Journal of Racial and Ethnic Health Disparities (2023) 10:2039–2053
https://doi.org/10.1007/s40615-022-01384-6

The Opioid Epidemic: a Crisis Disproportionately Impacting Black Americans and Urban Communities

Marjorie C. Gondré-Lewis[1] · Tomilowo Abijo[1] · Timothy A. Gondré-Lewis[2]

Received: 27 May 2022 / Revised: 29 July 2022 / Accepted: 1 August 2022 / Published online: 6 September 2022

Abstract

The heroin epidemic has existed for decades, but a sharp rise in opioid overdose deaths (OODs) jolted the nation in the mid-twenty-teens and continues as a major health crisis to this day. Although the new wave of OODs was initially approached as a rural problem impacting a White/Caucasian demographic, surveillance records suggest severe impacts on African Americans and urban-dwelling individuals, which have been largely underreported. The focus of this report is on specific trends in OOD rates in Black and White residents in states with a significant Black urban population and declared as hotspots for OOD: (Maryland (MD), Illinois (IL), Michigan (MI), and Pennsylvania (PA)), and Washington District of Columbia (DC). We compare OODs by type of opioid, across ethnicities, across city/rural demographics, and to homicide rates using 2013–2020 data acquired from official Chief Medical Examiners' or Departments of Health (DOH) reports. With 2013 or 2014 as baseline, the OOD rate in major cities (Baltimore, Chicago, Detroit, Philadelphia) were elevated two-fold over all other regions of their respective state. In DC, Wards 7 and 8 OODs were consistently greater than other jurisdictions, until 2020 when the rate of change of OODs increased for the entire city. Ethnicity-wise, Black OOD rates exceeded White rates by four- to six-fold, with fentanyl and heroin having a disproportionate impact on Black opioid deaths. This disparity was aggravated by its intersection with the COVID-19 pandemic in 2020. African Americans and America's urban dwellers are vulnerable populations in need of social and political resources to address the ongoing opioid epidemic in under-resourced communities.

Keywords Health disparity · Opioid overdose · Opiates · Heroin · Opioid · Fentanyl · Black · African American · European American · Caucasian · Homicides · Social Determinants of Health · Social Determinants of Mental Health

Introduction/Background

Opioid overdose deaths (OODs) continue to occur at epidemic levels, worsened by the COVID-19 pandemic. A 2021 provisional report from the Center for Disease Control's (CDC's) Vital Statistics Rapid Release (VSRR) estimated that nationwide 144 of the 208 people who died each day from drug overdose during the 12-month period ending March 2020, died from opioid overdose (https://www.drugabuse.gov/drug-topics/opioids/opioid-overdose-crisis) [1]. In the era of COVID-19, escalation of drug use and overdoses are predicted to rise sharply given months-long isolation of individuals with behavioral health issues, substance use disorders (SUDs), and economic insecurities associated with lack of jobs [2–4].

The earliest reports of the recent opioid crisis identified a sharp rise in unintentional pharmaceutical overdose deaths due to overprescribing of opioid analgesics [5–9]. As these OOD-causing "pain management" prescriptions were replaced with street drugs such as heroin, laced with relatively inexpensive but potent synthetic opioids like fentanyl and its derivatives, the demographics of those succumbing to opioid overdose expanded [10, 11]. The new synthetics were unregulated and potent, with largely unknown mechanistic cascades, and indeed, their availability in cities have contributed to the urban epidemic of OODs (https://www.drugabuse.gov/drug-topics/opioids/opioid-overdose-crisis) [12, 13]. In a study of Indianapolis, Phalen et al. showed fentanyl-involved OODs rose from 15% in 2010 to 50% in

✉ Marjorie C. Gondré-Lewis

[1] Developmental Neuropsychopharmacology Laboratory, Department of Anatomy, Howard University College of Medicine, Washington D.C. 20059, USA

[2] National Institute of Allergy and Infectious Diseases, National Institutes of Health, Bethesda, MD 20814, USA

2017, concomitant with a shift from a younger White to a middle-aged Black demographic [9]. The lag between White and Black OOD peaks can be attributed to biased prescribing that promote unequal access to prescription opioids based on race or ethnicity, where young White women (and men) were more likely to receive opioids for pain management than Black counterparts of any age [14–16]. This trend of indiscriminate prescribing to Whites for emergency and surgical interventions, cancer treatment and/or pain management was referred to as the natural/semi-synthetic wave and involved mostly codeine, morphine, hydrocodone, and oxycodone abuse [17–19]).

The subsequent rise in urban addiction and overdose is likely the combined result of easy accessibility to fentanyl-contaminated heroin on the streets and worsening impacts of social determinants of health (SDoH). Many of the same parameters (structural racism, systemic biases, lower socioeconomic status, toxic stress, interpersonal struggles with negative life events and mistrust of systems, and lack of social or emotional support) attributed to SDoH [20, 21] also contribute to Social Determinants of Mental Health (SDoMH) health, with added social stigma associated with SUDs and mental health disorders [22, 23]. Combined with already existing chronic disorders or genetic risk for disease, these SDoMH greatly contribute to a greater overdose rate for substance use disorder (SUD) and disparities in health care that lead to decreased quality of life (Fig. 1). From a public health perspective, SUD, specifically opioid use disorder (OUD), confers increased risk of adverse outcomes in patients infected with SARS-CoV2 and pre-existing systemic diseases involving the heart, lung, liver, kidney, and multi-organ ailments such as diabetes, obesity, and cancer [24]; comorbidities prevalent in African Americans/Blacks. There is a disparate vulnerability for Black people in specific, especially given their unique experience of structural and systemic biases (Fig. 1). Conscientious, comprehensive, tailored approaches must acknowledge that this disparity exists, and target its root causes.

A PubMed search for "African Americans and opioid epidemic" yielded only 22 relevant publications published within the past 2 years. In metropolitan areas stratified by age and ethnicity, OOD rates increased across all ethnic lines in both large and fringe metro areas [16]. Categorically, from 2015 to 2017, African Americans experienced the highest OOD increase of all races analyzed; 103% for opiates and 361% for synthetic opioids in large central metropolitan cities, and respectively 100% and 332% in large fringe metros [16]. Illicitly manufactured fentanyl accounts for increased overdose deaths more than any other opioid across the USA [25, 26]. Because fentanyl derivatives have flooded the urban market, understanding their specific impact on Black communities is imperative.

Fentanyl has a strong binding affinity for the opioid receptor with resultant powerful high sensations/feelings, as well as short duration of action [10]. The biochemical cascades of new fentanyl derivatives are not well-studied, and given that people of different ancestry exhibit different allelic variations in genes associated with susceptibility to SUD, the biology-influenced difference on the behavioral and cognitive impact of new drugs on Black and White individuals are also unknown [27]. A nationwide snapshot of metro areas from 2015 to 2017 shows a doubling of OODs in middle-aged Blacks 45–64 years, from approximately 20 to 42 per 100,000 whereas in non-Hispanic Whites, individuals between age 25 and 34 years showed the greatest increase in overdose rates [16]. Thus, the age demographic of Black and White opioid OOD victims differ.

Homicides are a leading cause of death across the USA, and disproportionately impact Blacks in urban areas, with Black-White disparities in mortality rate ratios evident during periods of low or high crime [28, 29]. Cities like Baltimore, Chicago, Detroit, DC, Philadelphia, significantly contribute to the overall homicide rates of their states, and are among the top 20 regions with high homicide rates in America, whether during periods of high or low national murder rates [28, 30]. Given the significant death rates from the opioid overdose in the Black and urban communities, the murder rate metric was used as a consistently documented comparator.

The aim of this study was to assess OOD rates in DC and other major cities with significant numbers of Blacks constituents (Baltimore, Chicago, Detroit, Philadelphia), from states where the epidemic was pervasive: Maryland (MD), Illinois (IL), Michigan (MI), and Pennsylvania (PA). Using data acquired directly from Offices of the Chief Medical Examiner or states' Departments of Health, we evaluate the urban trend, the comparative Black/White death rates, and compare OODs to homicides over temporally matched periods. We hypothesized that the contribution of Black deaths to overall OOD rates have been underreported compared to Caucasian/White constituents. The data provided herein will provide justification to target resources to address the urban opioid crisis, focused on Black communities and the economic disparities that contribute to its continuation.

Methods

Any opioid-, heroin- and synthetic opioid-related death data were collected from online publications of Department of Health Services of selected states and cities: (1) *Drug Overdose Deaths by Sex, Age Group, Race/Ethnicity and County, August 1, 2019 Illinois Residents, 2013–2019* by the Illinois Department of Public Health; (2) *Unintentional Drug- and*

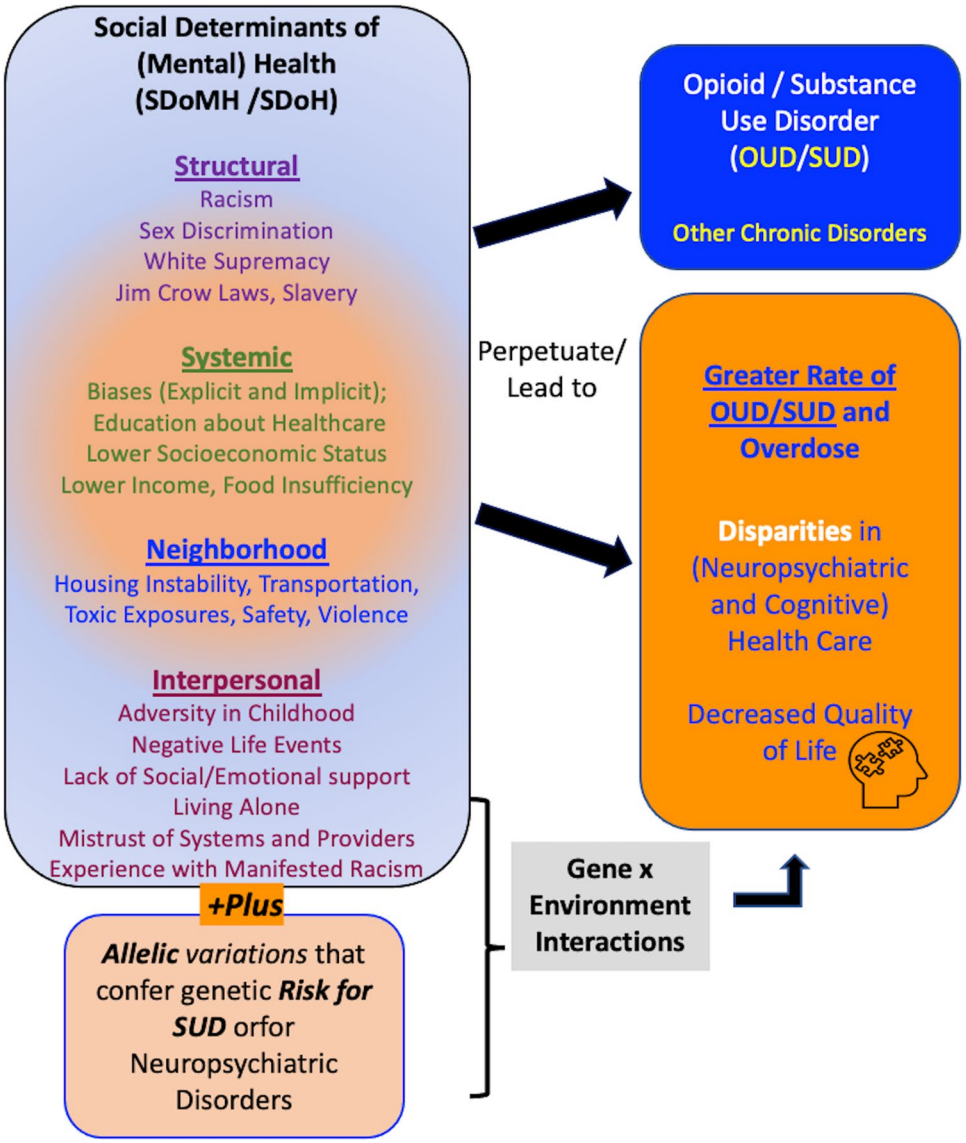

Fig. 1 Factors contributing to disparities in neuropsychiatric and cognitive health care. Social determinants of mental health (SDoMH) are derived from structural and systemic biases, local disparities in neighborhood environment and public resources, and interpersonal experiences of abuse, violence and racism. These SDoMH combine with existing chronic disorders including SUD and genetic risk to create an amplified gene × environment interaction to lead to or perpetuate 1) a greater rate of SUD and overdose, 2) disparities in neuropsychiatric and cognitive health care, 3) and a resultant decreased quality of life

Alcohol-Related Intoxication Deaths in Maryland, 2020 by the Maryland Department of Health; (3) *Opioid-related Fatal Overdoses: January 1, 2014 to March 31, 2018 and January 1, 2016 to April, 2021* by the Government of the District of Columbia Office Of The Chief Medical Examiner. Where the parameters of interest could not be accessed online, the relevant Department of Health was directly contacted for clarification. DC data was only available from 2014 onwards. The Michigan 2013–2018 OOD data was obtained directly from the Department of Health & Human Services of the state of Michigan. Pittsburgh, as a major city with a significant Black demographic could not be separated from Allegheny County and thus could not be compared in an equivalent fashion to data presented for "cities." Fentanyl data by race was not available for Pennsylvania's Dept. of Health for the full range of years included for other states. However, Philadelphia, PA was available directly from the city of Philadelphia, and thus was included in Fig. 5. The rate of change in death for each year was calculated as percentage change from the first year under consideration, typically 2013 or 2014, as indicated in each graph. Similarly, changes in homicide deaths were measured as a percentage change in deaths with respect to the first year of consideration.

Graphs expressing raw death numbers per 100,000 persons in the population were based on census data from the United States Census Bureau (https://www.census.gov). Homicides in a given state were obtained from vital statistics data of the CDC and from FBI Uniform Crime reports (http://www.disastercenter.com). Raw numbers used for the

calculations are shown in Supplementary Tables 1–5. "Baltimore" directly refers to the city of Baltimore, and does not include Baltimore County in MD.

Drug-specific Categories are Defined as Follows

"Opioid" deaths comprise of drug overdoses in which any opiate/opioid drug was recorded as a contributing cause of death. Heroin deaths are overdoses in which heroin was reported as a contributing cause. Similarly, "fentanyl" comprises OODs in which synthetic fentanyl or fentanyl-derived opioids were reported as contributing causes of death. Heroin and fentanyl drug categories are subsets of "opioid," and therefore contribute to the "opioid" values. In some cases, due to limitations with laboratory testing for heroin, some deaths reported as overdoses involving "morphine" or the generic term "opiates" may be heroin overdoses. Therefore, overdose deaths involving heroin may be slightly underreported in datasets.

Race Definitions and Inclusion

Notwithstanding differences in the meaning of "Black" and "African American," Black ethnic groups of African descent were not differentiated in any dataset, and thus African American and Black are treated interchangeably. Likewise, "Caucasian" and "White" are treated as one group. The term European American was not used. Hispanic/Latino populations were excluded in the racial/ethnic comparison of OOD rates because of the inconsistent reporting over the years and across cities and states.

Analyses To normalize data across municipalities and account for differences in population density, overdose death rates (increase or decrease) were calculated in reference to a 2013 or 2014 baseline specified as the beginning year in each graph. A student's *t*-test was utilized to analyze aggregate Black/White data across states for 2018 and 2019 and test the hypothesis that there are racial differences in OOD rates. Year 2020, highlighted with an oval, reflects the impact of the COVID-19 pandemic when people were home-confined with limited access to treatment resources, and represents altered cultural, socioeconomic, neuropsychiatric, and cultural dynamics compared to previous years. A linear regression and Spearman's correlation statistic was utilized in the comparison of OODs to homicides.

Results

Opioid-related deaths were examined in Washington, DC, and Philadelphia, PA, as well as IL, MD, MI, and their corresponding major cities of Chicago, Baltimore, and Detroit for a 6-to-8-year period ranging from 2013 to 2020. These cities have residential diversity, allowing for comparison of the impact of opioid overdose on Black/African ancestry and White/Caucasian populations in states identified as hotspots of the opioid epidemic.

In IL, OOD rates increased from 2013 to 2019 by up to 107%, but jumped to 175% in 2020, a 64% increase from 2019 (Fig. 2A). In the city of Chicago, OODs lagged and even decreased in 2013–2015 when the rest of IL showed a 36% spike in cases. By 2019 when statewide OOD levels stabilized, Chicago OODs increased to 145% of 2013. In 2020, Chicago OODs rose sharply to 259% of 2013 rates, 72% year-to-year 2019-to-2020.

Opioid-related death rates increased in MD from 2013 to 2018, with the city of Baltimore showing the highest rates of OOD increase compared to non-Baltimore city regions. By 2018, OODs had increased by 284% in Baltimore city compared to 157% in non-Baltimore MD (Fig. 2A). In 2019, Baltimore OODs increased 477% from 2013 (50% from 2018), with OODs surpassing "all other" regions. In 2020, all of MD showed an upward trajectory of OODs, with the state rate increasing 30% from 2019.

In MI, the OOD rate in Detroit increased from 2013 to 2018 by 280% versus the rest of MI, which only increased by 108%, similar to the pattern for MD. Only 6 years were included in the graph as 2019 and 2020 data were not available.

DC, though not a state, was evaluated based on empirical evidence of a rising drug abuse crisis, and the racial, economic, and health disparities that exist among its residents [31]. OODs peaked in 2017 at 239% of the 2013 baseline, declined significantly in 2018 and rebounded to 239% in 2019. The year 2020 yielded 65% greater OODs than in 2019. DC is divided into 8 regions (wards) and is 43.8% Black. The majority of Black people reside in Wards 7 (91.5% Black) and 8 (91.6% Black) east of the Anacostia River (www.dchealthmatters.org/demographicdata). Wards 7 and 8 also have the greatest economic disparity: incomes equal 49% of the DC average, with 22% of families living below the poverty line. To understand the impact of the epidemic on the underprivileged, OOD rates in wards 7 and 8 were compared to the rest of DC (Fig. 2A, bottom right). From 2013 to 2019, wards 7 and 8 consistently bore a greater burden of OODs and exhibited OOD rates greater than other neighborhoods. In 2020, which included the COVID-19 pandemic, OODs spiked city-wide: wards 7 and 8 exhibited a 39% increase over 2019, and all other DC wards (neighborhoods) were at 34% greater than their 2019 OODs. Overall, whereas individuals in predominantly Black neighborhoods of DC have disproportionately borne the impact of the opioid epidemic through the years, the COVID-19 pandemic in 2020 has particular been impactful in raising DC OODs everywhere.

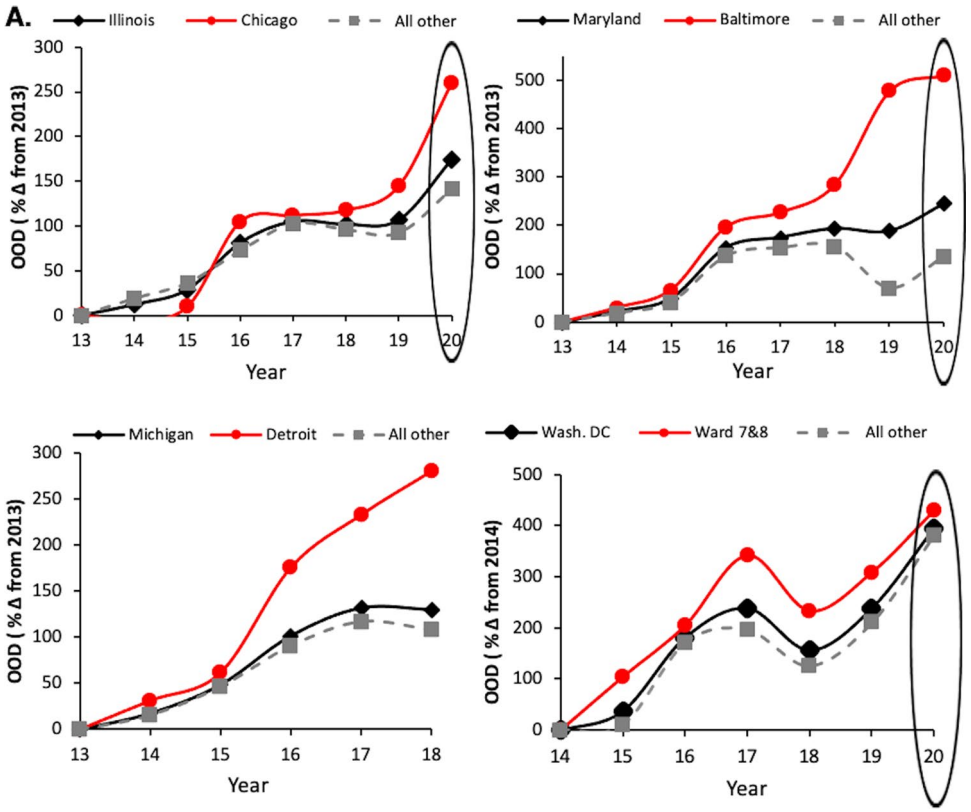

Fig. 2 Opioid overdose deaths (all opioids) and heroin overdose deaths in Illinois, Maryland, Michigan and Washington DC—Comparison of Urban Capitals and Rural. **A** All deaths due to any opioids were analyzed for Chicago, Illinois, and non-Chicago regions (top left); Baltimore, Maryland, and non-Baltimore city regions of MD (top right); Detroit, Michigan, and non-Detroit regions of MI (bottom left); Wards 7 and 8, all of Washington DC, and non-Wards 7 and 8 parts of DC (bottom right). Note that Ward 5 is also considered a hotspot for OODs but not calculated with wards 7 and 8, thus may reduce the extent of disparities for Washington DC's Black neighborhoods. **B** Deaths where heroin was implicated (heroin overdose deaths (HOD). Red circles (cities or Wards 7 and 8); black diamonds (overall state or Washington DC data); gray squares (overall state—city = 'all other' regions of that state). Data expressed as percent change over 2013, or 2014 for DC. The large oval highlights data influenced by the COVID-19 pandemic in 2020

Heroin-related Opioid Overdose Deaths

Next, we examined the trend of deaths specifically where heroin was implicated (Fig.2B), i.e., heroin-involved overdose deaths (HODs). Compared to the state of IL overall, Chicago lagged (2013–2015), suddenly equaled (2016), then significantly surpassed state rates, and maintained high death rates from 2017–2020. In fact, whereas all other regions experienced a considerable reduction in HODs through 2020 (43% above 2013 levels), Chicago HODs were 154% above 2013 levels. Likewise, in Maryland, the trend in HODs peaked in 2016 up to 203% above 2013 but registered a sharp decline thereafter such that in 2020 HODs were nearly indistinguishable from 2013 (Fig. 2B). In MI, HOD rates of Detroit and all other regions were indistinguishable until 2016 when Detroit surpassed the overall MI rates. In the year 2018, the last dataset available, HODs remained 115% higher than the 2013 baseline. By contrast, all other MI regions were only 42% above the 2013 baseline (Fig. 2B). In DC overall in 2016, HOD rates increased steeply to their peak at 230% from the 2014 baseline year. HOD rates in 2019, however, were 100% over 2014 levels. In Wards 7 and 8, with economically disadvantaged residents, death due to heroin rose by 513% in 2019 and 694% in 2020; in stark contrast to more affluent parts of DC that exclude wards 7 and 8 which recorded 91% reduction in HODs in 2019 compared to 2014 (Fig. 2B). These data illustrate a focused crisis in Wards 7 and 8 in DC.

Fentanyl-related Opioid Overdose Deaths

As is well documented, a major contributor to the opioid crisis in America is the introduction of fentanyl and its potent derivatives into the drug market, mixed with not only heroin, but also cocaine and other illicit substances. In fact, amphetamine overdose deaths are on the rise, often combined with synthetic opioids (33–35). In IL, FOD rates lagged in comparison to HODs 2013–2015; they steadily rose through

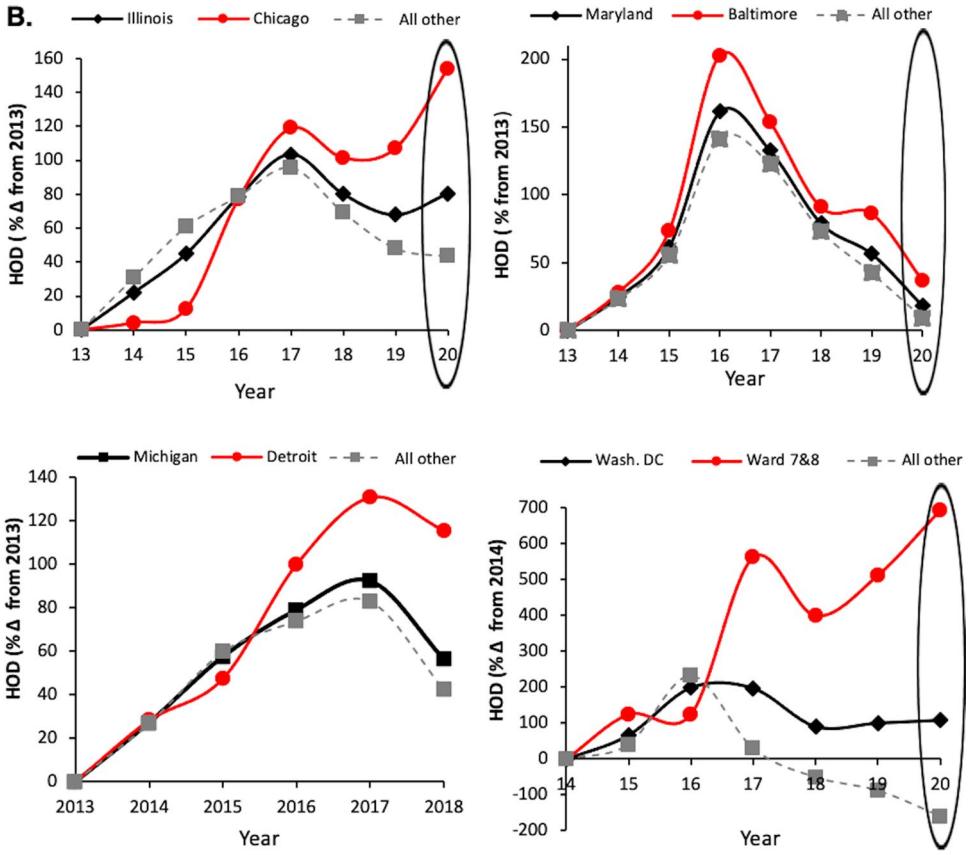

Fig. 2 (continued)

2019 but exhibited a sharp rise from 2019 to 2020 (Fig. 3). In MD, the rates of increase of FODs substantially dwarfed HODs and overall OODs. The FOD rate increased in a sigmoidal pattern from 2013 to 2019 when there was a 3155% increase (Fig. 3). In Michigan in 2019, FOD rates rose 1709% from 2013 baseline compared to HOD which had increased by only 56%. In DC, FOD rates increased 1909% from 2014 to 2019, whereas HOD increased 78% during the same time period (Fig. 3). In 2020, where analyzed, fentanyl-associated deaths increased ~ 30% from 2019. Collectively, these data indicate that fentanyl and its analogs, introduced in combination with other illicit drugs, greatly contributed to the death rate increases shown in Fig. 2.

Impact of the Opioid Epidemic on Black and White Residents

At this study's inception, there was sparse data regarding the impact of the opioid epidemic on the African American community in part due to the opioid epidemic having been initially viewed as a rural White problem. Thus, we evaluated the racial breakdown of opioid-related deaths. In Fig. 4, at each timepoint, rates of OOD increases were significantly higher for Black individuals in all three states and DC (Fig. 4). In IL, Black OODs rates were 252%, whereas Whites were 72% above their 2013 baseline. Thus, there was a greater than three-fold disparity in the rate of increase between Black and White OODs in IL. The discrepancy for OODs in 2020, the first year of the pandemic, was four-fold greater for Black residents of IL. In MD, OODs were consistently two-fold greater for Black residents beginning in 2018, a ratio maintained through the pandemic in 2020. OOD rates were also more pronounced in Black Michiganders, with a steep slope through 2018 at 309% in Blacks vs. 102% in Whites. No data was available past 2018 for MI. Finally, for DC, the rate of increase of OODs was even more disparate for the Black community. When the opioid crisis peaked in 2016, it was a defining year for DC overall, and OODs borne by Blacks increased five-fold compared to Whites (225% vs. 48% from 2014 baseline). In 2020, the discrepancy widened further: Black residents in DC experienced a six-fold (600%) greater death rate than Whites (485% vs. 81% from 2014 baseline). Thus, in all regions analyzed, unequivocally, OODs have risen from 2013 (Fig. 2, Fig. 4). However, as OODs in the White population has stabilized (or decreased), the death rate in Blacks continued to rise approximately six-fold in some cases as in DC (Fig. 4).

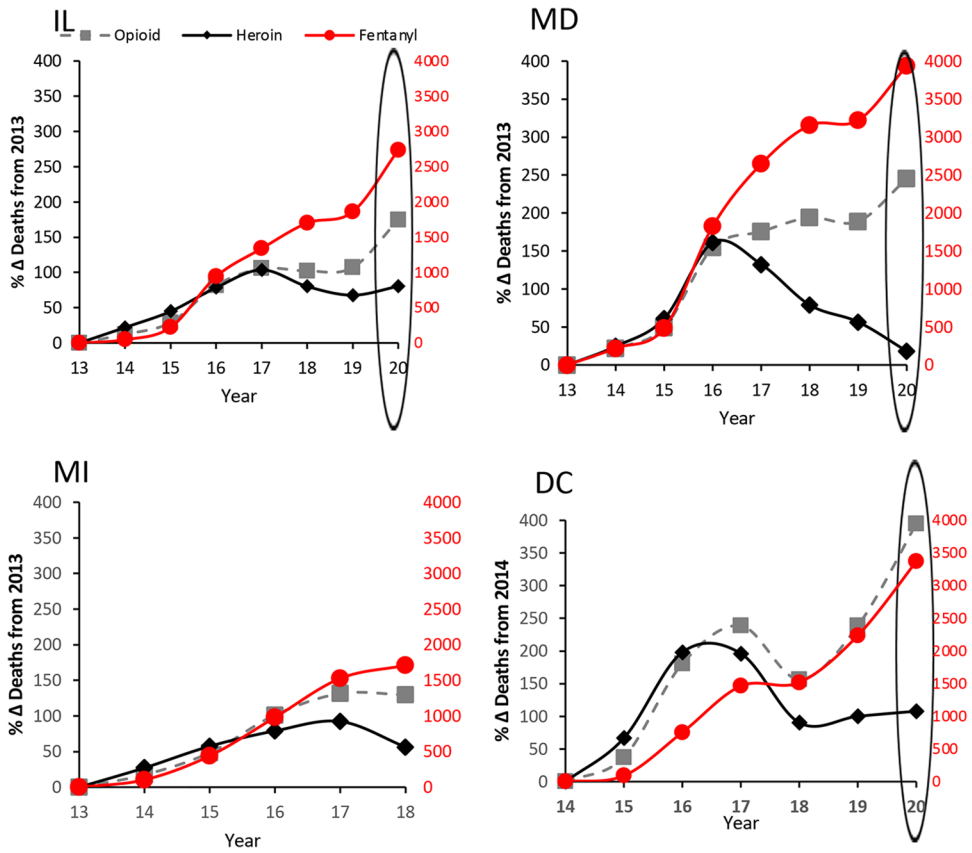

Fig. 3 Rate of fentanyl overdose deaths compared to heroin and overall opioid deaths. Red circles (fentanyl); black diamonds (heroin); gray squares (overall OODs). Dual *y*-axis (right, red) corresponds to fentanyl deaths, which was an order of magnitude greater than OODs or HOD. The large oval highlights data influenced by the COVID-19 pandemic in 2020

Like in Figs. 2, 3, and 4, the city of Philadelphia showed an increase in OOD from 2013 that was sustained through 2020 (Fig. 5A, gray-dashed). HODs declined sharply during that time span (Fig. 5A, black solid), a trend that coincided with a 4000% increase in FODs (Fig. 5B). There was a nearly five-fold greater rate of opioid deaths in Black vs. White populations in 2020 (Fig. 5C). As compared to deaths due to homicide in Philadelphia which were 20% below 2013 levels, OODs were ~ 170% higher than in 2013 (Fig. 5D). Therefore, in Philadelphia, OODs are increasing at a pronounced, elevated rate even compared to homicides.

To emphasize the disparity per capita, we used census data for IL, MD, MI, and for DC (Fig. 6A). In 2013 IL, the rate of OODs was 5 per 100,000 for both Black and White residents. In 2020, Black and White deaths had diverged to 56 vs. 16 per 100,000, respectively. MD recorded a similar statistic where in 2013, the OODs for Black and White people per capita was 16.3 vs. 15, respectively. In 2020, OODs per capita increased to 118.8 for Blacks vs. 17 for Whites (Fig. 6A). In 2013 MI, OODs per capita was slightly greater in Whites (9.7) than Blacks, (7.3) and then sharply inverted by 2018, where Black per capita OOD rates were 30.8 vs. 19.4 for Whites. For DC, the disparity was evident beginning in 2014 when the per capita OOD rate was 18 vs. 6.5 for Black and White respectively and broadened every year. By 2020, Black/White OODs in DC per capita respectively increased to 108 vs. 12 (Fig. 6A).

These data show an accelerated growth in the raw number of opioid-related deaths for Blacks (Fig. 6A). When values are averaged for all regions in 2018 and 2019, there was a statistically significant 2.3 and 2.7-fold greater, $p < 0.05$, Black compared to White OOD rate (Fig. 6B). In addition, in states where 2020 data was available, the pandemic clearly expanded already existing disparities.

Heroin- and Fentanyl-related Deaths in Black and White Residents

Next, we evaluated heroin and fentanyl's contributions to the disparate rise in OODs for Blacks and Whites. Figure 7A and B shows the difference in percentage increase for HODs and FODs, respectively. By 2020, HODs were ten-fold and FODs twelve-fold more prevalent in Black IL residents. The IL FOD graph (Fig. 6B) shows the widening gap in fentanyl-induced deaths for Blacks. In MD in 2015 and 2017, there was no disparity between Black and White HODs, but by 2020 the gap was widened: a 4% reduction from 2013 levels for Whites versus a 66% increase for Blacks. In 2020 in MD, the prevalence of FODs was approximately two-fold greater in Black

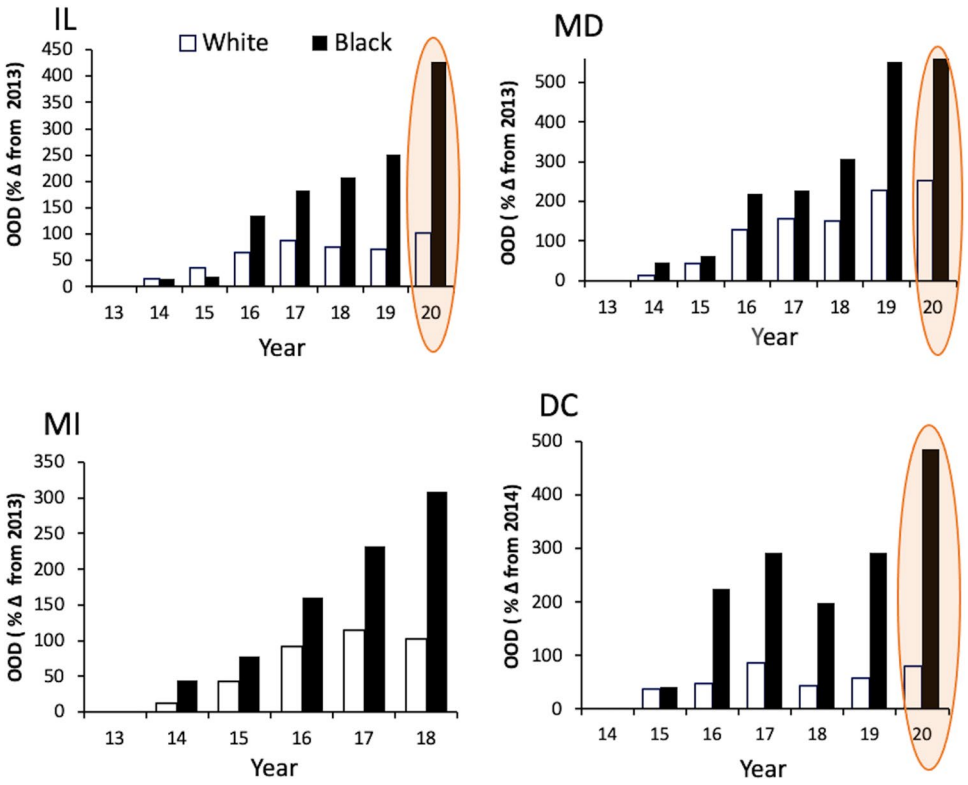

Fig. 4 Racial disparity of the Opioid Epidemic. Illinois (top left), Maryland (top right), Michigan (bottom left), and Washington DC (bottom right). Black bars, individual deaths recorded as Black, African American, African ancestry; white bars, deaths recorded as White, Caucasian, or European heritage. The large oval highlights data influenced by the COVID-19 pandemic in 2020

residents (Fig. 7B). For MI, the trends of Blacks being at greater risk for overdose continued in 2018, but the difference in HOD and FOD rates were similar at 4- and 2.4-fold respectively over Whites (6A vs. 6B for MI). For DC, ethnicity data was available from 2016 onward, and thus the same 2014 baseline as other DC data could not be shown. Comparing to 2016, both Black and White DC residents showed a substantial decline in HODs in 2017–2019. However, FODs (Fig. 7B, right) continued to rise significantly over 2016 levels. White fentanyl deaths, although on the rise, lagged behind the rate of FODs in Blacks. The year 2019 was the last available report of ethnicity-specific deaths for each opioid/opiate class in DC. Overall, FODs rose for all regions analyzed in this report, and revealed a greater disparity for Blacks.

Comparison of Opioid Overdose Deaths to Homicides

Lastly, to emphasize the extent of the opioid problem, OODs were compared to homicides as was done for Philadelphia (Fig. 5D). The states analyzed have cities with traditionally high crime rates, inclusive of Chicago, Detroit, and Baltimore. In all three states and in DC, the rate of increase in opioid-related deaths were higher than homicides (Fig. 6). Even in IL, which registered similar homicide and OOD rates during 2013–2015, by 2020 OODs had surpassed homicides by three-fold (Fig. 8). The trend of vastly diverging multi-fold increased rates of OODs compared to homicides was evident in MD, MI, as well as DC through 2020. Opioid-related deaths did not correlate with homicides in any state or DC; Spearman's correlation coefficient, $\rho < 1$, P value > 0.05 for each region.

Discussion

The current opioid crisis is a public health emergent biological disease and as such, aggressive interdisciplinary attention is needed to address the social, medical, and legal implications [35]. As a shift in the afflicted demographic from rural White to urban Black Americans has become evident, a compassionate awareness, vigilant surveillance, and directed corrective action is necessary. In the current study, we analyze the rate of opioid-related death in the District of Columbia and four critical states associated with the opioid crisis: Illinois, Maryland, Michigan, and Pennsylvania. Expectedly, our results showed a steep increase in OOD rates, amplified by fentanyl overdose in major cities in the country. The OOD rates far surpassed homicide rates in all regions by several fold. When death rates were normalized against population density, Blacks

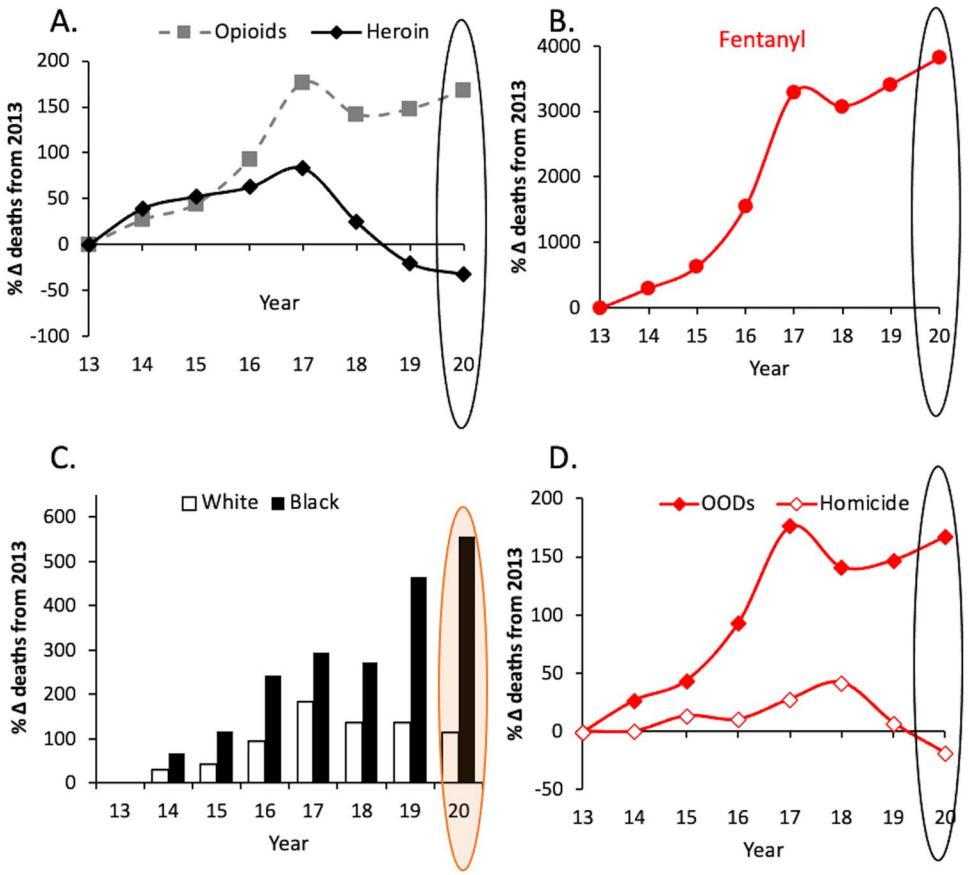

Fig. 5 Opioid-related deaths in Philadelphia, PA. **A** Comparison of OODs and heroin deaths from 2013 to 2020. **B** Deaths where fentanyl was implicated. **C** Racial disparity of the opioid epidemic; black bars, individual deaths recorded as Black, African American, or of African ancestry; white bars, deaths recorded as White, Caucasian, or European heritage. **D** Comparison of OODs to homicides from 2013 to 2020. The large ovals highlight data influenced by the COVID-19 pandemic in 2020

were significantly more impacted—by several fold—in terms of mortality compared with Whites. The findings herein should contribute to a national recognition of the shift in the profile of the opioid epidemic and serve as justification for resource allocation to address opioid addiction in Black, urban communities; the disproportionately impacted demographic.

Apart from the loss of lives, the economic burden of the misuse of illicit drugs in the USA was estimated at well over $1.0 trillion per year in 2017, to cover the cost of healthcare, lost productivity, addiction treatment, and criminal justice involvement [36]. In 2020, the costs of the epidemic are even greater because a multi-disciplinary, all hands-on-deck strategy by SAMHSA, NIDA, social, scientific, academic, and legal entities have been deployed to tackle complexities of the opioid crisis. Even with these resources, the age-adjusted rate of deaths involving synthetic opioids other than methadone increased 1040% from 2013 to 2019, with the largest relative increase occurring in the Western United States (67.9%) from 2018 to 2019 [37, 38].

Indeed, in every region analyzed, OODs increased over the 7-year period from 2013 to 2020. We find the OOD toll and rate of increase is far greater in cities like DC, but also in Detroit, Chicago, Baltimore, than the remaining parts of their respective states (Fig. 2). Most prominent is the predominant synthetic opioid contribution to OOD rates (Fig. 3), supporting a significant shift in consumption and usage from ill-prescribed pharmaceuticals in rural non-urban regions to manufactured opioids introduced into the street drug market (Figs. 2 and 3) [39]. For Pennsylvania, our compiled findings show that Philadelphia OODs lagged behind that of Pittsburgh and Allegheny County, with Allegheny County having peaked in 2016 (data not shown). The Philadelphia data support the trend in other cities investigated in this study.

In comparing opioid deaths between White and Black individuals, the latest years analyzed show higher death rates among Black users in all cities and states (Figs. 4, 5). The data suggests that Black people are disproportionately dying from drugs adulterated with fentanyl- or its derivatives (Fig. 7), consistent with previous reports [16]. Synthetic opioids like fentanyl derivatives are very cheap and readily available on the streets mostly as contaminated heroin. Increasingly, opioids are also being used with stimulants such as cocaine and especially with amphetamines [40]; methamphetamine use disorder increased ten-fold among Black individuals from 2015 to 2019 [32], expanding the fatal impact to people with primary dependency on non-opioid sustances. In addition, the time of action of many manufactured opioids is short, requiring less amount and time to achieve euphoric sensations compared with other opioids [41], and opioids

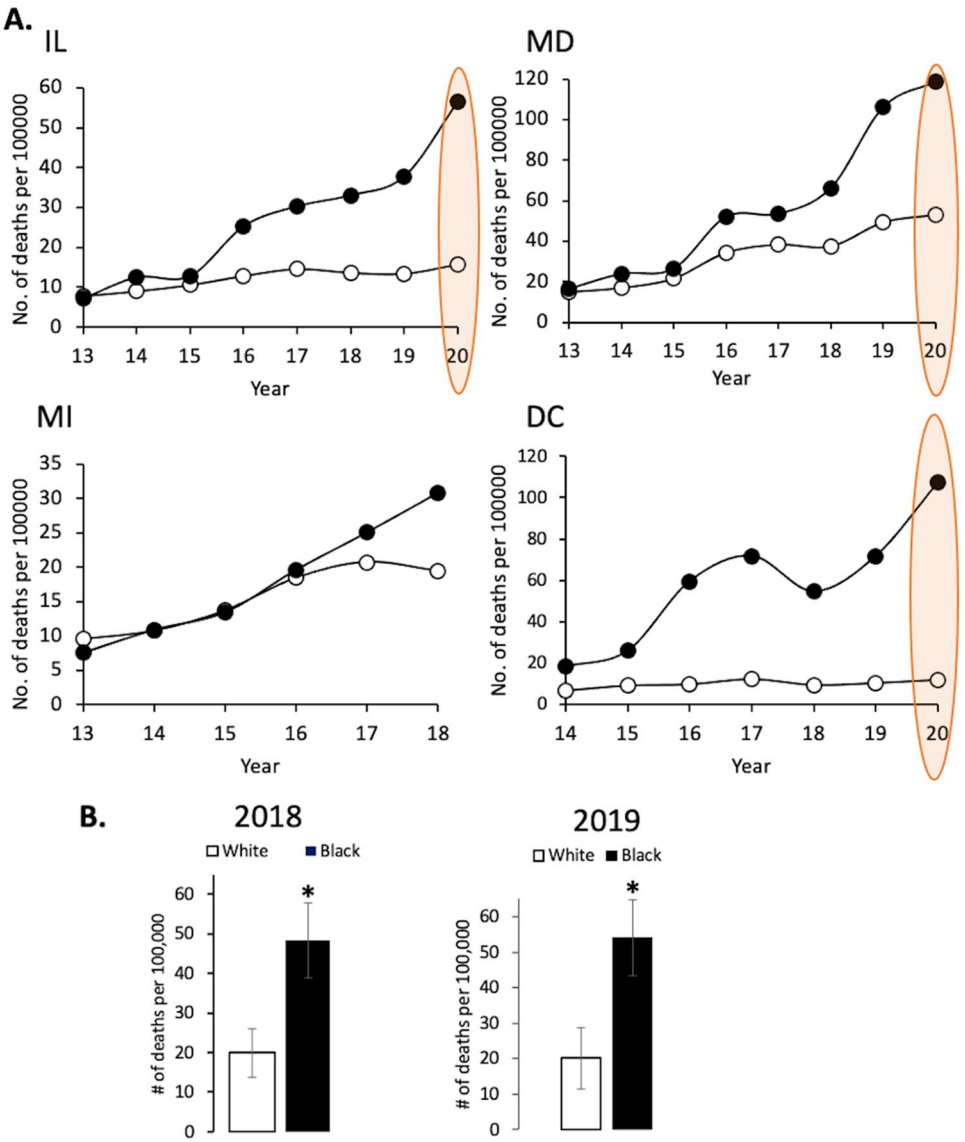

Fig. 6 Opioid-related deaths by race, per capita. **A** Deaths were expressed per 100,000 Black or White people based on census data for each state. In Illinois (top left), Maryland (top right), Michigan (bottom right), and Washington DC (bottom left). **B** Average of the 2018 or 2019 per capita deaths for all regions; Black solid graphs are deaths recorded as being Black, African American, or of African ancestry; white/clear open graphs are deaths recorded as White, Caucasian, or of European heritage

combined with stimulants could confer enhanced abuse-related effects that manifest into greater persistence and motivation for drug seeking, and/or increased likelihood of relapse [42].

As stated previously, the past few years have revealed a shift in the communities where the opioid epidemic is most widespread. Monnat and Rigg reported that opioid mortality rates have grown faster in rural areas, especially in the Northeast and Midwest [43], but the data presented in this report and by others show a landscape where opioid overdoses have a staggering toll on Black communities [25]. Strong data supports that the increase in urban OOD rates is attributable to the tainting of drugs with synthetic potent fentanyl, but importantly, there is equally strong evidence that Blacks receive (1) less appropriate treatment and rehabilitation, (2) have fewer treatment centers available, and (3) may not hold private insurance, and thus experience a disparity in access to healthcare [44, 45]. A comprehensive strategy to address the opioid abuse and overdose problem will include awareness of comorbid mental health disease and research focused on racially disadvantaged individuals [46]. For example, the 1970's heroin addiction and the 1990's crack cocaine epidemic in primarily urban and Black neighborhoods were not viewed as medical, psychological, or behavioral health issues, but rather, were particularly punitive, criminalized with steep sentences that disrupted the social construct of Black family life [47]. Muennig et al. [48] has countered the case made by Case and Deaton [49] to suggest that deaths of despair are neither a recent problem nor confined to Whites, that with every epidemic (heroin in the 1970s, crack in the 1980's HIV/AIDS

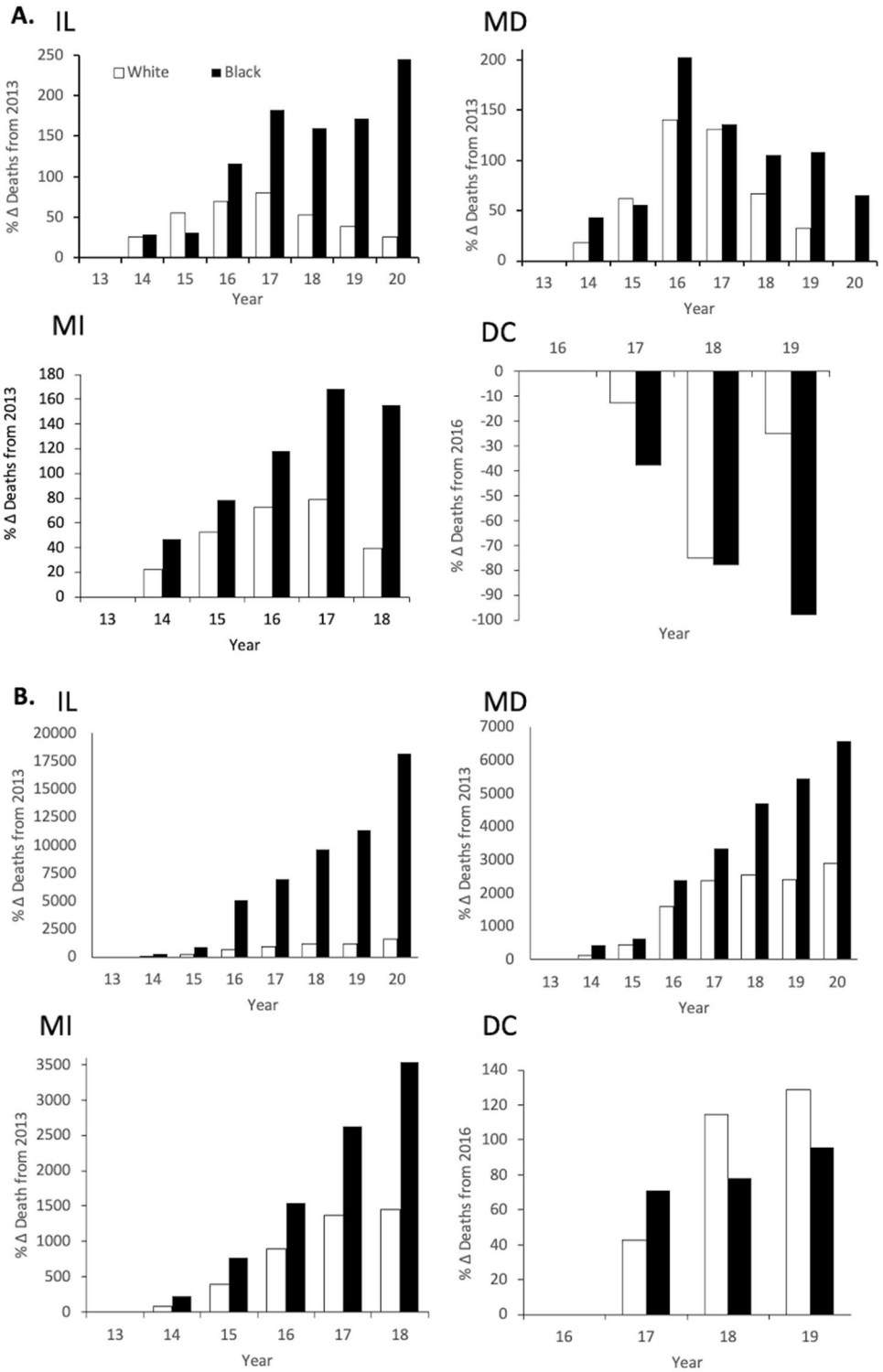

Fig. 7 Heroin and fentanyl-related deaths by race. **A** Heroin and **B** fentanyl deaths in Black (black bars) and White (white bars) individuals in Illinois (top left), Maryland (top right), Michigan (bottom left), and Washington DC (bottom left)

in the 1990s and now opioids), Blacks have been the group predominantly affected, with a resultant spike in death rates compounded by race-based health and healthcare disparities [48, 50].

Treatment approaches that are one-size-fits-all based on regimen developed with White research participants and few to no African Americans must be carefully vetted, as discussed by our group in Abijo et al., Gondré-Lewis et al., and Limgala et al. [27, 51, 52]. Vulnerability to cancers, systemic, and psychiatric disorders can vary by ethnicity, but opioid addiction can as well [53, 54]. Recent genome-wide association studies (GWAS) have identified two risk alleles for opioid dependence in Black individuals, KNC1 and KCNG2 involved in potassium

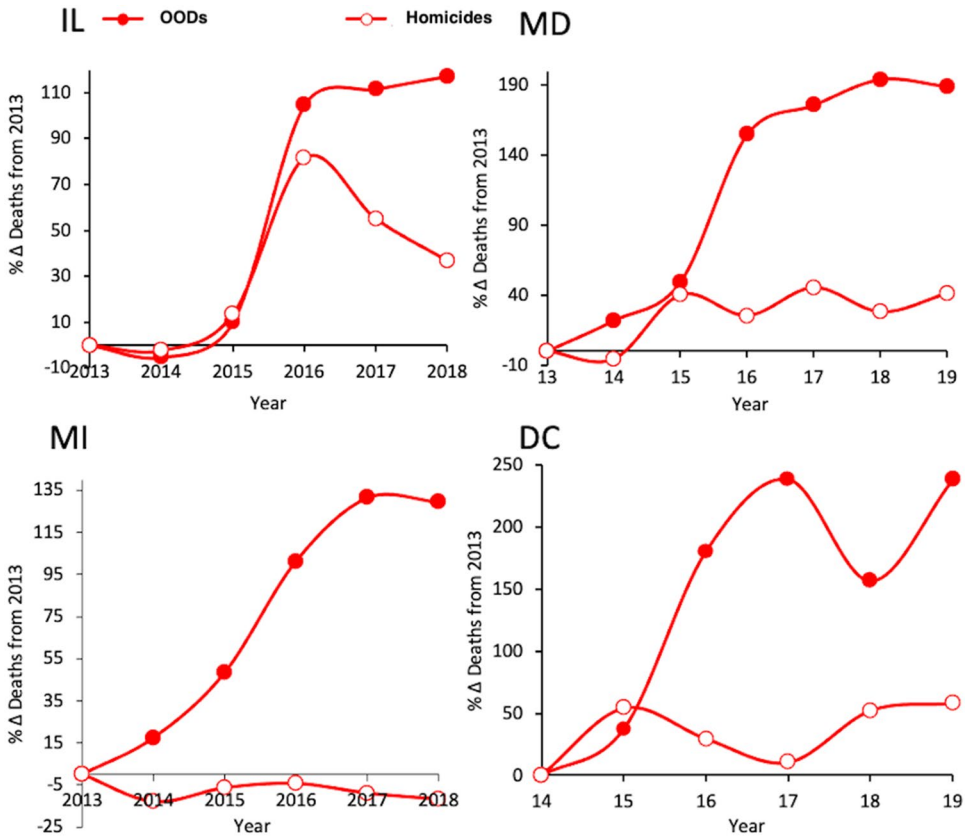

Fig. 8 Comparison of opioid-related deaths and homicides. Illinois (top left), Maryland (top right), Michigan (bottom left), and Washington DC (bottom right). Solid red circles are OODs for each region, and open circles, homicides

signaling; very different than a risk variant of the axon guidance protein RGMA, associated with White opioid dependence [55, 56]. Pacific islanders, Asians, Hispanic individuals also show different behavioral and biological risk for various diseases [27]. Based on pharmacogenomics, biological response to treatment also varies for different racial groups. Genetic differences in metabolism of buprenorphine, used to treat the negative symptoms of opioid dependence, may leave patients undertreated and at increased risk for relapse [57, 58]. Identifying ethnicity-specific genetic risk profiles is necessary to develop personalized approaches to opioid addiction treatment.

Some study limitations include that OOD data were not available for the full period from 2013 to 2020 uniformly across all states and territories sampled. Additionally, states differed on the emphasis of reporting on specific opioids from year-to-year and dependent on local decisions. DC, for example, began stratifying heroin from fentanyl derivatives in specific in 2016 when OODs were at their peaks but not in previous years, etc. (Fig. 7). Nonetheless, all available data are fully reported in the graphs.

Public Health Relevance and Conclusions

We show an alarming shift in overdose deaths from White suburban to Black urban communities. The impact of opioid epidemic for Blacks is aggravated by its convergence with COVID-19-induced health concerns and social isolation, exacerbating already existing social determinants of health. Because many in this population also experience severe economic disparity, housing stability is a critical and ongoing issue, particularly as it pertains to the maintenance of health status and the avoidance of negative health outcomes [59]. Urban Blacks frequently reside in health care deserts, with little access to transportation, child/adult care, and medical treatment. The logistical barriers associated with traveling to a medical center across town can be as insurmountable as the isolation faced by rural communities, impacting access to behavioral health treatment. The opioid crisis in urban environments cannot be solved without addressing the housing crisis and transportation deficiencies faced by the poor, the underprivileged or those living at the fringes of society. Efforts by agencies in all sectors (medical, educational, housing, legal), and indeed science, must prioritize the disparate impact of opioid drugs on Black communities across the country. Much like the Department of Health and Human Services developed the Rural Communities Opioid Response Program (RCORP), urban community-focused programs for the socioeconomically disadvantaged are needed to address barriers to treatment for substance or opioid use disorders. In this study, we highlight the still-growing unrelenting opioid

epidemic for Blacks and urban dwellers and advocate a need for an opioid response that is specific, with focused attention on urban socioeconomically disadvantaged populations.

From a biological standpoint, precision-based therapeutic approaches that account for genetic allelic variations in different ethnicities and racial groups are essential to effectively target relevant mechanisms of addiction in Blacks, Hispanics, Native Americans, and other minority groups. We herein join James and Jordan [47] to advocate for a public health framework where treatment solutions can be tailored to target communities of color to avoid racial exclusion and repeating past de-valuation of the experience of Black people with addiction. Siloed efforts have not worked. Therefore, aside from efforts to remove these fatal drugs from urban streets, an aggressive holistic public health response is needed that integrates housing resources, job navigation and training, transportation, medical care, addiction psychiatry, and behavioral health counseling. These will begin to mitigate the SDoMH (Fig. 1), within a social net. In addition, community education/destigmatization about mental health and addiction is critical.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s40615-022-01384-6.

Acknowledgements The authors extend sincere gratitude to the Illinois Department of Public Health, Maryland Department of Health, Michigan Dept of Health and Human Services, and the District of Columbia Medical Examiner's office in the DC Department of Health for their hands-on involvement in helping us acquire the datasets. We applaud Pennsylvania and the city of Philadelphia for maintaining open and up-to-date data on the web.

Author Contributions Dr. Marjorie Gondré-Lewis conceived and designed the study. Material preparation, data collection, and analysis were performed Tomilowo Abijo and Marjorie Gondré-Lewis. The first draft of the manuscript was written by Marjorie Gondré-Lewis and Tomilowo Abijo, and revised and finalized by Marjorie C. Gondré-Lewis and Timothy Gondré-Lewis. All authors have read and approved the final manuscript.

Funding This work was supported in part with grant awards from Research Centers at Minority Institutions, National Institute of Minority Health and Health Disparities (NIMHD) of the National Institutes of Health (NIH) under Award Number # U54MD07597, and from the District of Columbia Center for AIDS Research, an NIH funded program (P30AI117970), which is supported by the following NIH Co-Funding and Participating Institutes and Centers: NIAID, NCI, NICHD, NHLBI, NIDA, NIMH, NIA, NIDDK, NIMHD, NIDCR, NINR, FIC, and OAR. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

Declarations

Ethics Approval This study uses publicly available data and thus does not require Ethics Committee review.

Competing Interests The authors declare no competing interests.

References

1. Vital statistics rapid release: provisional drug overdose death counts [Internet]. Center for Disease Control and Prevention. 2021. Available from: https://www.cdc.gov/nchs/nvss/vsrr/drug-overdose-data.htm#selection_specific_states_jurisdictions.
2. Vo AT, Patton T, Peacock A, Larney S, Borquez A. Illicit substance use and the COVID-19 pandemic in the United States: a scoping review and characterization of research evidence in unprecedented times. Int J Environ Res Publ Health. 2022;19:14.
3. Mericle AA, Sheridan D, Howell J, Braucht GS, Karriker-Jaffe K, Polcin DL. Sheltering in place and social distancing when the services provided are housing and social support: the COVID-19 health crisis and recovery housing. J Subst Abuse Treat. 2020;119:108094.
4. Avena NM, Simkus J, Lewandowski A, Gold MS, Potenza MN. Substance use disorders and behavioral addictions during the COVID-19 pandemic and COVID-19-related restrictions. Front Psychiatry. 2021;12:653674.
5. Hall AJ, Logan JE, Toblin RL, Kaplan JA, Kraner JC, Bixler D, et al. Patterns of abuse among unintentional pharmaceutical overdose fatalities. JAMA. 2008;300(22):2613–20.
6. Dunn KM, Saunders KW, Rutter CM, Banta-Green CJ, Merrill JO, Sullivan MD, et al. Opioid prescriptions for chronic pain and overdose: a cohort study. Ann Intern Med. 2010;152(2):85–92.
7. Hartung DM, Middleton L, Haxby DG, Koder M, Ketchum KL, Chou R. Rates of adverse events of long-acting opioids in a state Medicaid program. Ann Pharmacother. 2007;41(6):921–8.
8. (CDC) CfDCaP. CDC grand rounds: prescription drug overdoses - a U.S. epidemic. MMWR Morb Mortal Wkly Rep. 2012;61(1):10–3.
9. Phalen P, Ray B, Watson DP, Huynh P, Greene MS. Fentanyl related overdose in Indianapolis: estimating trends using multilevel Bayesian models. Addict Behav. 2018;86:4–10.
10. Comer SD, Cahill CM. Fentanyl: Receptor pharmacology, abuse potential, and implications for treatment. Neurosci Biobehav Rev. 2019;106:49–57.
11. Baldwin GT, Seth P, Noonan RK. Continued increases in overdose deaths related to synthetic opioids: implications for clinical practice. JAMA. 2021.
12. Fischer B, Keates A, Bühringer G, Reimer J, Rehm J. Non-medical use of prescription opioids and prescription opioid-related harms: why so markedly higher in North America compared to the rest of the world? Addiction. 2014;109(2):177–81.
13. Jones CM, Baldwin GT, Manocchio T, White JO, Mack KA. Trends in methadone distribution for pain treatment, methadone diversion, and overdose deaths - United States, 2002–2014. MMWR Morb Mortal Wkly Rep. 2016;65(26):667–71.
14. Hansen H, Netherland J. Is the prescription opioid epidemic a White problem? Am J Public Health. 2016;106(12):2127–9.
15. Allen-Watts K, Sims AM, Buchanan TL, DeJesus DJB, Quinn TL, Buford TW, et al. Sociodemographic differences in pain medication usage and healthcare provider utilization among adults with chronic low back pain. Front Pain Res (Lausanne). 2021;2:806310.
16. Lippold KM, Jones CM, Olsen EO, Giroir BP. Racial/ethnic and age group differences in opioid and synthetic opioid-involved overdose deaths among adults aged ≥18 years in metropolitan areas - United States, 2015–2017. MMWR Morb Mortal Wkly Rep. 2019;68(43):967–73.
17. Perrone J, Mycyk MB. A challenging crossroad for emergency medicine: the epidemics of pain and pain medication deaths. Acad Emerg Med. 2014;21(3):334–6.
18. Mazer-Amirshahi M, Mullins PM, Rasooly I, van den Anker J, Perrone J, Pines JM. Rising opioid prescribing in adult U.S. emergency department visits: 2001–2010. Acad Emerg Med. 2014;21(3):236–43.

19. Alexander MJ, Kiang MV, Barbieri M. Trends in Black and White opioid mortality in the United States, 1979–2015. Epidemiology. 2018;29(5):707–15.
20. Healthy People 2030. Social determinants of Health. In: U.S. Department of Health and Human Services OoDPaHP, editor. 2022.
21. World Health Organization (WHO). Social determinants of health. 2022.
22. Shim RS, Ye J, Baltrus P, Fry-Johnson Y, Daniels E, Rust G. Racial/ethnic disparities, social support, and depression: examining a social determinant of mental health. Ethn Dis. 2012;22(1):15–20.
23. Cotton NK, Shim RS. Social determinants of health, structural racism, and the impact on child and adolescent mental health. J Am Acad Child Adolesc Psychiatry. 2022.
24. Wang QQ, Kaelber DC, Xu R, Volkow ND. COVID-19 risk and outcomes in patients with substance use disorders: analyses from electronic health records in the United States. Mol Psychiatry. 2020.
25. Scholl L, Seth P, Kariisa M, Wilson N, Baldwin G. Drug and opioid-involved overdose deaths - United States, 2013–2017. MMWR Morb Mortal Wkly Rep. 2018;67(5152):1419–27.
26. O'Donnell J, Gladden RM, Goldberger BA, Mattson CL, Kariisa M. Notes from the field: opioid-involved overdose deaths with fentanyl or fentanyl analogs detected - 28 states and the District of Columbia, July 2016-December 2018. MMWR Morb Mortal Wkly Rep. 2020;69(10):271–3.
27. Abijo T, Blum K, Gondre-Lewis MC. Neuropharmacological and neurogenetic correlates of opioid use disorder (OUD) as a function of ethnicity: relevance to precision addiction medicine. Curr Neuropharmacol. 2020;18(7):578–95.
28. Schober DJ, Hunt BR, Benjamins MR, Saiyed NS, Silva A, De Maio FG, et al. Homicide mortality inequities in the 30 biggest cities in the U.S. Am J Prev Med. 2021;60(3):327–34.
29. Wong B, Bernstein S, Jay J, Siegel M. Differences in racial disparities in firearm homicide across cities: the role of racial residential segregation and gaps in structural disadvantage. J Natl Med Assoc. 2020;112(5):518–30.
30. Kegler SR, Stone DM, Mercy JA, Dahlberg LL. Firearm homicides and suicides in major metropolitan areas - United States, 2015–2016 and 2018–2019. MMWR Morb Mortal Wkly Rep. 2022;71(1):14–8.
31. DC Department of Behavioral Health.
32. Han B, Compton WM, Jones CM, Einstein EB, Volkow ND. Methamphetamine use, methamphetamine use disorder, and associated overdose deaths among US adults. JAMA Psychiat. 2021;78(12):1329–42.
33. Cano M, Huang Y. Overdose deaths involving psychostimulants with abuse potential, excluding cocaine: state-level differences and the role of opioids. Drug Alcohol Depend. 2021;218:108384.
34. Jones CM, Underwood N, Compton WM. Increases in methamphetamine use among heroin treatment admissions in the United States, 2008–17. Addiction. 2020;115(2):347–53.
35. Cole DM, Thomas DM, Field K, Wool A, Lipiner T, Massenberg N, et al. The 21st Century Cures Act implications for the reduction of racial health disparities in the US criminal justice system: a public health approach. J Racial Ethn Health Disparities. 2018;5(4):885–93.
36. Florence C, Lui F, Rice K The economic burden of opioid use disorder and fatal opioid overdose in the United States, 2017. Drug and Alcohol Dependence (2021):218. https://pubmed.ncbi.nlm.nih.gov/33121867/.
37. Mattson CL, Tanz LJ, Quinn K, Kariisa M, Patel P, Davis NL. Trends and geographic patterns in drug and synthetic opioid overdose deaths - United States, 2013–2019. MMWR Morb Mortal Wkly Rep. 2021;70(6):202–7.
38. Vivolo-Kantor AM, Seth P, Gladden RM, Mattson CL, Baldwin GT, Kite-Powell A, et al. Vital signs: trends in emergency department visits for suspected opioid overdoses - United States, July 2016-September 2017. MMWR Morb Mortal Wkly Rep. 2018;67(9):279–85.
39. Mars SG, Ondocsin J, Ciccarone D. Sold as heroin: perceptions and use of an evolving drug in Baltimore. MD J Psychoactive Drugs. 2018;50(2):167–76.
40. Whitley P, LaRue L, Fernandez SA, Passik SD, Dawson E, Jackson RD. Analysis of urine drug test results from substance use disorder treatment practices and overdose mortality rates, 2013–2020. JAMA Netw Open. 2022;5(6):e2215425.
41. Suzuki J, El-Haddad S. A review: Fentanyl and non-pharmaceutical fentanyls. Drug Alcohol Depend. 2017;171:107–16.
42. Maguire DR, Minervini V. Interactions between opioids and stimulants: behavioral pharmacology of abuse-related effects. Adv Pharmacol. 2022;93:1–33.
43. Monnat SM, Rigg KK. The opioid crisis in rural and small town America. University of New Hampshire Carsey School of Public Policy; 2018.
44. Squires LE, Palfai TP, Allensworth-Davies D, Cheng DM, Bernstein J, Kressin N, et al. Perceived discrimination, racial identity, and health behaviors among black primary-care patients who use drugs. J Ethn Subst Abuse. 2018;17(4):460–77.
45. Griffith C, La France B, Bacchus C, Ortega G. The effects of opioid addiction on the Black community. Intl J Coll Res Intern Med Publ Health. 2018.
46. Knighton JS, Stevens-Watkins D, Staton M, Pangburn K. Trends and mental health correlates of nonmedical opioid use among criminal justice-involved African American men. Addict Behav. 2018;85:14–20.
47. James K, Jordan A. The opioid crisis in Black communities. J Law Med Ethics. 2018;46(2):404–21.
48. Muennig PA, Reynolds M, Fink DS, Zafari Z, Geronimus AT. America's declining well-being, health, and life expectancy: not just a White problem. Am J Publ Health. 2018;108(12):1626–31.
49. Case A, Deaton A. Rising morbidity and mortality in midlife among white non-Hispanic Americans in the 21st century. Proc Natl Acad Sci U S A. 2015;112(49):15078–83.
50. Griffith C, La France B, Bacchus C, Ortega G. The effects of opioid addiction on the Black community. Int J Coll Res Intern Med Publ Health. 2018;10:2.
51. Gondré-Lewis MC, Elman I, Alim T, Chapman E, Settles-Reaves B, Galvao C, et al. Frequency of the dopamine receptor D3 (rs6280) vs. opioid receptor μ1 (rs1799971) polymorphic risk alleles in patients with opioid use disorder: a preponderance of dopaminergic mechanisms? Biomedicines. 2022;10:4.
52. Limgala RP, Furtak V, Ivanova MM, Changsila E, Wilks F, Fidelia-Lambert MN, Goker-Alpan O, Gondré-Lewis MC. Selective screening for lysosomal storage disorders in a large cohort of minorities of African descent shows high prevalence rates and novel variants. JIMD Rep. 2021;59(1):60–68.
53. Abijo T, Blum K, Gondré-Lewis MC. Neuropharmacological and neurogenetic correlates of opioid use disorder (OUD) as a function of ethnicity: relevance to precision addiction medicine. Curr Neuropharmacol. 2019.
54. Blum K, Badgaiyan RD, Dunston GM, Baron D, Modestino EJ, McLaughlin T, et al. The DRD2 Taq1A A1 allele may magnify the risk of Alzheimer's in aging African-Americans. Mol Neurobiol. 2018;55(7):5526–36.
55. Cheng Z, Zhou H, Sherva R, Farrer LA, Kranzler HR, Gelernter J. Genome-wide association study identifies a regulatory variant of RGMA associated with opioid dependence in European Americans. Biol Psychiatry. 2018;84(10):762–70.
56. Gelernter J, Kranzler HR, Sherva R, Koesterer R, Almasy L, Zhao H, et al. Genome-wide association study of opioid dependence: multiple associations mapped to calcium and potassium pathways. Biol Psychiatry. 2014;76(1):66–74.
57. Ettienne EB, Chapman E, Maneno M, Ofoegbu A, Wilson B, Settles-Reaves B, et al. Pharmacogenomics-guided policy in opioid use disorder (OUD) management: an ethnically-diverse case-based approach. Addict Behav Rep. 2017;6:8–14.
58. Chapman E, Ettienne E, Clarke M, Dunston G. Wide pharmacogenetic variations in dosing of buprenorphine in the treatment of opioid

addiction in African Americans 2nd International Conference on Addiction Medicine and Reward Deficiency Syndrome; Baltimore, MD2017.
59. Ruiz MS, Williams A, O'Rourke A, MacIntosh E, Moné S, Clay C. The impact of housing insecurity on access to care and services among people who use drugs in Washington, DC. Int J Environ Res Publ Health. 2022;19:13.