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ORIGINAL ARTICLE

Syringe services programs in the Bluegrass: Evidence of population health benefits using Kentucky Medicaid data

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"People in small towns, much more than in cities, share a destiny."

Richard Russo

Abstract

Purpose: To evaluate whether Kentucky counties that established a new syringe services program realized a significant decline in the incidence rate of a set of infectious disease diagnoses commonly transmitted via injection drug use.

Methods: Longitudinal count models of within-county rates of newly diagnosed infections among populations at risk were estimated using Medicaid claims/encounters data. Generalized estimating equation models were used to report incident rate ratios of 6 diagnoses: (1) HIV; (2) hepatitis C; (3) hepatitis B; (4) osteomyelitis; (5) endocarditis; and (6) skin/soft tissue infection. To investigate whether a delay in effect was present, separate models were fit to estimate the effects of establishing a syringe services program: at its opening date, and again at 1, 3, and 6 months postopening date.

Findings: Taken together, the aggregated within-county incidence rate of these 6 diagnoses was significantly lower following the implementation of a syringe services program ($P < .05$). Our models estimated that counties which opted to open a syringe services program realized an approximate month-over-month decline in new diagnoses of 0.5% among the population at risk.

Conclusions: These results lend further support to previous conclusions made in the public health literature regarding the efficacy of syringe services programs. Specifically, declines in incidence rates were observable beginning at 1 month post syringe services program opening. These results are particularly notable due to the typical setting in which these syringe services programs operated—rural communities of fewer than 40,000 residents.

KEYWORDS
harm reduction, injection drug use, Kentucky, Medicaid, syringe services programs

INTRODUCTION

The United States has grappled with an alarming rise in substance use over the course of the last several years.[1] Often referred to as "The Opioid Epidemic," this public health crisis has involved the illicit use of opioid pain medications and led to the US Department of Health and Human Services declaring a public health emergency in 2017.[2] Among this illicit use of opioid drugs, use via injection has been worryingly prominent.[3] The associated harms of this crisis have been felt acutely in the Appalachian region of the country.[4] These harms have manifested themselves in the form of increased rates of neonatal abstinence syndrome,[5] a surge in overdose cases,[6] and pockets of infectious disease outbreaks in regions of Kentucky, West Virginia, and Tennessee.[7]

As this crisis has shifted from dependence on oral opioid formulations to injection drug use, a dramatic lack of prevention capacity and treatment infrastructure for both substance use disorder (SUD) and associated infectious diseases that exist in many rural counties has been exposed.[6,7] This has forced several states to reconcile their public health policy with the painful lived experiences and needs of their constituents.

Syringe services programs for people who inject drugs

Given the risks associated with sharing used syringes, syringe services programs ([SSPs]; also referred to as "*syringe exchange*" programs) have been identified as an important component of public health policy that states consider.[8–10] While some variation exists from one program to another, SSPs perform a set of core practices, including: (1) exchanging used syringes for sterile ones, (2) distributing health promotion materials, and (3) making referrals to health and social services in the community.[8] SSPs have been in existence since the 1970s in the United States, and they have been identified as an effective means of controlling the spread of infectious diseases among people who inject drugs, especially HIV/AIDS.[9,10] This has been documented in published meta-analyses,[10,11] as well as by studies conducted in New York City[12] and Vancouver.[13] Taken as a whole, these studies posit that communities which have implemented SSPs have realized a subsequent decline in rates of infectious disease transmission, without any considerable increases in crime or public disorder.[11,14–16] SSPs are also recognized by the US Centers for Disease Control and Prevention as a safe and effective means of preventing the transmission of viral hepatitis, HIV, and other infections.[8]

In spite of this consensus among the public health and research communities, SSPs are often controversial and frequently face considerable political resistance.[17–20] Illicit drug use, especially via injection, is a stigmatized behavior frequently associated with crime and wantonness, and SSPs are thought by many to enable such social pathology.[19,20] This stigma often informs Americans' beliefs about the proper ways to address health problems that arise as a result of injection drug use. In a nationally representative survey study, a large majority of survey respondents reported feeling that individuals who use opioids are both weak (90%) and undeserving (73%), with only 39% of respondents supporting the legalization of SSPs.[20] The authors also noted: "Higher household income was associated with greater support for legalization of syringe services programs, perhaps reflecting greater exposure to such programs in high cost-of-living cities; educational messages about the value of harm reduction strategies may need to be tailored to rural communities."[20] Policy makers and medical practitioners in rural communities conduct their work within this social context.[17–21]

Changing attitudes and the case of Austin, Indiana

In light of these challenges, a significant milestone in the political history of SSPs occurred in 2015 after a widely publicized outbreak of HIV in Scott County, Indiana.[22] That outbreak in the city of Austin became a national turning point, as the country witnessed a small rural community implement an SSP in a state which had historically been against them.[23] In the wake of that outbreak, in December 2015, the US Congress lifted a nearly 3-decade-long funding ban on using federal dollars to fund the operations of SSPs.[24] This allowed federal funds to support SSPs in American communities, consequently paving the way for state legislatures to change their laws in favor of using SSPs as public health interventions. In interviews with the news media during this period, legislators from Kentucky recounted that the episode in southern Indiana was influential in their choice to change this federal policy.[25]

In spite of what many health officials in that community viewed as the exemplary success of their SSP, county officials reversed course and closed the program in June 2021.[26] *The Washington Post* cited officials' concerns about enabling dangerous behavior, with one official saying: "I know people who are alcoholics, and I don't buy them a bottle of whiskey."[26] Reportedly, in public hearings related to the decision to close the SSP, officials voiced concerns about providing individuals with the means to overdose.[26] There is evidence that these attitudes are driving public policy in other rural states: in April 2021, West Virginia Governor Jim Justice signed a bill into law that imposed new restrictions on SSPs in the state.[27]

Syringe services programs in Kentucky

Austin, Indiana, is less than 40 miles from Louisville, Kentucky, the state's most populous city. During the period when Indiana labored to contain their HIV outbreak in this region, Kentucky's General Assembly introduced Senate Bill 192 in the 2015 legislative session, which proposed new statutory language that would permit the operation of SSPs in the state.[28] Specifically, Senate Bill 192 proposed to amend Kentucky Revised Statutes, Chapter 218A, Section 500 related to drug paraphernalia. Table 1 describes the section of Kentucky law that was reformed to allow for the implementation of SSPs in the state.

On March 25, 2015, Governor Steve Beshear signed Senate Bill 192 into law. After this legislative effort was concluded, Kentucky's Department for Public Health began to publish guidelines to support county-level health department initiatives to begin operating SSPs in their local communities.[29,30,33] Since 2015, local governments have established more than 70 new operational SSPs across Kentucky, most of which, like Austin, IN, are located in rural counties of fewer than 40,000 residents.

Operating a syringe services program in a rural community

SSPs were largely designed and implemented in large metro areas. Taking a model with that characteristic and deploying it in a rural area requires some adjustment. Public health authorities in Kentucky have learned lessons about the unique approach necessary to successfully operate SSPs in small rural communities. First, because Kentucky's law requires authorization from local leaders, initial dialog is needed to clarify why a given community could benefit from an SSP, respond to concerns, and build trust. For example, common sources of community resistance noted by public health officials in Kentucky are: (1) Denial that the community has a problem with drug use (therefore meaning an SSP is not necessary), and (2) concerns about finding used syringes on playgrounds and other places where children gather.

Kentucky counties have also gained insights about how to serve rural communities once their SSPs are operational, including the example of the Lake Cumberland District Health Department, which posts an online tool to generate monthly reports on SSP utilization.[28–30] Dialog between health officials and local police departments has often led to fruitful collaboration and the soothing of fears that police will patrol SSPs to arrest their clientele. Also, the familiarity and tightknit nature that is common in small communities can be a motivation for some to avoid stigma by traveling to another county to patronize an SSP. Sensitivity to this desire may be a promising way to enhance engagement.

Some descriptive work has also been completed on Kentucky's implementation of SSPs.[32,33] One analysis of 186 SSP participants from Kentucky's Appalachian region found that methamphetamine was reported as the primary drug of injection (45.2% of the sample), followed by nonprescribed buprenorphine (25.8%), and heroin (16.1%).[33] These authors also noted that polysubstance injection was frequently endorsed, finding that 39.3% of primary methamphetamine injectors also reported injecting an opioid in the month before their interview.[33] Problems related to transportation and hours of operation were also noted as the most frequently identified barriers to utilizing SSP services among the identified sample of 186 participants.[33]

When Kentucky chose to legalize SSPs, the public health authorities at the time believed that the medical and public health evidence was sufficiently strong to advocate in favor of their adoption in a largely rural state. There were a set of assumptions embedded in this position: namely, that a public health intervention with an established track record in large metropolitan areas would also be effective in small and sparsely populated rural areas. We also believed that, if such evidence were present, it would be especially meaningful if it could be found within data generated by the Medicaid program—a significant source of access to health services for low-income individuals in Kentucky's rural communities. The present study sought to test those assumptions, and empirically test whether SSPs have demonstrated evidence of a capacity to reduce the spread of infectious disease in Kentucky counties that implemented them.

TABLE 1 Kentucky Revised Statutes, Chapter 218A; Section 500

(5)	**(a) This section shall not prohibit a local health department from operating a substance abuse treatment outreach program which allows participants to exchange hypodermic needles and syringes.**
	(b) To operate a substance abuse treatment outreach program under this subsection, the local health department shall have the consent, which may be revoked at any time, of the local board of health and:
	1. The legislative body of the first or home rule class city in which the program would operate if located in such a city; and 2. The legislative body of the county, urban-county government, or consolidated local government in which the program would operate.
	(c) Items exchanged at the program shall not be deemed drug paraphernalia under this section while located at the program.

METHODS

Source of data

This study was conducted to retrospectively investigate whether the SSPs that arose as a result of Kentucky Senate Bill 192 were an effective means of preventing the spread of infectious disease in Kentucky. A quasi-experimental study was conducted to test whether a county's establishment of a new SSP was associated with a significant decrease in the incidence rate of new cases of infectious disease.

Health care data from Kentucky's Medicaid Management Information System (MMIS) were used to identify our study sample of individuals enrolled in a Kentucky Medicaid health insurance plan during the study period. According to data from the Kaiser Family Foundation and the American Community Survey, only ∼6% of Kentucky's population was uninsured during the study period. Furthermore, approximately one-quarter of Kentucky's adult population was covered by a Medicaid health insurance plan (that rate is often higher in Kentucky's rural areas). Health services literature has also noted that people with SUD have a much greater likelihood of receiving health insurance through Medicaid than any other source.[34] These facts lead us to believe that a sample of Medicaid-enrolled individuals in Kentucky was sufficiently targeted to identify any significant changes in incidence rates of infectious disease associated with the opening of an SSP. Patient-level data were collected from this system within a highly secure, HIPAA-compliant environment. Data for the study were deidentified prior to analysis, and diagnoses were aggregated to the county level.

Because the largest SSPs began to operate in earnest in the middle of 2015, we considered the period from January 1, 2015, through June 30, 2019, to be the SSP implementation phase—which was also considered our study period. The final analysis involved data from 42 counties with SSPs that were opened during this study period. The authors obtained a list of counties with confirmed operational SSPs, as well as their opening dates, from authorities at the Kentucky Department for Public Health. While there are some densely populated metro counties included in this analysis, 31 of these 42 counties were rural areas with a Rural-Urban Continuum Code (RUCC) of 4 or higher. A county RUCC of 1, 2, or 3 is considered "metro" (population of 250,000-1 million+ in a metropolitan area); counties with an RUCC of 4, 5, 6, or 7 are considered "nonmetro" (population of 2,500-20,000+ in an area adjacent to a metropolitan area), and counties with an RUCC of 8 or 9 are considered "nonmetro" (population of less than 2,500 and completely rural). These divisions are further illustrated in the Gantt chart found in Figure 1.

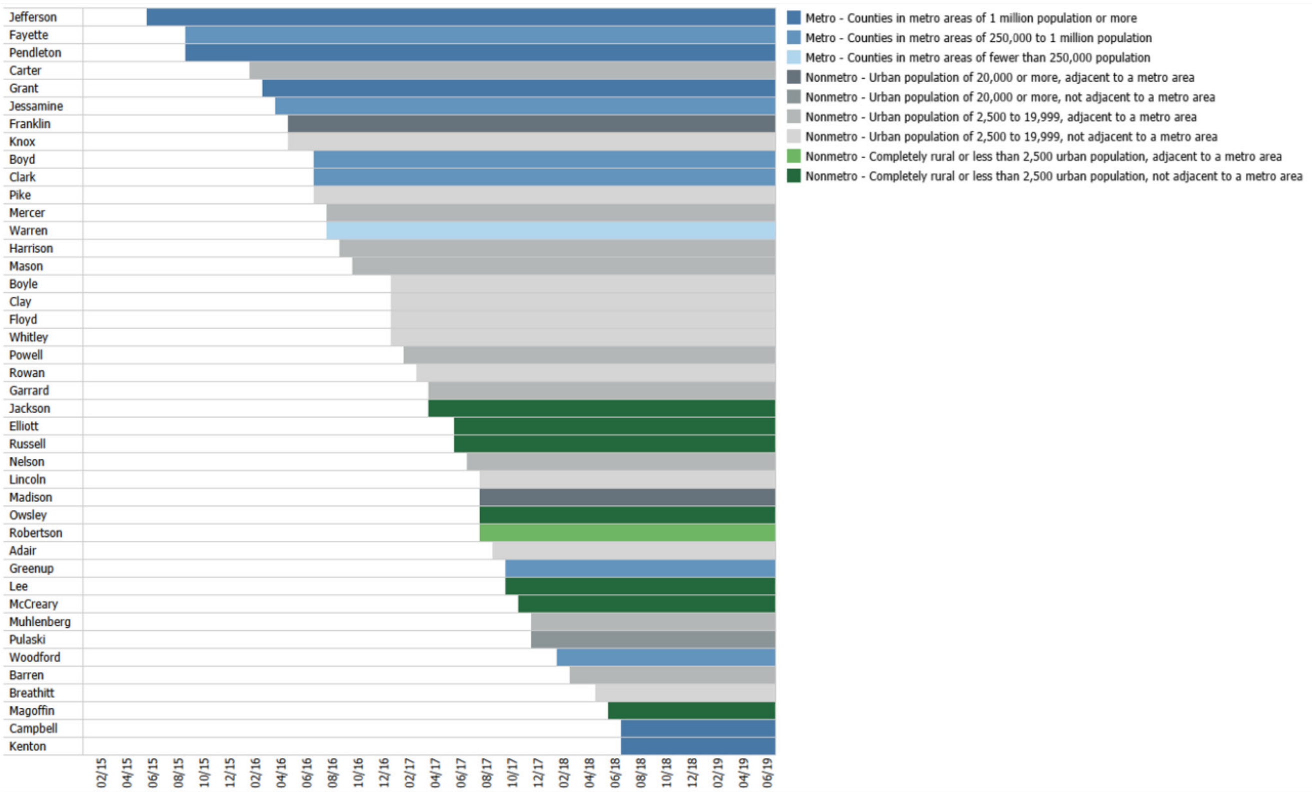

FIGURE 1 Gantt chart of syringe services program adoption by Kentucky counties

Incidence rates of infectious diseases among a population at risk

Identification of a population at risk using administrative data

Baseline infection rates of a set of diagnoses measured before a county implemented an SSP were compared to incidence rates within the same county after SSP opening to examine whether these rates changed over time. Prior to statistical analyses, it was necessary to identify an appropriate "at-risk" sample population to use as the denominator when calculating incidence rates of infection. This process began with a consultation of national infectious disease experts to discuss the most appropriate way to define such a population using only claims and encounters data from state government databases. There have been past examples in the literature where researchers aimed to estimate the size of a population of people who inject drugs in a given geographic area using administrative health records and International Classification of Disease (ICD) data.[35–37] The most pertinent of these investigations to our analyses was conducted by Janjua and colleagues, who compared several algorithmic estimation approaches using administrative health data matched against a cohort dataset (the British Columbia Hepatitis Testers Cohort).[37] The algorithm selected for our analyses—the presence of at least one SUD claim related to an ICD code for an injectable drug—was observed by Janjua and colleagues to have 80% sensitivity, 81% specificity, 71% positive predictive value, and 88% negative predictive value.[37] The ICD diagnosis codes used for our analyses are provided in the online Appendix.

We also consulted with clinicians and public health authorities with experience related to medical billing and coding practices in Kentucky to select this method for identifying our population at risk, as well as our method for identifying new infectious disease cases among this population. Because individuals who do not inject drugs have no need to utilize an SSP, it was deemed inappropriate to examine infection rates using the entirety of the county population served by Medicaid as the denominator. Instead, as mentioned earlier, individuals who had a documented SUD diagnosis that involved a drug commonly administered via injection (eg, heroin but not alcohol) were identified in the claims data using ICD codes for each study month. Given that our study period straddled the adoption of ICD-10, versions 9 and 10 of the ICD were used according to the year a given claim was generated. Individuals who met these criteria served as the population-at-risk where any changes in the rate of new infectious disease diagnoses were most likely to be observed.

Identification of incident infectious disease diagnoses

This study involved surveillance of 6 infectious disease diagnoses. These 6 conditions were selected because they are commonly transmitted via injection drug use. They were: human immunodeficiency virus (HIV), hepatitis C virus (HCV), hepatitis B virus (HBV), osteomyelitis, endocarditis, and skin and soft tissue infection. Notably, nearly half of Kentucky's 120 counties are considered vulnerable to an outbreak of HIV or HCV among local residents who inject drugs.[38] In order to determine if a given claim contained a new (ie, not preexisting) diagnosis, a process of applying "look-back periods" was used for each infection. Infectious disease diagnoses were also identified using ICD codes, and were included if they were contained within the first 4 positions on the claim. This decision was made based on expert advice as well as the assumption that the most clinically salient diagnoses are those coded higher on claims.

For HIV and HCV, a look-back window sought any recorded diagnosis of either disease in the MMIS dating back to January 1, 2009. Diagnoses following the implementation of an SSP without indication of prior diagnosis were deemed incident (ie, new) cases. For HBV, osteomyelitis, and endocarditis, a look-back window of 6 months was implemented. For skin and soft tissue infections, a look-back window of 3 months was utilized in the analysis (these claims also required an infection *plus* an SUD code to be considered valid for our outcome measure). Each of these look-back periods was informed by their respective clinical presentations. These collections of codes—both for identifying the population at risk and infectious disease cases—are broadly consistent with the Centers for Medicare & Medicaid Services Chronic Condition Warehouse condition algorithms.[39]

Statistical analysis

After the appropriate population and infections were identified for all months of the study period, statistical analysis of the changes in rates of diagnosed disease was conducted using generalized estimating equations (GEEs) with negative binomial count models that employed robust standard error calculations and took into account correlation over time. GEE models are especially appropriate for longitudinal analyses of correlated data, and are therefore very useful for epidemiological studies involving disease surveillance.[40] Because it was assumed that opening a new service would require a certain amount of time to begin providing services to clients at capacity, we assumed any significant changes could take time to manifest. Therefore, models examined various lag periods (0, 1, 3, and 6 months after SSP opening) and whether effectiveness of an SSP was associated with length of time the SSP was open. The selection of these lag periods was informed by the number of operational SSPs at the time that analyses were conducted. Specifically, the upper limit of 6 months after opening was chosen because many of the rural SSPs were less than a year old when we began analyses.

Regression models were adjusted to account for the effects of county demographic profiles (race/ethnicity, sex, and age), rurality (using RUCC), and the proportion of Medicaid beneficiaries covered by traditional compared to Medicaid-expansion policies (ie, those who enrolled in Medicaid via the provisions of the Affordable Care Act). Statistical significance for all analyses was set at $P = .05$. The Institutional Review Boards of both the Kentucky Cabinet for Health and Family Services and the University of Kentucky approved this study.

TABLE 2 Demographics of the population at risk for counties contained within the study sample

Variable	Mean	Standard deviation
# of months post SSP opening	28.21	9.61
At-risk population[a]	367.08	453.03
Beneficiaries with OUD[c] diagnosis[a,b]	278.73	324.47
Adult beneficiaries[a,b]	360.17	443.94
White beneficiaries[a,b]	312.05	344.49
Male beneficiaries[a,b]	164.86	210.62
Expansion beneficiaries[a,b,d]	213.79	290.71
Hispanic beneficiaries[a,b]	1.30	3.42

[a]Calculated as per-county, per-month.
[b]As a subset of the at-risk population.
[c]Opioid-use disorder.
[d]Beneficiaries enrolled in a Medicaid expansion plan via the Affordable Care Act (ACA).
N = 42 counties.

RESULTS

Table 2 displays sociodemographic characteristics forall study participants identified to belong to the population at risk for contracting a blood-borne pathogen via injection drug use. Over half of the sample was female (55%). The sample was also predominantly White (87%), which is consistent with the racial demographics of the Kentucky Medicaid-enrolled population. Furthermore, the sample largely was enrolled in managed care organization plans through Kentucky's adoption of Medicaid expansion under the Affordable Care Act in 2014. Because this expansion occurred prior to the start date of our study period, we did not consider its implementation phase to be a significant validity threat to the study.

Implementation of syringe services programs in Kentucky

Fifty-four months of Medicaid claims data were included in our analyses (January 2015-June 2019). During this study period, 42 counties opened SSPs (35% of Kentucky's counties). Specifically, there were 4 SSPs opened in 2015, 16 opened in 2016, 17 opened in 2017, and 5 opened in 2018. Figure 1 illustrates the date at which each of these SSPs opened and how long they were in operation during the study period. Figure 1 also illustrates that the earliest SSPs were opened in metro areas with higher population densities (eg, Jefferson County/Louisville and Fayette County/Lexington). These larger metro areas were followed by rural counties with smaller populations in the following years.

Table 3 displays the results of the GEE models of incidence rate changes over time for counties that implemented SSPs. For these models, the estimated rate ratios for each measurement should be

TABLE 3 Model estimates of changes in county-level infectious disease incidence rates

	Longitudinal count model							
	At time of SSP opening		1 month after SSP opening		3 months after SSP opening		6 months after SSP opening	
Variable	ERR	95% CI	ERR	95% CI	ERR	95% CI	ERR	95% CI
SSP in operation (reference = period prior to opening)	1.103	0.919 -1.324	1.153	0.948 -1.401	1.117	0.919 -1.358	1.147	0.953 -1.381
Month	1.002	0.996 -1.007	1.003	0.997 -1.008	1.003	0.998 -1.008	1.001	0.997 -1.005
Month * SSP in operation (reference = Month * period prior to opening)	0.995	0.990 -1.001	0.994*	0.988 -0.999	0.994*	0.989 -0.999	0.995*	0.990 -0.999
Rurality (reference = Rural County [RUC = 8-9])								
Metro county (RUC = 1-3)	1.218	0.972 -1.527	1.219	0.974 -1.524	1.229	0.985 -1.533	1.221	0.978 -1.523
Nonmetro county (RUC = 4-7)	0.915	0.768 -1.089	0.917	0.771 -1.091	0.922	0.774 -1.097	0.918	0.771 -1.092
Medicaid expansion count	1.000	0.999 -1.001	1.000	0.999 -1.001	1.000	0.999 -1.001	1.000	0.999 -1.001
Male beneficiary count	0.999	0.996 -1.001	0.999	0.997 -1.001	0.999	0.997 -1.001	0.999	0.997 -1.001
White beneficiary count	0.999	0.996 -1.002	0.999	0.996 -1.002	0.999	0.996 -1.002	0.999	0.996 -1.002
Hispanic beneficiary count	0.998	0.976 -1.020	0.998	0.976 -1.020	0.998	0.977 -1.020	0.998	0.976 -1.020
Adult beneficiary count	1.001	0.999 -1.002	1.001	0.999 -1.002	1.001	0.999 -1.002	1.001	0.999 -1.002
Total OUD	1.001	0.999 -1.003	1.001	0.999 -1.003	1.001	0.999 -1.003	1.001	0.999 -1.003

Abbreviations: ERR, estimated rate ratio; OUD, opioid use disorder; RUC, Rural Urban Continuum code.
*$P < .05$.

interpreted as the month-over-month percentage change in infection rates for counties after they implemented an SSP. These results suggest that, on average and adjusting for measured confounding variables (including time), the rate of new infections among people at risk in a county that implemented an SSP decreased by roughly 0.5% each month following the opening of the SSP.

DISCUSSION

We used Medicaid claims data to investigate county-level changes in the incidence rates of infectious disease diagnoses following the implementation of a syringe services program. Using data collected from 42 Kentucky counties over a 10-year period, we found a statistically significant decline in rates of new infections after 1 month of opening an SSP. While our results are consistent with similar favorable findings from SSPs in large metropolitan communities,[41,42] they expand upon the smaller knowledge base related to their functioning in rural, and especially Appalachian, communities.

Our findings provide evidence that these programs can be effectively implemented in rural settings, and especially rural Appalachian settings where the opioid crisis has been particularly acute. We believe this finding is salient because rural SSPs operate in a social environment that is distinct from SSPs that operate in large metro areas (the subject of the preponderance of the literature on SSPs). Principally, the stigma that people who inject drugs in rural areas experience frames their treatment seeking efforts in ways that are less common for their peers in metropolitan areas. While injection drug use is stigmatized all over the United States, recent work by Ibragimov and colleagues suggests that it is a marked barrier to engaging with an SSP in rural areas.[43] This finding was consistent with work by Lancaster and colleagues, who found that only approximately 49% of the people who inject drugs in rural Kentucky had interacted with their local SSP.[44] Fear of being seen utilizing an SSP or disclosing drug use was a prominent reason offered for those individuals who had not received SSP services.[44]

Ibragimov and colleagues also brought to light that local opposition makes the operation of these facilities difficult.[43] As SSPs are frequently county-owned and operated, local opposition to these programs provides the death knell for many facilities. As discussed earlier, the closure of the SSP in Scott County, Indiana, is such an example.[26] Officials and community leaders in rural areas often voice beliefs that injection drug use is a "big city problem" or "not a problem where they live," suggesting, by extension, that programs to help people who inject drugs in those areas are unnecessary. Targeted scholarship and public health work in rural areas is necessary to help bridge divides, dialog with the concerns of local communities, and foster sustainable programs to prevent disease.

The harm reduction provided by an SSP does not end at the provision of sterile needles. The programs also provide valuable education and information on health conditions and how to minimize the risk of contracting infectious diseases. Though the percentage of people who use the program within a given county is estimated to be low, we can assume that the influence of an SSP does not end at the clients themselves.[44] We can assume some distribution of information and resources to social networks, as it has been identified that word-of-mouth is an important factor in soliciting engagement to the program.[43] Educational information on safe injection practices provided by the SSP, as well as resources (ie, new needles) themselves may extend beyond the direct clientele of the program, creating a larger circle of influence than can be captured by a dataset like the one we used for this study.

Using an independent data source not provided by the SSP itself, our findings provide evidence that these programs might be effective at minimizing disease burdens related to injection drug use. While the findings cannot conclusively determine causality, our findings do illustrate that rates of infections do decrease over time after the implementation of an SSP. To our knowledge, this is the first study to utilize Medicaid claims data at this scale to investigate whether the establishment of an SSP is associated with a significant decline in the spread of infectious disease. While Medicaid claims are not produced for the purposes of research, they offered unique advantages for this study. Access to a large database such as the MMIS enabled our analyses to utilize a large amount of information over extended periods. Medicaid claims also capture a naturalistic portrait of health services utilization from the daily lives of individuals as they seek care for their medical needs.

While these features of Medicaid claims data are useful for research, they also have applications for policy and practice. In the United States, the Medicaid program disproportionately insures individuals diagnosed with SUD.[45] Therefore, state Medicaid programs are important means of increasing access to treatment for SUD, and consequently bear a significant share of the cost for associated encounters with the health care system.[45]

Medication costs alone for these conditions account for significant portions of annual Medicaid spending.[46,47] For example, to treat HCV, the current gross ingredient cost for a regimen of Sofosbuvir/velpatasvir for one Medicaid beneficiary for 30 days is approximately $26,071—or over $78,000 for a 12-week course of treatment.[48] This being the case, our results suggest that SSPs may be a source of considerable cost savings for state Medicaid programs, a feature of SSPs that has been described elsewhere in the literature.[49]

Limitations

Our results should be considered in light of important limitations. First, it must be mentioned that SSPs were often implemented in Kentucky counties as one component of several multifaceted public health campaigns throughout the state. For example, health promotion activities aimed at reducing the spread of HIV and HCV often involve educational media and expanded access to diagnostic testing. Any initiatives that were concurrently offered alongside an SSP may have contributed to the incidence rate reductions that we observed.

Second, given the source of our data, our analyses were only able to describe the association between SSP establishment and rates of new diagnoses among individuals insured through Kentucky's Medicaid program. While this arguably captured a significant proportion of individuals who received SSP services, those services were available to all county residents regardless of their health insurance status. Furthermore, because our models are dependent on the way that health care providers code diagnoses, the models may have missed diagnoses for Medicaid-enrolled individuals. For example, physicians often record diagnoses in accordance with a "chief complaint," which may suggest that 1 of the 6 diagnoses could have been present, but not recorded if they were considered secondary to some other condition. It is, therefore, possible that our results underestimate the true strength of association between SSP implementation and reductions in the regional spread of infectious disease. Additionally, because we did not analyze data from neighboring counties to those that opened SSPs, we cannot comment on broader regional effects. In other words, because we suspect that some degree of intercounty travel to utilize SSP services occurred during our study period, our models described here will have failed to capture that dynamic. Kentucky also elected to expand access to Medicaid in 2014, which could mean that the subsequent surge in enrollment included previously uninsured individuals with existing infectious disease diagnoses that may have artificially elevated our baseline measures.

Third, our inclusion criteria for the population at risk of contracting infectious disease from injection drug use (ie, the population most likely to benefit from the operation of an SSP) involved a methodology that has not been validated by past research. Though there have been recent investigations that have affirmed the use of ICD-10 codes from administrative data in public health research,[36] our study is the first to define a study population in this manner for the purposes of testing the effects of a public health intervention. Future inquiries could consider the use of additional sensitivity analyses to test the validity of these algorithm-based inclusion criteria.

Directions for future research

When rural communities resist having SSPs operate is rarely predicated on whether they are an effective means of preventing the spread of disease. Rather, lack of support for these interventions more often rests on beliefs that they will invite crime and social decay.[14–21,26] Several notable studies have explored this perception. For example, an investigation in Baltimore found no significant associations between SSP implementation and increased arrest rates.[11] Another study found that a city without an operating SSP (Miami, FL) had 8 times the quantity of improperly discarded syringes in public spaces as a city that *did* have operational SSPs (San Francisco, CA).[16] A later study also found that the presence of discarded syringes in public spaces in Miami fell by almost half after the city established an SSP.[50] New empirical analyses that investigate whether the establishment of an SSP is associated with significant changes in crime, overdoses, proliferation of illegal drug sales, and so on, would produce valuable results to further inform these disagreements.

It is also worth noting here that while our study sample predominantly consisted of rural counties, the inclusion of metropolitan counties suggests that our results were also produced from data from beneficiaries in large metro areas. In spite of this, we propose that adhering to a rigid rural/metro dichotomy in this case would miss important dynamics related to how individuals utilize SSPs. Principally, as previously noted, we suspect that some degree of "SSP commuting" occurs in Kentucky; to preserve their anonymity, individuals may travel from one county to another to receive SSP services (eg, from one rural county to another county). Future work on SSPs in rural areas may consider involving mobility data or other geographic variables in analyses.

While this study does have important limitations, its results are broadly consistent with past investigations of the efficacy of SSPs.[11] Principally, our results found a significant association between the establishment of a new SSP and subsequent reductions in the growth rate of infectious disease cases. While this finding is notable by itself, it is especially remarkable for 3 additional reasons: (1) it was discovered using Medicaid data—a novel source of information for this type of inquiry; (2) it was discovered in a sample of predominantly rural areas, several of which are in Kentucky's Appalachian region; and (3) it was discovered among a sample of 42 counties, a larger geographic area than previous investigations of the efficacy of SSPs.

CONCLUSIONS

In 2015, Kentucky began a significant policy shift in favor of making SSPs legally available to its citizens. Our finding that SSPs appear to be contributing to a positive public health result in rural counties has particular value for states that may be considering taking steps toward implementing similar policy. This is especially true for states where injection drug use has become a concern in rural regions.

In spite of the lifting of the federal funding ban, SSPs are still prohibited by state and local laws in many areas of the country, with some communities reversing course and closing programs. Even so, there is evidence that more political leaders are beginning to feel that SSPs can be an important part of a comprehensive public health strategy.[51] For instance, in June 2019, Florida Governor Ron DeSantis signed the Infectious Disease Elimination Act into law, which legalized SSPs in a state of over 20 million residents.[52]

SUD is a painful and often debilitating condition. When it involves injection drug use, it dramatically increases an individual's risk of contracting permanent, life-altering infectious diseases. SSPs operate on the premise that it is impossible to foresee when individuals will be able to enter sustained recovery, and it is, therefore, more humane to lessen their suffering in the interim. These results add to the existing body of knowledge that suggests SSPs have beneficial effects on population health outcomes in rural communities.

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DISCLOSURES

This study was conducted at the direction of the Medical Director of the Kentucky Medicaid program at the time of study initiation.

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