One Heroin Fatality Increases the Probability of Kentucky Counties Adopting Syringe Service Programs by One Percent: Lessons Learned from Kentucky’s Response to the Opioid Epidemic

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Abstract

Opioid mortality remains of epidemic proportions despite the efforts of policymakers across the United States. This study examines an underutilized and understudied policy option, Syringe Service Programs (SSPs). SSP adoption is estimated as a function of heroin mortality in Kentucky, where opioid mortality consistently ranks among the highest in the country. Additionally, Kentucky has the highest rate of Hepatitis C and many counties are at risk for Hepatitis-C and Human Immunodeficiency Virus outbreaks. Kentucky has experienced rapid SSP policy diffusion since 2015, growing from zero programs to over 45 in 2018. This study finds that as counties experience one additional death per 100,000 residents, regardless of blood-borne disease prevalence, counties are one percent more likely to implement a SSP. These findings indicate that policymakers, despite SSPs remaining a highly politicized activity, become more receptive to policy options that could help alleviate burdens of the opioid epidemic as mortality—and therefore, problem recognition—climbs.
Introduction

As opioid epidemic mortality continues to climb, policymakers around the country are searching for policy options with potential to provide relief to their constituencies. Recent provisional estimates from the Centers of Disease Control and Prevention (CDC) show that all drug mortality rates have risen by 9.5 percent in 2017, surpassing 2016 by over 6,000 deaths, which is largely attributed to illicit opioids such as fentanyl.¹ From a public health perspective, the rise in intravenous drug use poses morbidity risks to communities at large for the onset and outbreak of blood-borne diseases, human immunodeficiency virus (HIV) and Hepatitis C virus (HCV), due to equipment sharing behaviors and other nonsterile practices, and accidental needle-sticks.

Syringe Service Programs (hereafter, SSPs; also called syringe exchange programs, needle exchange programs, and needle syringe programs) are a harm reduction-based intervention that supply sanitary injection equipment to persons who inject drugs (PWID). But beyond their general function, SSPs serve as a critical touchpoint to healthcare services PWID may not otherwise have. Participants receive education on safer injection practices and safer sex practices, receive on-site disease testing or referrals to testing and treatment services for HIV and HCV, are connected to social services, and critically, participants can receive referrals to treatment for substance use disorder and receive training and supplies for overdose prevention (i.e. Narcan/naloxone). Despite SSPs’ merits as a harm reduction program, SSPs are highly politicized activities that are often met with moral panic among political leaders and communities due to the stigma and rhetoric that SSPs enable or encourage drug use and attract new users into communities.
However, prior studies have shown that SSPs effectively reduce needle-sharing behaviors and disease transmission, do not increase drug use or attract new PWID, and result in fewer improperly discarded used syringes.\textsuperscript{2,3,4} Evidence from a randomized experimental study found that enrollment in substance use disorder treatment is \textit{five times} more likely for participants than that of non-participants, the duration of stay in treatment is longer for participants, and that participation leads to \textit{reduced} and \textit{ceased} drug use.\textsuperscript{5} Therefore, SSPs are an underutilized and underexamined policy option that show potential to provide opioid epidemic relief.

Additional prior literature has assessed facilitators to SSP adoption, finding that political pressure to act and action from grassroots activists were predictive of adoption.\textsuperscript{6} The way in which program adoption is approached also facilitates adoption, as one study found that making the case that SSPs promote equity, liberty, social and fiscal efficiency, and increase security facilitates SSP adoption.\textsuperscript{7} Ultimately, the political climate must be amenable for SSPs to operate, particularly in the eight states—Kentucky included—that require local approval to operate.

\textbf{Kentucky’s Opioid Epidemic}

While all drug mortality has continued to climb well into 2017, Kentucky is one of a few states where all drug mortality is predicted to have declined from February 2017 to February 2018, falling by -3.6\% in 2017.\textsuperscript{8} The state is experiencing a substitution to amphetamines, and poly-use of opioids and amphetamines, but opioid use remains high. Several targeted interventions have been underway in Kentucky to address the opioid crisis that could be associated with a decline in mortality, including SSPs. Former Kentucky Governor Steve Beshear legalized SSPs in March 2015 under Senate Bill 192, more commonly referred to as The Heroin Bill. The Heroin Bill legalized SSPs, increased coroner or medical examiner cause of death identification and reporting requirements, budgeted for the expansion of substance use
disorder treatment programs including the expansion of medically assisted treatment for inmates and pregnant women, expanded access to naloxone, legalized a Good Samaritan law, and allowed for alternative sentencing to the enrollment of faith-based residential substance use disorder treatment, among other items. In addition to The Heroin Bill, Kentucky’s Prescription Drug Monitoring Program was enacted in December 1998 and the state passed Pain Management Clinic Regulations in June 2015.9

Within three years after passage of The Heroin Bill, the state experienced rapid SSP policy diffusion, moving from zero SSPs to having operational SSPs in 35 counties with at least ten more in the works in 2018. Kentucky will shortly (if not already) lead the nation in the number of known SSPs in a state, surpassing larger states like California (n=42) and New Mexico (n=49), who have been leaders in SSPs since the 1980s.10 In square miles, Kentucky is three times smaller than New Mexico, four times smaller than California, and has 35 million less residents than the state of California.

This study examines SSPs in the context of a state with unprecedented SSP policy diffusion and higher than average opioid mortality and blood-borne disease prevalence. Kentucky has consistently ranked among the top ten states with the highest rates of opioid mortality, rates nearly twice as high as the national rate.11 Moreover, Kentucky’s HCV rates are highest in the nation with 1,089 new HCV cases reported between 2008-2015, at least twice the national rate.12,13 Fifty-four counties in the state of Kentucky, nearly half of the 120-county total, were identified by the CDC as being at vulnerable for HIV and HCV outbreaks in 2016—making up a quarter of the identified 220 at-risk counties nationwide.14 The Heroin Bill in Kentucky passed in the wake of climbing opioid mortality rates and an awareness of HIV and HCV outbreak risks. The importance of SSP legalization was further demonstrated not long after
The Heroin Bill’s passage by the HIV outbreak in nearby Scott County, Indiana, which was attributed to needle sharing among PWID.15,16

Little, if any, research has been done on SSPs within the context of the opioid crisis and none have examined SSP policy diffusion. I also contribute to the literature by examining SSP adoption within the context of the opioid epidemic and outbreak risks, in a southern state, in Appalachia, and in a state with a large rural population. I conducted qualitative interviews with key stakeholders in the SSP implementation process in Kentucky in 2016 and found that heroin mortality, and therefore problem recognition, is a significant driver of SSP adoption. Qualitative interviews informed the current study, where I examine heroin mortality as a function of SSP adoption and find that heroin mortality is more predictive of SSP adoption than HIV incidence. I find that as heroin mortality climbs, decisionmakers are more likely to perceive and accept a problem. I quantify decisionmaker willingness to act and find that willingness increases by one percent for each additional death of an individual whose cause of death is heroin-related.

Study Data and Methods

Qualitative Data

Qualitative data was collected via interviews conducted in 2016 with key Kentucky stakeholders in the SSP adoption and implementation process. Each subject was asked a standard set of IRB approved questions about SSP approval and the implementation process in their respective counties. The question set asked depended upon the role of the stakeholder. I interviewed a total of 21 stakeholders, including five local public health department directors, three district health department directors, four local board of health chairs, one district board of health chair, one public safety chair, four mayors or mayor staff persons, and three judge executives in counties with programs and without programs, representing a total of 16 counties.
Quantitative Data

Heroin opioid-related drug poisoning death (hereafter, “heroin mortality”) data were drawn from The Centers for Disease Control and Prevention (CDC), National Center for Health Statistics’ National Vital Statistics System multiple cause-of-death mortality files from years 2000 to 2016. Heroin mortality data were identified by utilizing International Classification of Disease, Tenth Revision (ICD-10) underlying cause of death codes: X40-44 (unintentional), X60-64 (suicide), X85 (homicide), or Y10-Y14 (undetermined intent). Code T40.1 was used to identify heroin mortality. A heroin mortality rate measure was calculated as the rate of heroin-related deaths per 100,000 in the county population and is a conservative proxy of opioid-related mortality in Kentucky. Heroin mortality alone was examined as SSPs are intended to engage PWID and heroin is most commonly administered via injection. Licit and illicit non-heroin opioids, including fentanyl, are also used intravenously, though not as commonly as heroin.

A binary SSP indicator variable for whether a county had an operational SSP was created utilizing data collected from numerous sources. Implementation dates, including the day, month, and year that programs became operational were compiled from historical documents, the Kentucky Department of Public Health: HIV/AIDS Branch website, the North American Syringe Exchange Network (NASEN) website, and phone calls with County Health Department staff. Data on HIV cases from the Kentucky Department of Public Health: HIV/AIDS Branch for years 2011 to 2016 was employed to create a control measure for HIV incidence. The control for HIV incidence was calculated as the rate of HIV cases per 100,000 in the total county population.

Demographic and geographic variables from the US Census and Bureau of Labor Statistics for the years 2000-2017 were also employed as controls at the year and county-level. US Census Urban-Rural Continuum codes were utilized to create indicator variables for metro,
urban, and rural county population groups. Other US Census data included as controls were the county population size, sex, age, and race. A county unemployment control variable was created using Local Area Unemployment Statistics from the Bureau of Labor Statistics. Lastly, an indicator variable for the years 2000-2017 was created to control for time. Because the heroin death data was not censored, controlling for clustering and observation weights were not needed.

**Qualitative Methods**

A grounded theory approach was employed to analyze the qualitative data collected from interviews. I conducted a thematic content analysis of transcribed interviews using the coding software Nvivo.

**Quantitative Methods**

This study used a quasi-experimental design to examine the relationship between heroin mortality and SSPs at the county-level. The data are county-year panel data. The dependent variable in this study is a binary indicator (1, 0) of SSPs in Kentucky at the county-level. First, I conducted descriptive statistics and t-tests. I then estimated a linear probability model with lagged heroin and HIV rates for four years and year, urban classification status, and county fixed effects with robust standard errors. The model is depicted below:

\[
(SSP) = \beta_1 L_x \text{ heroin death rate } X_1 + \beta_2 L_x \text{ HIV rate } X_2 + \beta_3 \text{ population group } X_3 + \beta_4 \text{ sex } X_4 + \beta_5 \text{ age } X_5 + \beta_6 \text{ race } X_6 + \beta_7 \text{ population } X_7 + \beta_8 \text{ unemployment } X_8 + \beta_9 \text{ year fixed effects } X_9 + \beta_{10} \text{ urban classification fixed effects } X_{10} + \beta_{11} \text{ county fixed effects } X_{11} + e
\]

The heroin mortality and HIV rates were lagged in the model because, in theory, policy actions are motivated by factors from the year prior. In other words, whether a SSP is adopted this year is influenced by last year’s heroin mortality or disease rates. The models were estimated by panel setting the data and using the `xtreg` command in Stata 15.
Qualitative Results

Policy diffusion occurred from metro to urban counties between 2015 and 2016, and from metro and urban counties to rural counties between 2016 and 2017. Early leader counties who adopted SSPs in 2015 were within metro areas where there was an existing recognized need for intervention, as one public health professional provided that “. . . the heroin issue was already on people’s minds and in the forefront of their thoughts. It really wasn’t that we had to do any major push for it, people were expecting it and ready for it.”

A mayor of an urban county that adopted SSPs a year later in 2016 shared their motivation to alleviate the opioid epidemic, having said that having a trained substance use counselor on site was, “a key element; if we were able to make the difference in one of 10 people’s lives over a period of time, that would be huge.” However, many battles championed by county health department staffs were hard won in counties where programs now exist. A rural county aiming to adopt a program in 2016 was met with moral panic by political leaders. The public health professional of that county shared that:

“. . . part of the people who make decisions here do not want to admit that we have a problem or think that by having this program we would be admitting there is a drug problem. They can’t see that we wouldn’t be encouraging drug use. All of their friends feel the same. You can bury your head in the sand for quite a while and that is what has happened.”

This quote signifies that a barrier to program adoption is a systemic issue of a lack of problem recognition. After two years of continued attempts to gain SSP approval, and as a result of heroin mortality rates climbing in that county and elected leaders personally experiencing opioid related losses, a SSP was approved and implemented in 2018. This confirmed a sentiment a public health provider provided, which was, “As the people that sit on the fiscal courts and city councils
have friends and family members who have problems with heroin, it comes home and they become a bit more empathetic,” indicating shifts in perception due to climbing mortality.19

To further motivate the current study, SSPs meet those with substance use disorder where they are on the recovery continuum. SSPs serve as a critical touchpoint to healthcare and social services that may not otherwise be accessible. As prior studies have identified, SSP services facilitate substance use disorder treatment enrollment. One public health leader noted that, “participants get treatment every time they walk through the door whether they realize it or not. It is helping people start on that path toward recovery.”20 Another echoed this sentiment, providing that,

“We find that once you start treating people with compassion and working with them, building trust, and educating them they start taking better care of themselves and then they start becoming more receptive to treatment.”21

The qualitative data analysis provided that ultimately, in part due to the language in Kentucky law, the recognition of a drug issue among stakeholders and the political climate are more predictive of SSP adoption than other factors such as policy-oriented learning or having policy champions. The findings in my qualitative research motivated the following quantitative analysis. I aimed to examine whether heroin mortality, a proxy for problem recognition, was a statistically significant driver of SSP adoption across Kentucky counties. Understanding the motivation behind this rapid policy diffusion in Kentucky can increase understanding regarding SSP expansion, which remains a highly politicized activity across much of the United States.

**Quantitative Results**

Descriptive statistics are provided in Table 1. The mean heroin mortality rate in the state of Kentucky between 2011 and 2016 per 100,000 in the county population was 2.13. However,
the mean is much higher, 8.59, when examining the mean of counties between 2011 and 2016 with at least one heroin fatality.

**Table 1. Variable Means and Standard Deviations, 2011-2017**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Var. Years</th>
<th>Obs.</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSPs</td>
<td>(2015-2017)</td>
<td>360</td>
<td>.147</td>
<td>.355</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Heroin Mortality Rate</td>
<td>(2011-2016)</td>
<td>722</td>
<td>2.129</td>
<td>4.891</td>
<td>0</td>
<td>32.178</td>
</tr>
<tr>
<td>HIV Rate</td>
<td>(2011-2016)</td>
<td>722</td>
<td>101.911</td>
<td>72.65</td>
<td>0</td>
<td>572.939</td>
</tr>
<tr>
<td>Total Population</td>
<td>(2014-2017)</td>
<td>480</td>
<td>36951.81</td>
<td>76819.94</td>
<td>2134</td>
<td>771158</td>
</tr>
<tr>
<td>(%) Male</td>
<td>(2014-2017)</td>
<td>480</td>
<td>.497</td>
<td>.016</td>
<td>.463</td>
<td>.567</td>
</tr>
<tr>
<td>(%) Ages 20-64</td>
<td>(2014-2017)</td>
<td>480</td>
<td>.436</td>
<td>.144</td>
<td>.273</td>
<td>.641</td>
</tr>
<tr>
<td>Unemployment Rate</td>
<td>(2014-2017)</td>
<td>480</td>
<td>6.562</td>
<td>2.223</td>
<td>3.2</td>
<td>18.8</td>
</tr>
</tbody>
</table>

Descriptive statistics also show that the mean differences in heroin mortality rates from 2011 to 2016 range from 4.195 in metro areas (29% of counties in the state), 1.826 in urban areas (41% of counties in the state), to .547 per 100,000 in rural counties (30% of counties in the state). HIV and HCV rates have increased in tandem with the rapid growth of the opioid epidemic. Since 2011, HIV rates increased from a mean of 91.379 (per 100,000) in 2011 to a mean rate of 112.013 in 2016.

Table 2 displays the rapid policy diffusion of SSPs across county population groups between the years 2015 and 2017. Percentages of programs in metro, rural, and urban areas are provided in brackets.

**Table 2. Diffusion of SSPs in Kentucky 2015-2017: Operational SSPs by Year and Population Group**

<table>
<thead>
<tr>
<th>County Type</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metro</td>
<td>3 [100%]</td>
<td>8 [53%]</td>
<td>9 [26%]</td>
</tr>
<tr>
<td>Urban</td>
<td>-</td>
<td>7 [47%]</td>
<td>19 [54%]</td>
</tr>
<tr>
<td>Rural</td>
<td>-</td>
<td>-</td>
<td>7 [20%]</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>15</td>
<td>35</td>
</tr>
</tbody>
</table>
In 2015, three programs were adopted and implemented in metro areas, followed by five additional metro areas and seven urban areas implemented SSPs in 2016. By 2017, an additional metro area, 12 additional urban areas, and seven rural areas had implemented SSPs resulting in a total of 35 programs throughout the state. Thus far in 2018, an additional 10 counties have implemented programs, meaning over a third of the counties in the state have programs. Figure 1 graphically displays the diffusion of SSPs across counties by year.

**Figure 1. Policy Diffusion of Kentucky Syringe Service Programs: 2015-2017**

Means testing provided that the means between SSP implementation and heroin mortality rates are significantly different from zero. In counties where SSPs are active in the years after 2015, the mean heroin mortality rate was 9.84 versus 2.7 in counties without SSPs, indicating that heroin mortality is a predictor of SSP adoption.

Model results (Table 3) show that as the heroin mortality rate in the year prior increases by one individual per 100,000 in the county population, the likelihood of a county implementing a SSP increases by 1.2% at the 95 percent level of confidence. Lagging deaths by two years, the likelihood of SSP adoption increases by 2.2% per heroin-related fatality at the 99 percent level of confidence.
Table 3. Lagged Heroin Mortality and HIV Rates on SSP Implementation Model Results, Estimated for 2011-2017

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>95% confidence intervals in brackets</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1. Heroin Mortality Rate</td>
<td>0.012**</td>
<td>[.000, .025]</td>
</tr>
<tr>
<td>L2. Heroin Mortality Rate</td>
<td>0.022***</td>
<td>[.005, .038]</td>
</tr>
<tr>
<td>L3. Heroin Mortality Rate</td>
<td>0.015**</td>
<td>[.001, .028]</td>
</tr>
<tr>
<td>L4. Heroin Mortality Rate</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>L1. HIV rate</td>
<td>0.006</td>
<td>[-.004, .015]</td>
</tr>
<tr>
<td>L2. HIV rate</td>
<td>-0.005</td>
<td>[-.013, .003]</td>
</tr>
<tr>
<td>L3. HIV rate</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>L4. HIV rate</td>
<td>-0.003</td>
<td>[-.010, .004]</td>
</tr>
<tr>
<td>Year [2015]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>-.117</td>
<td>[-1.815, 1.582]</td>
</tr>
<tr>
<td>2017</td>
<td>.099</td>
<td>[-1.577, 1.776]</td>
</tr>
<tr>
<td>Population Group [Metro]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>.744*</td>
<td>[.059, 1.546]</td>
</tr>
<tr>
<td>Rural</td>
<td>.510</td>
<td>[-.718, 1.738]</td>
</tr>
<tr>
<td>(%) Male</td>
<td>-6.651</td>
<td>[-17.560, 4.257]</td>
</tr>
<tr>
<td>(%) Ages 20-64</td>
<td>.657</td>
<td>[-5.223, 6.537]</td>
</tr>
<tr>
<td>(%) White</td>
<td>-3.661***</td>
<td>[-5.373, -1.949]</td>
</tr>
<tr>
<td>Total Population</td>
<td>-.00002</td>
<td>[-.000, .000]</td>
</tr>
<tr>
<td>Unemployment Rate</td>
<td>.0008</td>
<td>[.069, .071]</td>
</tr>
</tbody>
</table>

Coefficients represent the impact of county-level heroin mortality rates, in each year, on the adoption of SSPs in Kentucky counties. The model includes lag indicators for the heroin mortality and HIV rates and controls for year, population group, and county fixed effects. *p<.10, ** p<0.05, *** p<.01
When lagging deaths for three years, counties are 1.5% more likely to implement a SSP per additional heroin death. These findings support the qualitative analysis findings that as heroin mortality climbs over time and problem recognition increases, county decisionmakers are more likely to act. When lagging for beyond three years, the coefficient is small and no longer significant, which is to be expected given that the opioid epidemic had yet to reach epidemic proportions for an extended period of time. Urban county status in comparison to metro counties and the percentage of the population that are white per county were also predictive of SSP adoption. The model shows no indication of a relationship between HIV incidence and SSP adoption.

Discussion

From a policy perspective, this paper provides evidence that as opioid mortality climbs, health officials and county policymakers become more willing to act due to increased recognition of a need for intervention. As of May 2017, a reported 7,300 people had participated in a Kentucky SSP, over 650 participants had received HIV testing, and 609 participants were referred to treatment.\(^{22}\) As highlighted earlier, participation in SSPs provides a critical touchpoint between PWID and healthcare services.

The counterfactual of Kentucky opioid mortality is unobservable. In other words, it is unclear whether HIV or HCV outbreaks have been avoided due to SSP participation and it is unclear whether the 609 individuals who enrolled in treatment between 2015 and 2017 would have survived had they opted out of SSP participation. The evidence in this study, triangulated with findings from qualitative interviews, support that heroin mortality is a significant driver of SSP adoption and thus far, evidence suggests that SSPs can save lives.
SSP adoption remains a highly politicized activity in the United States. As of 2018, only 18 states (CA, CO, CT, DE, HI, IN, KY, ME, MD, MA, NV, NJ, NM, NY, NC, RI, VT, WA) and DC explicitly authorize SSPs by law. Additional legal approval is required in eight states (CO, IN, KY, MD, MA, NJ, NM, VT), where health officials must gain approval from local governing authorities prior to implementing a program. Despite legal barriers, as of 2014, 194 known SSPs existed across 33 states.

The Consolidated Appropriations Act of 2016 lifted a ban against using federal funds for SSPs that had been in place since 1988 (though briefly lifted between 2009 and 2011). Kentucky Senator Mitch McConnell and Appropriations Committee chairman Hal Rogers, R-Ky, worked jointly to lift the ban in Congress. Though funding cannot be applied toward the purchase of needles, needles are inexpensive (~$.017 each) and dollars can be applied toward other operational costs. Additional resources may also be available from states and local interest groups.

**Limitations**

This study had some limitations. First, other opioid epidemic targeted policies were not accounted for in this study, such as prescription drug monitoring programs or pill mill legislation because the data did not converge in the models. Policies at the state level are important and interact with mortality and potentially the probability of adopting SSPs. However, because opioid policy control variables are at the state-level, there is no variation in those data at the county-level. Second, HCV data is not publicly available at the county-level in Kentucky from the CDC. I was only able to receive HCV observations at the county level for 2015 to 2016 from the Kentucky Department of Public Health. However, health department workers informed me that the data has validity concerns due to a lack of compliance with the new electronic reporting
system. Therefore, it was excluded from this study. While this study did not find an association between HIV prevalence and SSP adoption, as future data become available, I will work to disentangle mortality, HIV, and HCV rates that are concurrently occurring and likely interconnected. While this study focuses specifically on the state of Kentucky, these results are generalizable to states that also require local legal approval for programs to operate, to other Appalachian states with high opioid mortality and morbidity, and to states with large rural populations and a similar political climate to the state of Kentucky.

Conclusion

Increased access to SSP services is needed, as SSPs show promise for curbing opioid-related mortality and morbidity. While SSPs remain highly politicized, context-specific political activities that require legal authorization to operate at the state and sometimes local level, the lifting of the ban on federal funding has opened a policy window for other areas to adopt SSPs. Future research on SSPs in line with the opioid epidemic is needed to 1) further examine SSP adoption and implementation in the context of the opioid crisis and their potential effect on opioid mortality, and 2) to examine substance use disorder treatment enrollment and outcomes for SSP participants, as SSPs are a promising and underutilized opioid epidemic policy intervention.
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