose deaths under-reported in Missouri and Kansas, study says. *The Kansas City Star.* Retrieved from http://www.kansascity.com/news/business/health-care/article168476002.html

14 Kansas Department of Health and Environment. (2016). *Kansas trends in drug poisoning deaths, special emphasis report: Drug poisoning deaths, 2000-2015.* Retrieved from http://www.kdheks.gov/pdomp/download/2016_KS_SER_Drug_Poisoning.pdf

15 Missouri Department of Health and Senior Services. (2017, July 17). *Missourians are dying every day from opioid overdoses.* Retrieved from http://health.mo.gov/information/news/2017/opioids71717

16 U.S. Department of Labor, Bureau of Labor Statistics. *Local area unemployment statistics.* Retrieved from https://www.bls.gov/lau/

17 Guy, G., Zhang, K., Bohm, M., et al. (2017, July 7). Vital signs: Changes in opioid prescribing in the United States, 2006–2015. *Morbidity and Mortality Weekly Report; 66:697-704.* Retrieved from https://www.cdc.gov/mmwr/volumes/66/wr/mm6626a4.htm

18 U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. (n.d.). *Drug poisoning mortality in the United States, 1999-2015.* Retrieved from https://www.cdc.gov/nchs/data-visualization/drug-poisoning-mortality/

19 Rossen, L., Bastian, B., Warner, M., Khan, D. & Chong, Y. (2017). *Drug poisoning mortality: United States, 1999–2015.* Retrieved from https://www.cdc.gov/nchs/data-visualization/drug-poisoning-mortality/

20 For discharges occurring in fiscal years 2012-2015, the following ICD-9 codes were used to identify hospital encounters for opioid misuse. Illicit (heroin, opium, etc.): 96500 96501 96502 96509 9701 E8500 E8501 E8502 E9350 E9351 E9352 E9401. Analgesic (prescription opiates): 30400 30401 30402 30403 30470 30471 30472 30473 30550 30551 30552 30553.

For discharges occurring in fiscal year 2016, the following ICD-10 codes were used to identify hospital encounters for opioid misuse. Illicit (heroin, opium, etc.): T400X1A T400X1D T400X1S T400X2A T400X2D T400X2S T400X3A T400X3D T400X3S T400X4A T400X4D T400X4S T400X5A T400X5D T400X5S T400X6A T400X6D T400X6S T401X1A T401X1D T401X1S T401X2A T401X2D T401X2S T401X3A T401X3D T401X3S T401X4A T401X4D T401X4S. Analgesic (prescription opiates): F1110 F11120 F11121 F11122 F11129 F1114 F11150 F11151 F11159 F11181 F11182 F11188 F1119 F1120 F1121 F11220 F11221 F11222 F11229 F1123 F1124 F11250 F11251 F11259 F11281 F11282 F11288 F1129 F1190 F11920 F11921 F11922 F11929 F1193 F1194 F11950 F11951 F11959 F11981 F11982 F11988 F1199 R781 T402X1A T402X1D T402X1S T402X2A T402X2D T402X2S T402X3A T402X3D T402X3S T402X4A T402X4D T402X4S T402X5A T402X5D T402X5S T402X6A T402X6D T402X6S T403X1A T403X1D T403X1S T403X2A T403X2D T403X2S T403X3A T403X3D T403X3S T403X4A T403X4D T403X4S T403X5A T403X5D T403X5S T403X6A T403X6D T403X6S T404X1A T404X1D T404X1S T404X2A T404X2D T404X2S T404X3A T404X3D T404X3S T404X4A T404X4D T404X4S T404X5A T404X5D T404X5S T404X6A T404X6D T404X6S Z79891

21 Muhuri, P., Gfroerer, J. & Davies, C. (2013, August). Associations of nonmedical pain reliever use and initiation of heroin use in the United States. *CBHSQ Data Review.* Retrieved from https://www.samhsa.gov/data/sites/default/files/DR006/DR006/nonmedical-pain-reliever-use-2013.htm

22 See for example, Dunteman, G. (1989). Principal Component Analysis. *Sage University Paper series on Quantitative Applications in the Social Sciences*, series no. 69. Newbury Park, CA: Sage.

23 Asebes, J. (2017, August 2). Wichita deals with a flood of opioid abuse. *NBC, KSN News 3.* Retrieved from http://ksn.com/2017/08/02/wichita-deals-with-flood-of-opioid-abuse/

Marso, A. (2017, July 30). These are the most opioid-soaked counties in Kansas and Missouri. *The Wichita Eagle.* Retrieved from http://www.kansas.com/latest-news/article164307857.html

Runyon, L. (2017, January 3). Why is the opioid epidemic hitting rural America particularly hard? *NPR, KMUW Wichita 89.1.* Retrieved from http://kmuw.org/post/why-opioid-epidemic-hitting-rural-america-particularly-hard

24 Asebes, J. (2017, August 2). Wichita deals with a flood of opioid abuse. *NBC, KSN News 3.* Retrieved from http://ksn.com/2017/08/02/wichita-deals-with-flood-of-opioid-abuse/

25 Substance Abuse and Mental Health Services Administration. (2016, December 14). *SAMHSA to award nearly $1 billion in new grants to address the nation's opioid crisis.* Retrieved from https://www.samhsa.gov/newsroom/press-announcements/201612141015