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Preventive Medicine 153 (2021) 106845



Contents lists available at ScienceDirect

Preventive Medicine

journal homepage: www.elsevier.com/locate/ypmed



Short Communication



Growing racial/ethnic disparities in overdose mortality before and during the COVID-19 pandemic in California

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ARTICLE INFO

Keywords:
Substance use
Overdose
Racial/ethnic disparities
COVID-19 pandemic
Fentanyl
Methamphetamine

ABSTRACT

As overdose mortality is spiking during the COVID-19 pandemic, few race/ethnicity-stratified trends are available. This is of particular concern as overdose mortality was increasing most rapidly in Black and Latinx communities prior to the pandemic. We used quarterly, age-standardized overdose mortality rates from California to assess trends by race/ethnicity and drug involved over time. Rates from 2020 Q2-Q4 were compared to expected trends based on ARIMA forecasting models fit using data from 2006 to 2020 Q1. In 2020 Q2-Q4 overdose death rates rose by 49.8% from 2019, exceeding an expected increase of 11.5% (95%CI: 0.5%–22.5%). Rates significantly exceeded forecasted trends for all racial/ethnic groups. Black/African American individuals saw an increase of 52.4% from 2019, compared to 42.6% among their White counterparts. The absolute Black-White overdose mortality gap rose from 0.7 higher per 100,000 for Black individuals in 2018 to 4.8 in 2019, and further increased to 9.9 during the pandemic. Black overdose mortality in California was therefore 34.3% higher than that of White individuals in 2020 Q2-Q4. This reflects growing methamphetamine-, cocaine-, and fentanyl-involved deaths among Black communities. Growing racial disparities in overdose must be understood in the context of the unequal social and economic fallout from the COVID-19 pandemic, during which time Black communities have been subjected to the dual burden of disproportionate COVID-19 deaths and rising overdose mortality. Increased investments are required to ameliorate racial/ethnic disparities in substance use treatment, harm reduction, and the structural drivers of overdose, as part of the COVID-19 response and post-pandemic recovery efforts.

1. Introduction

The COVID-19 pandemic has sharply exacerbated the decades-long North American overdose crisis (Ahmad et al., 2021; Friedman and Akre, 2021). In the US, overdose deaths were elevated by about 30% in 2020 relative to 2019 (Ahmad et al., 2021), with the pandemic implicated as a likely driver of the increase (Friedman et al., 2021a). Nevertheless, these provisional data (Ahmad et al., 2021) have not been disaggregated by race/ethnicity.

This gap is especially concerning because in the years leading up to the COVID-19 pandemic, overdose mortality increased most rapidly among Black and Latinx communities in many areas (James and Jordan, 2018; Lippold, 2019). The changing social profile of the US overdose crisis has been linked to shifts in the drug supply, especially the rising prevalence of illicitly-manufactured fentanyl (fentanyl) contaminating the heroin and cocaine supply (James and Jordan, 2018; Shover et al., 2020), a growing preference for fentanyl among people who use drugs (Morales et al., 2019), increased use of methamphetamine (Han et al., 2021), and polysubstance use. Communities of color have been disproportionately burdened by direct COVID-19 mortality, and the indirect social and economic fallout from the pandemic for myriad outcomes (Chowkwanyun and Reed, 2020). There is therefore ample concern that

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https://doi.org/10.1016/j.ypmed.2021.106845
Received 8 April 2021; Received in revised form 5 October 2021; Accepted 10 October 2021
Available online 12 October 2021
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rising inequalities in overdose mortality by race/ethnicity will continue to worsen during the pandemic (Arena et al., 2020). This may be especially likely given deep-seated disparities in access to medications for opioid use disorder (MOUD)—especially buprenorphine—and inequalities in access to the telehealth visits required to initiate MOUD in many contexts during the pandemic (Lagisetty et al., 2019; Chunara et al., 2021; Roberts and Mehrotra, 2020; Telehealth and Health Disparities, 2020; Davis and Samuels, 2020). A study using data from Philadelphia identified an increase in overdose mortality among Black individuals in 2020 (Khatri et al., 2021). The state of California may be a particularly apt place to assess for early indications of rising disparities, as it has a large and diverse population and has experienced sharply increasing overdose fatalities in recent years.

2. Methods

2.1. Data sources

We obtained quarterly, age-standardized, annualized overdose mortality rates from the California Department of Public Health (CA Department of Public Health, n.d.; Anderson et al., 2019). Trends were obtained by race/ethnicity and drug involved from 2006 to 2020, for overdoses related to all drugs, any opioid, fentanyl, heroin, prescription opioids (excluding synthetics like fentanyl), psychostimulants of abuse potential (which are mostly comprised of methamphetamine, and referred to as such (Han et al., 2021)), cocaine, benzodiazepines, opioids with benzodiazepines, and opioids with stimulants. These categories are not mutually exclusive, so an overdose fatality related to fentanyl and methamphetamine would show up in both categories separately, as well as the combined category. This study was a secondary analysis of aggregated, publicly available statistics, and was therefore deemed exempt from institutional ethics review at UCLA.

2.2. Forecasting analysis

Observed rates in Q2-Q4 2020 were compared to expected trends based on autoregressive integrated moving average (ARIMA) forecasting models (Hyndman and Khandakar, 2008). Models were fit on quarterly trends from 2006 to 2020 Q1 and used to predict for 2020 Q2-Q4. ARIMA models are a family of flexible timeseries forecasting models, with parameters that can be adjusted to account for seasonality and other aspects of the underlying trends. In this work, consistent with

Table 1
Observed and forecasted annual trends in overdose mortality by race/ethnicity and drug involved, 2017- 2020.

Drug	Group	2017	2018	2019	2020 Q1	2020 Q2-Q4 forecasted [95% CI] (% change vs 2019; 95% CI)	2020 Q2-Q4 observed (% change vs 2019)
All drugs	Total	11.6	12.9	15	17.1	16.7 [15.1–18.3] (11.5%; 0.5%–22.5%)	22.4 (49.8%)
All drugs	Black or AA	18.1	20.7	27	33.3	32.9 [28.0–37.8] (22.0%; 3.9%–40.1%)	41.1 (52.4%)
All drugs	White	18.1	20.1	22.2	24.8	24.9 [22.7–27.1] (12.0%; 2.1%–21.9%)	31.7 (42.6%)
All drugs	Latinx	7	8.2	10.3	12.4	13.0 [11.5–14.5] (26.3%; 11.5%–41.2%)	17.3 (68.1%)
All drugs	Asian	3.1	3.1	3.5	4.2	3.6 [2.7–4.5] (3.6%; −22.8%-30.0%)	5.7 (62.1%)
All drugs	(Black – White)	0	0.7	4.8	8.5	8.1 [3.3–13.4] (67.3%; −31.4%-177.7%)	9.5 (96.5%)
Fentanyl	Total	1.1	2	4	6.7	8.6 [8.0–9.2] (114.4%; 100.0%–128.8%)	10.6 (165.0%)
Fentanyl	Black or AA	1.3	2.6	7.3	12.6	17.1 [15.5–18.7] (133.8%; 112.1%–155.5%)	18.5 (153.1%)
Fentanyl	White	1.7	3.2	6	9.4	13.4 [12.5–14.4] (123.8%; 107.5%–140.1%)	15.4 (156.1%)
Fentanyl	Latinx	0.7	1.4	3.1	5.4	6.3 [5.6–6.9] (102.5%; 81.3%–123.7%)	8.5 (175.2%)
Fentanyl	Asian	0.2	0.4	0.7	2	1.8 [1.3–2.2] (152.7%; 87.6%–217.8%)	2.3 (231.4%)
Fentanyl	(Black – White)	−0.4	−0.6	1.3	3.2	3.6 [1.8–5.5] (188.2%; 43.8%–332.4%)	3.1 (146.1%)
Heroin	Total	1.7	1.9	2.4	2.3	2.4 [2.0–2.7] (0.3%; −15.5%-16.1%)	2.4 (0.9%)
Heroin	Black or AA	1.8	2.5	3	2.7	3.0 [2.0–4.0] (0.9%; −32.3%-34.1%)	2.8 (−5.4%)
Heroin	White	2.9	3.1	3.8	3.4	3.8 [3.2–4.5] (0.9%; −16.0%-17.7%)	3.8 (−1.1%)
Heroin	Latinx	1.2	1.4	1.8	2.1	1.9 [1.3–2.4] (3.2%; −27.1%-33.5%)	1.9 (7.0%)
Heroin	Asian	0.3	0.2	0.3	0.4	0.3 [0.1–0.5] (0.3%; −61.7%-62.2%)	0.3 (0.0%)
Heroin	(Black – White)	−1.2	−0.7	−0.8	−0.7	−0.8 [−2–0.4] (4.4%; 164.0%–148.9%)	−0.9 (19.1%)
Methamphetamine*	Total	4.6	5.8	6.9	7.7	8.2 [7.4–9.0] (18.6%; 6.5%–30.6%)	11.4 (64.4%)
Methamphetamine*	Black or AA	7.6	9.5	12.3	16.4	16.5 [14.6–18.5] (34.4%; 18.3%–50.5%)	19.5 (58.9%)
Methamphetamine*	White	6.7	8.5	10	11	11.4 [10.2–12.6] (14.3%; 2.1%–26.5%)	16.1 (61.0%)
Methamphetamine*	Latinx	3.1	4.2	5	5.4	6.0 [5.2–6.8] (20.4%; 3.8%–36.9%)	8.9 (78.8%)
Methamphetamine*	Asian	1.2	1.3	1.6	1.8	1.7 [1.1–2.2] (3.4%; −28.2%-35.0%)	2.9 (79.0%)
Methamphetamine*	(Black – White)	1	1	2.4	5.4	5.1 [2.9–7.5] (116.4%; 23.4%–215.7%)	3.4 (46.0%)
Cocaine	Total	1	1.4	2	2.6	2.9 [2.5–3.2] (42.4%; 25.0%–59.9%)	2.8 (40.6%)
Cocaine	Black or AA	4.7	6.5	9.5	11	11.1 [8.5–13.6] (16.6%; −10.2%-43.4%)	11.7 (23.3%)
Cocaine	White	1.2	1.9	2.2	2.5	2.8 [2.3–3.3] (27.4%; 6.3%–48.5%)	3.1 (40.9%)
Cocaine	Latinx	0.6	0.7	1.4	1.9	2.0 [1.6–2.4] (44.0%; 13.5%–74.4%)	2.0 (41.0%)
Cocaine	Asian	0.3	0.4	0.5	1.3	0.9 [0.6–1.3] (86.0%; 16.4%–155.5%)	0.9 (82.7%)
Cocaine	(Black – White)	3.5	4.6	7.3	8.5	8.3 [5.8–11.1] (13.6%; −21.0%-52.0%)	8.6 (18.3%)
Benzodiazepine	Total	1.4	1.3	1.5	2	1.7 [1.4–2.0] (12.6%; −8.8%-34.0%)	2.2 (46.4%)
Benzodiazepine	Black or AA	0.7	0.7	1.1	1.5	1.1 [0.3–1.8] (−3.5%; −73.7%-66.7%)	2.4 (115.5%)
Benzodiazepine	White	2.7	2.5	2.9	3.8	3.2 [2.5–3.9] (10.2%; −13.1%-33.5%)	3.7 (27.2%)
Benzodiazepine	Latinx	0.6	0.5	0.7	1.1	1.0 [0.7–1.3] (40.7%; 2.5%–78.8%)	1.5 (112.4%)
Benzodiazepine	Asian	0.3	0.3	0.3	0.4	0.3 [0.1–0.6] (13.6%; −72.7%-99.8%)	0.4 (46.7%)
Benzodiazepine	(Black – White)	−2	−1.8	−1.8	−2.3	−2.1 [−3.1–1.1] (21.1%; 77.5%–40.4%)	−1.3 (−25.1%)

Annual age-adjusted overdose mortality per 100,000 residents are shown by race/ethnicity and type of drug involved for 2017–2020 Q1, compared to 2020 Q2-Q4, both observed and forecasted. Absolute differences in Black overdose rates compared to White individuals are shown as seperate rows. For observed and forecasted values in 2020 Q2-Q4, percent increases from 2019 are shown in parentheses. 95% confidence intervals are shown for forecasted quantities in 2020 Q2-Q4 in brackets.
*Deaths coded as involving 'psychostimulants with abuse potential' predominantly refer to methamphetamine and are labeled as such.

other recent analyses describing pandemic-related shifts (Faust et al., 2020), we follow the ARMIA model selection approach defined by Hyndman and Khandakar, wherein numerous model specifications are tried, and the best-performing model is used (Hyndman and Khandakar, 2008). For each race/ethnicity and drug-specific time series parameters are selected using a grid search and the Akaike information criterion to maximize model fit. The statistical significance of observed trends compared to expectations from model predictions was conducted by comparing rates from 2021 Q2-Q4 to the 95% confidence intervals from each forecasted trend for the same period. All analyses were conducted in R version 4.0.3.

3. Results

The total age-adjusted overdose rate in California increased from 15.0 per 100,000 in 2019 to 22.4 in 2020 Q2-Q4, representing a 49.8% increase (Table 1). This exceeded the expected value based on forecasted trends, of 16.7(95% CI: 15.1–18.3), which would have represented a 11.5%(0.5% - 22.5%) increase. During the COVID-19 pandemic, all racial/ethnic groups saw greater-than-forecasted overdose deaths in California (Fig. 1). The largest absolute increase was seen for Black overdose mortality, increasing from a rate of 27.0 per 100,000 in 2019, to 41.1 per 100,000 in 2020 Q2-Q4. This represented a 52.4% increase—which exceeded the predicted increase of 22.0%(3.9%–40.1%).

After an upward trajectory in California, in 2018 Black overdose mortality overtook that of White individuals, with an absolute gap of 0.7 per 100,000. This rose sharply to 4.8 per 100,000 in 2019, and further increased to a gap of 9.5 per 100,000 during 2020 Q2-Q4, exceeding the forecasted gap of 8.1 per 100,000, although falling within the 95% confidence interval of 3.3–13.4. Through 2017, White individuals experienced higher overdose mortality rates, largely driven by elevated rates of overdose involving synthetic opioids, heroin, and benzodiazepines (Fig. 1, and Supplemental Figure). The reversal in 2018, and dramatic exacerbation in 2019 and 2020, largely reflected higher and climbing rates of overdoses involving fentanyl (+3.1 per 100,000 higher for Black individuals than White individuals in 2020 Q2-Q4), methamphetamine (+3.4), and cocaine (+8.6). Through 2020 Q2-Q4, White individuals continued to experience higher rates of overdose death involving benzodiazepines (+1.3 per 100,000 higher than Black individuals), heroin (+0.9), and prescription opioids (+1.7).

Although the largest absolute increases were seen among Black individuals, Latinx and Asian/PI communities saw the largest relative increases between 2019 and 2020 Q2-Q4 of 68.1% and 62.1%, respectively, despite lower overall rates. Rising rates for these groups reflected particularly large increases in fentanyl-related overdose deaths, of 175.2% and 231.4%, respectively.

4. Discussion

We document evidence that an already-accelerating overdose crisis in California was exacerbated during the COVID-19 pandemic, affecting all racial/ethnic groups examined. The observed increases in overdose mortality were over fourfold larger what would be expected based on prior trends. Furthermore, we find that racial/ethnic disparities in overdose mortality—already sharply increasing prior to the pandemic—grew substantially worse in 2020, reaching unprecedented levels.

Although similar disparities in overdose mortality have likely occurred nationally during the pandemic, the available national provisional data (Ahmad et al., 2021) have not been disaggregated by race or ethnicity. The COVID-19 pandemic has shown that rapid—even daily—data collection and reporting on emergent public health crises are possible when political and logistical hurdles can be overcome. Nevertheless, for the decades-old overdose crisis, data often lag by months or years (Spencer, 2016). Further, even the existing provisional data sources (available on a ~ 7-month lag) are not disaggregated by race/ethnicity, extending the wait to up 24 months for data regarding racial/ethnic inequalities. This limits the timeliness, precision, and cultural

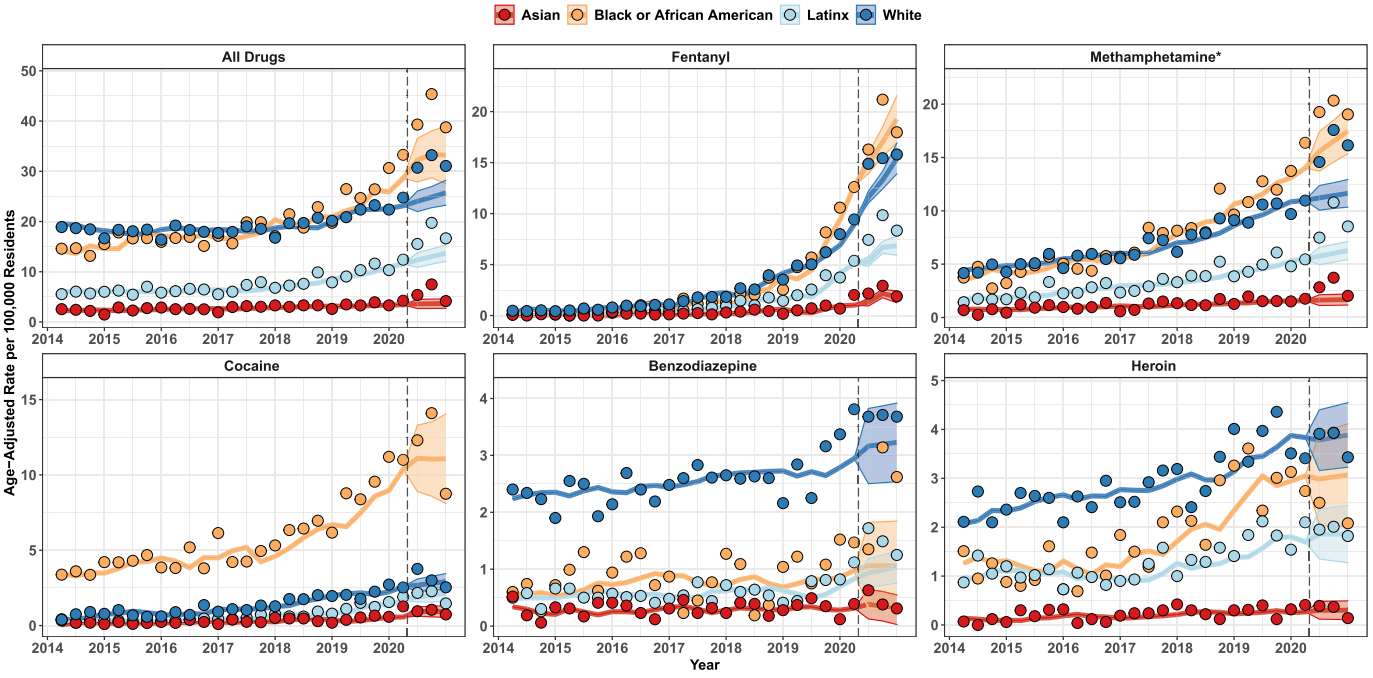


Fig. 1. Observed and Forecasted Quarterly Trends in Overdose Mortality by Race/Ethnicity and Drug Involved, 2015-2020.
Quarterly, age-adjusted, annualized overdose mortality rates per 100,000 residents are shown by race/ethnicity and type of drug involved for 2015-2020. Points represent observed data. Lines and shaded bands represent forecasts and 95% prediction intervals for 2020 Q2-Q4 based on ARIMA models fit on data from 2006 to 2020 Q1. Full timeseries beginning in 2006 can be seen in the Supplemental Figure. *Deaths coded as involving 'psychostimulants with abuse potential' predominantly refer to methamphetamine and are labeled as such.

relevance of interventions.

Among other factors, these rising inequalities likely reflect a shifting drug supply, increasingly characterized by a high prevalence of illicitly manufactured fentanyl, methamphetamine, and polysubstance use. Previous waves of the overdose crisis stemming from prescription opioids, and later heroin, were more concentrated among White communities (Netherland and Hansen, 2016; Friedman et al., 2019), which was likely related to systematic bias in the prescription of opioids in the healthcare system, and disparities in access to healthcare, among other factors (Netherland and Hansen, 2016; Hoffman et al., 2016). However, we find that overdose deaths involving fentanyl and methamphetamine are now disproportionately affecting Black communities in California. Previous studies have shown that Black people who use drugs may be disproportionately likely to be exposed to fentanyl, often unintentionally, perhaps reflecting power dynamics and a decreased ability to avoid unwanted exposure (Phalen et al., 2018; Mitra et al., 2020). Fentanyl is also increasingly found in samples sold as other drugs, such as cocaine, which have historically been involved in higher rates of overdose mortality among Black communities (Ciccarone, 2021). As fentanyl and methamphetamine continue to drive a shifting overdose crisis nationally, similar disparities are likely to become more acute in other regions of the country. Nevertheless, minority populations have been largely overlooked in the overdose crisis, which has been overwhelmingly portrayed in the media and national political stage as a "White problem" in recent years (James and Jordan, 2018; Hansen and Netherland, 2016).

We report increasing rates of overdose mortality among Latinx and Asian/PI communities that are large in magnitude, which could relate to factors such as 1) the increasing contamination of ostensibly non-opioid street drugs—such as cocaine—with fentanyl (Ciccarone, 2021), 2) the increase of fentanyl in new population centers (Shover et al., 2020), and 3) social and economic disparities stemming from the pandemic. Further study is warranted to explore underlying drivers and solutions, especially given that overdose in these groups have received considerably less attention.

Our findings suggest that during the pandemic, Black communities in particular have been subjected to the dual burden of disproportionate COVID-19 mortality and rising overdose deaths. Similarities between COVID-19 and overdose mortality disparities likely reflect that they share some common structural, socioeconomic drivers. The United States has deep-seated inequalities in access to healthcare, housing, education, and employment—symptoms of institutionalized racism (Jones, 2002)—that are known drivers of overdose, and have been further exacerbated by the pandemic (Arena et al., 2020; Friedman et al., 2021b; Dasgupta et al., 2017). Of particular concern, the variable and high potency of fentanyl has increased the lethality of recent incarceration as a risk factor for fatal overdose, as individuals recently release from jail or prison are more likely to have a lower tolerance to opioids and also lack knowledge of recent shifts in drug strength (Brinkley-Rubinstein et al., 2018). Combined with racialized policing and incarceration policies that have led to profound racial disparities in incarceration rates, this may be an important factor driving increased overdose death rates in Black communities (Bowleg, 2020). Increased jail cycling or longer duration of pretrial detention among Black communities during the pandemic may have played a contributing role (Reinhart and Chen, 2020; Covid Was Supposed to Cut Jail Time, 2021). Criminal justice reform is likely to play a key role in preventing overdose in Black communities. Additionally, programs to provide methadone and buprenorphine in jails and prisons, and naloxone distribution upon release, are key strategies to reduce the role of incarceration in driving overdose mortality and morbidity (Wenger et al., 2019; Davidson et al., 2019; Leung et al., 2020; Lee et al., 2012; Scott et al., 2021). Against a backdrop of pre-existing disparities in naloxone access for Black communnities (Egan et al., 2020; Kinnard et al., 2021), naloxone distribution may have been further limited during the pandemic, leading to lower probability of overdose reversal.

While fatal overdose represents a "worst possible" outcome of substance use, these overdose trends foreshadow impacts on morbidity that could occur years into the future. For example, the replacement of black tar heroin with fentanyl has been associated with increased risks for HCV and HIV infection, due to increased injection frequency and differences in drug preparation (Lambdin et al., 2019; Bobashev et al., 2019). Additionally, non-fatal overdoses are associated with substantial morbidity and increased risk of mortality (Warner-Smith et al., 2002; Weiner et al., 2020).

4.1. Limitations

This study is limited by its observational nature; we cannot eliminate the possibility that some other factor beyond the COVID-19 pandemic is driving the trends we note here. Nevertheless, the widespread increases in overdose deaths observed across numerous geographies and forms of provisional data (Ahmad et al., 2021; Friedman et al., 2021c) suggest that the pandemic is likely to be playing a key role. Further research into the effects of the pandemic on patterns, settings, and social networks of substance use is needed. Furthermore, due to small numbers, we were not able to assess disparities for Indigenous or Native Americans individuals, which remains an important area for further study, especially given historically higher rates of overdose in these communities.

4.2. Conclusions

Black individuals in California now suffer substantially higher rates of overdose mortality than their White counterparts. We find that racial/ethnic disparities in overdose were rising prior to the pandemic and were considerably exacerbated during the social and economic fallout from the pandemic in 2020. As the United States navigates the pandemic and post-pandemic recovery, increased investments will be required to flatten the overdose curve overall and combat rising inequalities. Access to substance use treatment—especially buprenorphine—has long lagged for Black and other racial/ethnic minority communities (Lagisetty et al., 2019). Steps taken by the federal government to decrease logistical barriers for buprenorphine prescribers are laudable and should be coupled with additional deregulation and financial supports to increase effective access. In this aim, greater funding and outreach efforts are required to increase access to telehealth visits. There are also a remarkably low number of addiction specialists in the United States, especially from underrepresented minority backgrounds (Jordan and Jegede, 2020). Improving access to harm reduction, including overdose prevention sites and drug checking to detect the presence of fentanyl, represent important strategies that have been incompletely enacted in California (Johnson and Beletsky, n.d.; Zibbell et al., 2021). However, these approaches are unlikely to be fully sufficient to reverse rising disparities in overdose. As basic survival has become more difficult for millions of Americans, investments in housing, employment, food security, and medical care—as well as dismantling racist policies that limit them for communities of color (Jones, 2002)—will be essential to address many of the structural drivers of inequalities in overdose and other causes of death such as suicide and firearm violence (Arena et al., 2020; Reger et al., 2020).

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

J. Friedman received support from the UCLA Medical Scientist Training Program (National Institute of General Medical Sciences training grant GM008042). N. Harawa's time is supported on grants

from the California HIV/AIDS Research Program (CHRP) TU4-LA-594 (PI, Harawa); the UCLA Clinical and Translational Science Institute (CTSI) NIH/NCATS grant UL1-TR001881 (PI, Dubinett), and by the NIMH-funded Center for HIV Identification, Prevention, and Treatment (CHIPTS) NIMH grant P30MH058107 (PI, Shoptaw).

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ypmed.2021.106845.

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