Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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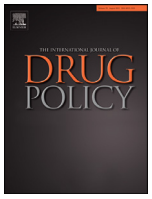

Short Report

Impact of COVID-19 on the characteristics of opioid overdose deaths in Arkansas

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ABSTRACT

Background: In the US, spikes in drug overdose deaths overlapping with the COVID-19 pandemic create concern that persons who use drugs are especially vulnerable. This study aimed to compare the trends in opioid overdose deaths and characterize opioid overdose deaths by drug subtype and person characteristics pre-COVID (2017-2019) and one-year post-COVID-19 emergence (2020).

Methods: We obtained death certificates on drug overdose deaths in Arkansas from January 1, 2017, through December 31, 2020. Our analyses consisted of an interrupted time-series and segmented regression analysis to assess the impact of COVID-19 on the number of opioid overdose deaths.

Results: The proportion of opioid overdose deaths increased by 36% post-COVID emergence (95% CI: 14%, 59%). The trend in overdose deaths involving synthetic narcotics other than methadone, such as fentanyl and tramadol, has increased since 2018 (74 in 2018 vs 79 in 2019; p =0.02 and 79 in 2019 versus 158 in 2020; $p = 0.03$). Opioid overdose deaths involving methamphetamine have more than doubled (36 in 2019 vs 82 in 2020; $p = 0.06$) despite remaining steady from 2018 to 2019. Synthetic narcotics have surpassed methamphetamine (71% vs. 37%) as the leading cause of opioid overdose deaths in Arkansas during the pandemic. This study found that synthetic narcotics are the significant drivers of the increase in opioid overdose deaths in Arkansas during the pandemic.

Conclusions: The co-occurrence of the COVID-19 pandemic and the drug abuse epidemic further highlights the increased need for expanding awareness and availability of resources for treating substance use disorders.

Introduction

Fatal drug overdoses for all types have continued to increase in the United States (US) since 2010 (Jalal et al., 2018). Over 91,000 drug overdose deaths have occurred recently, with mortality rates increasing by 31% from 2019 to 2020 (21.6 to 28.3 overdoses per 100,000 deaths) (CDC, 2022b,c). While deaths from prescription opioids have declined, deaths from heroin and synthetic opioids have increased rapidly (Jalal et al., 2018). Illegal fentanyl has driven much of the recent increases (Reuter, 2022). Moreover, the burden of drug overdose mortality has shifted towards mid-aged (20 to 40), white, rural populations (Jalal et al., 2018). Rural populations have also been especially vulnerable to the impacts of the COVID-19 epidemic. Therefore, it is crucial to understand how the COVID-19 pandemic has impacted drug overdose mortality. In this study, we investigated trends in opioid overdose deaths pre- and post-COVID-19 emergence in Arkansas, which has a sizable rural population.

There are reasons to suspect that the COVID-19 pandemic may have contributed to increased opioid overdoses. First, efforts to mitigate the spread of COVID-19, such as travel restrictions, border closures, stay-at-home orders, and social distancing, may have reduced the foreign supply of heroin, leading to greater reliance upon domestically produced opioids such as fentanyl and its derivatives. Second, increased economic stress and social isolation may have led to increased illegal drug use and changed or limited access to treatment and healthcare providers among people who use drugs (Glober et al., 2020; United Nations Office on Drugs and Crime, 2020). Third, inflammation and neuroimmune signaling related to COVID-19 may modulate brain regions involved in drug abuse formation (Cisneros & Cunningham, 2021).

A few studies using US state data have evaluated the impact of the COVID-19 pandemic on drug overdoses and mortality. One study evaluated opioid overdose deaths before and after the COVID-19 stay-at-home order in Los Angeles County and found that nearly 56% more opioid-related deaths occurred between January and April 2020 compared to 2019 (Kelley et al., 2021). Another study using Indianapolis's county

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emergency medical services (EMS) data found that drug overdose deaths increased by 47% (Glober et al., 2020). A study in Kentucky showed a 50% increase in EMS runs for suspected opioid overdose deaths after the state's COVID-19 state emergency declaration (Slavova et al., 2020). However, overall overdose deaths based on vital records did not significantly increase from 2018 through 2020 in Massachusetts. The study found no correlation between the COVID-19 case fatality rate and the increased drug overdose death rate, although the number of overdose deaths involving amphetamines did increase from 2019 to 2020 (DiGennaro et al., 2021). These limited and inconsistent findings suggest the need for further studies on a state level, especially in states with significant rural populations.

To address this need, we examined changes in the trend and characteristics of opioid overdose deaths in Arkansas based on death certificates comparing pre–COVID-19 (2017-2019) and post-COVID-19 emergence (2020). For context, in March 2020, the State of Arkansas declared a state of emergency due to COVID-19, and the US government announced COVID-19 as a national emergency and instituted travel restrictions on non-US citizens (AJMC, 2021). Provisional data released by National Center for Health Statistics has shown that the number of drug overdose deaths in Arkansas increased by 39% in 2020 compared to 2019 (CDC, 2022d). Therefore, there is an urgent public health need and opportunity in Arkansas to conduct this study.

Materials and methods

Data

This study obtained deidentified death certificate data on all drug overdose deaths in Arkansas between January 1, 2017, and December 31, 2020, from the Arkansas Registry of Vital Records and Statistics. The University of Arkansas for Medical Sciences institutional review board determined this study to be non-human subjects research and did not require approval or informed consent.

Measures

Death certificates included a single underlying cause of death and up to 20 additional multiple contributing causes of death. Drug overdose deaths were identified using the following International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) (CDC, 2022a) underlying cause of death codes for poisoning based on intent: X40-X44 (unintentional), X60-X64 (self-harm/suicide), and Y10-Y14 (undetermined intent). We defined deaths involving opioids based on whether any of the following ICD-10-CM codes were listed as contributing causes of death: T40.1 (heroin), T40.2 (prescription opioids), T40.3 (Methadone), T40.4 (Other synthetic narcotics), T40.6 (Other and unspecified narcotics). The code of T40.2 includes both natural opioid analgesics (morphine and codeine) and semisynthetic opioid analgesics (oxycodone, hydrocodone, hydromorphone, and oxymorphone). Co-involvement of non-opioids in deaths involving opioids was defined based on the presence of the following ICD-10-CM codes if they are listed as contributing causes of death, including cocaine (T40.5), methamphetamine (T43.6), benzodiazepines (T42.4), ethanol (T51.0), or alcohol, unspecified (T51.9). Because there can be multiple contributing causes of death, an individual might be counted more than once based on drug subtype.

Statistical Analysis

To characterize opioid overdose deaths by drug subtype and person characteristics, we included opioid overdose deaths that occurred in Arkansas between April 1 through December 31 in the years 2017 to 2020. We compared differences in age for 2017 vs. 2018, 2018 vs. 2019, and 2019 vs. 2020 using Mann-Whitney U tests. We also compared several characteristics of opioid overdose deaths (sex, race, poisoning intent, poisonings by opioid subtype, co-involvement with non-opioids, and location [home vs. other]) across years using Pearson's Chi-Square Test of Independence. We used interrupted time series and linear segmented regression analysis to evaluate the association of COVID-19 emergence with the overall number of opioid overdose deaths. We included opioid overdose deaths in Arkansas between January 1, 2017, through December 31, 2020. Using this model, y_t represents the outcome (monthly count of opioid overdose deaths) in month *t*, *time* is a continuous variable ranging from 1 (January 2017) to 48 (December 2020), and *period* is a binary variable indicating whether a month was before or after COVID-19 emergence. All analyses were performed using RStudio v1.3.1093-1 software (RStudio, Boston, MA).

$$y_t = \beta_0 + \beta_1 * time_t + \beta_2 * period$$

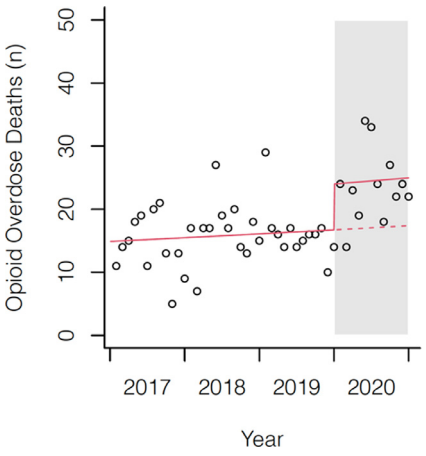

Fig. 1. Impact of COVID-19 on the number of Opioid Overdose Deaths in Arkansas from January 2017 to December 2020. Interrupted time series with level change regression model. Line: predicted trend based on the unadjusted regression model.

Results

From April through December, there were 346 overdose deaths in 2017, 359 overdose deaths in 2018, 282 overdose deaths in 2019, and 428 overdose deaths in 2020. Opioids contributed to 37% of overdose deaths in 2017, 45% in 2018, 47% in 2019, and 52% in 2020. Opioid overdose deaths that had an opioid as a primary cause of death constituted 37% of overdose deaths in 2017, 31% of overdose deaths in 2018, 27% of overdose deaths in 2019, and 23% of overdose deaths in 2020 (these data are not shown in tables).

Fig. 1 plots the number of monthly opioid overdose deaths from 2017 to 2020. A fitted regression line shows the trend in monthly opioid overdose deaths pre-COVID-19 (solid line) and the hypothetical trend post-COVID-19 (dashed line), assuming no change. This counterfactual scenario provides a comparison assuming COVID-19 had not occurred (Bernal et al., 2017). Pre-COVID-19, the monthly trend in opioid overdose deaths was not statistically significant (Fig. 1; 0.003; 95% CI: −0.005 0.01); however, post-COVID-19, there was a substantial increase in monthly opioid overdose deaths by 36% (95% CI: 14% 59%).

The increase in opioid-related overdose deaths occurred despite declining deaths involving heroin and prescription opioids: 17% (2019) to 5% (2020) and from 43% (2019) to 33% (2020), respectively (Table 1). The decline was offset by increased deaths involving other synthetic narcotics significantly across pre–and post-COVID-19 emergence. For example, overdose deaths involving other synthetic narcotics rose from 59% to 71% between 2019 and 2020. We observed no significant changes in opioid overdoses involving methadone and other unspecified narcotics from 2017 to 2020.

Table 1
Characteristics of opioid overdose deaths in Arkansas pre- (2017-2019) and post-COVID-19 (2020) emergence, months of April to December.

	Pre–COVID-19			Post- COVID-19 emergence	*p*-value		
	2017	2018	2019	2020	2017 vs. 2018	2018 vs. 2019	2019 vs. 2020
Total opioid overdose deaths, N	129	160	133	223			
Age, mean	42.0	40.8	39.6	40.6	0.66	0.37	0.63
(95% CI)	(39.5 44.4)	(38.9, 42.8)	(37.5, 41.8)	(38.8, 42.3)			
Sex					0.28	0.40	0.24
Male	66 (51%)	92 (58%)	83 (62%)	125 (56%)			
Female	63 (49%)	68 (42%)	50 (38%)	98 (44%)			
Race/Ethnicity					0.04	0.31	0.33
Non-Hispanic White	115 (89%)	143 (89%)	117 (88%)	182 (82%)			
Non-Hispanic Black	8 (6%)	15 (9%)	14 (11%)	31 (14%)			
Hispanic	5 (4%)	0	2 (1%)	9 (4%)			
Other	1 (1%)	2 (1%)	0	1 (0.4%)			
Poisoning intent					0.26	0.11	0.93
Unintentional	101 (78%)	129 (81%)	116 (87%)	194 (87%)			
Undetermined	8 (6%)	15 (9%)	12 (9%)	19 (8.5%)			
Suicide	20 (16%)	16 (10%)	5 (4%)	10 (4.5%)			
Deaths involving opioids[a]							
Heroin	10 (8%)	16 (10%)	22 (17%)	12 (5%)	0.54	0.12	<0.001
Prescription opioids[b]	77 (60%)	84 (53%)	57 (43%)	74 (33%)	0.22	0.10	0.06
Methadone	11 (9%)	10 (6%)	13 (10%)	14 (6%)	0.49	0.26	0.23
Other synthetic narcotics[c]	52 (40%)	74 (46%)	79 (59%)	158 (71%)	0.31	0.02	0.03
Other and unspecified narcotics[d]	11 (9%)	11 (7%)	3 (2%)	12 (5%)	0.59	0.30	0.18
Co-involvement with non-opioids[e]							
Cocaine	8 (6%)	12 (7.5%)	8 (6%)	16 (7%)	0.81	0.65	0.83
Methamphetamine	14 (11%)	38 (24%)	36 (27%)	82 (37%)	<0.01	0.52	0.06
Benzodiazepines	59 (46%)	59 (37%)	38 (29%)	68 (30%)	0.12	0.13	0.70
Ethanol	8 (6%)	8 (5%)	6 (4.5%)	13 (6%)	0.79	0.99	0.80
Alcohol, unspecified	8 (6%)	5 (3%)	6 (4.5%)	5 (2%)	0.25	0.56	0.34
Place of death					0.43	0.77	0.48
Home	76 (59%)	87 (54%)	70 (53%)	126 (57%)			
Other	53 (41%)	73 (46%)	63 (47%)	97 (43%)			

[a]Subtype categories are not mutually exclusive as deaths can involve multiple drugs. Subtype total may exceed total opioid deaths.
[b]Includes natural opioid analgesics: morphine and codeine (T40.2); and semisynthetic opioid analgesics: oxycodone, hydrocodone, hydromorphone, and oxymorphone (T40.2).
[c]Synthetic opioid analgesics (other than methadone): fentanyl and tramadol (T40.4).
[d]Drug overdose deaths where 'opioid' is reported without more specific information to assign a more specific ICD–10 code (T40.6).
[e]Indicates presence of ICD-10-CM codes including cocaine (T40.5), methamphetamine (T43.6), benzodiazepines (T42.4), ethanol (T51.0), or alcohol, unspecified (T51.9) in deaths involving opioids.

We also examined opioid overdose deaths involving non-opioid drugs and poisoning intent (Table 1). Opioid deaths involving methamphetamines increased post-COVID-19 from 27% (2019) to 37% (2020). We observed no changes in co-involvement with cocaine, benzodiazepines, ethanol, and alcohol. Most overdose deaths were ruled unintentional (78-87%) with no changes over time.

Person characteristics of decedents remained unchanged across the years (Table 1). Across these years, the average age of death was about 41 years, and most were male (51-61%)—racial/ethnic composition of deaths varied pre-COVID-19 but not between 2019 and 2020. Despite the more significant burden of COVID-19 on hospitals, we observed no differences in location of death, with most occurring in the home (53-60%).

Discussion

We examined the possible impact of the US COVID-19 epidemic on trends in opioid-related overdose deaths in Arkansas. Our findings show a 36% excess in opioid overdose deaths post-COVID-19 emergence relative to pre-COVID-19. We find an increased contribution of synthetic narcotics (other than methadone), such as fentanyl, and a diminished role of heroin and prescription opioids in these deaths, which is consistent with national trends of the changing nature of the opioid epidemic (National Institute on Drug Abuse, 2021, 2022). Notably, pre-COVID-19 increases in opioid deaths involving other synthetic narcotics such as fentanyl continued post-COVID-19. This evidence is aligned with national surveillance data showing that fentanyl is the primary contributor to the rapid increase in overdose deaths from 2019 to 2020 (CDC, 2020). However, our estimate that synthetic opioids-involved deaths (mainly fentanyl) accounted for 69% of all opioid-related deaths in Arkansas in 2020 is lower than the national average of 82% (CDC, 2022e). Historically and in 2020, Arkansas ranked high among opioid dispensing states (2nd in 2020; 75.8 per 100 persons) (CDC, 2021). Therefore, there could be less incentive for people who abuse opioids to seek out other illegal sources of opioids that might be laced with fentanyl. Nonetheless, the degree to which the COVID-19 pandemic accelerated these trends remains uncertain especially given the ongoing nature of this pandemic.

Our findings add to the growing literature on the impact of the COVID-19 pandemic on drug overdoses in the US, including studies based on city-level, county-level, and state-level data (DiGennaro et al., 2021; Glober et al., 2020; Kelley et al., 2021; Rodda et al., 2020).

One prior study observed a temporary spike in weekly opioid overdose deaths just before COVID-19 emergence in Cook County, Illinois (December 2019 to February 2020) that remained elevated in 2020 (Mason et al., 2021). In contrast, we did not observe a consistent rise in monthly opioid overdose deaths just before COVID-19 emergence. Our findings also align and contrast with those from the only other study to examine changes in opioid overdose deaths pre- and post-COVID-19 emergence using state vital records from Massachusetts. The researchers found no changes in fentanyl or prescription opioid overdoses, decreased heroin overdoses, and increased overdoses involving cocaine, amphetamines, or alcohol with fentanyl (DiGennaro et al., 2021). Differences between the two states in urbanicity, opioid harm reduction policies (e.g., Massachusetts allows syringe exchange programs, Arkansas does not), and COVID-19 case rates might account for disparate find-

ings. Additional studies from other states differently impacted by the COVID-19 pandemic would help generalize these findings.

Before further discussing the implications of our findings, it is essential to place them in the context of study limitations. First, our results are correlative, and from these data, we cannot infer causality between the individual- and societal-level impacts of the COVID-19 epidemic and overdose deaths. Studies that build upon these findings should investigate causal mechanisms that directly or indirectly link the COVID-19 pandemic to opioid drug overdoses, such as social isolation or restrictions on the drug supply. Second, death certificates can contain misclassifications leading to both under- and over-reporting of opioid overdoses. States with a decentralized county coroner system, such as Arkansas, may over-report overdose deaths where the drug is unspecified, even when over three-quarters of overdose deaths specify the drug (Warner et al., 2013). Finally, it is unclear if these findings generalize to the other US States or countries. For example, European countries reported a record number of drug-related deaths in 2020, increases in drug-related deaths during the pandemic lockdown, and changes in opioid use patterns during the pandemic (General de Drogodependències, 2021; Lindqvist et al., 2021; National Records of Scotland, 2021).

Despite these limitations, our findings have implications for vulnerable drug-using populations, such as those who use opioids during a pandemic. Given the increased number of opioid overdose deaths involving synthetic narcotics and the social disruption caused by COVID-19, additional efforts may be needed to mitigate overdose risk among those especially vulnerable during a health crisis. For instance, fentanyl test strips (FTS) could be distributed among people who consume illegal drugs to test them for fentanyl (Peiper et al., 2019). However, in several states, including Arkansas, possession and distribution of FTS remain illegal under existing drug paraphernalia laws. Further, states could invest in evidence-based strategies such as targeted naloxone distribution to train and equip individuals who use drugs or first responders (Carroll et al., 2018). They could also expand medication-first treatment approaches such as low-threshold buprenorphine treatment programs or offer audio-only telehealth to initiate buprenorphine treatment to reduce barriers to enrollment and access to treatment (Berk, 2020; Davis & Samuels, 2021).

Conclusions

We found a significant increase in opioid overdose deaths in 2020 post-COVID-19 emergence in Arkansas relative to pre-COVID-19 trends (2017 to 2019). Our findings confirm a continuing trend in opioid overdose deaths involving other synthetic narcotics, such as fentanyl and tramadol. This finding highlights the need for targeted interventions in response to the increased overdose deaths due to illicitly manufactured drugs such as fentanyl. Further research is needed to understand the causes of the increased prevalence of fentanyl in Arkansas. Complete data on drug overdose deaths in 2021 were unavailable at the time of publication, but provisional numbers suggest a 16.1% increase in 2021 compared to 2020 in Arkansas. These increases could indicate a continued and perhaps lingering impact of the COVID-19 pandemic that will not be fully understood until it has ended.

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Institutional Review Board Statement

The study was approved by the Institutional Review Board (or Ethics Committee) of the University of Arkansas for Medical Sciences (protocol code 262639 on 03/25/2021).

Informed consent statement

Patient consent was waived since this project does not meet the definition of human subjects research.

Data availability statement

The data for this research is not publicly available. Data requests should be made at https://www.healthy.arkansas.gov/programs-services/topics/office-of-the-chief-science-officer.

Declarations of Interest

The authors declare no conflict of interest.

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