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BRIEF REPORT

Racial/Ethnic Disparities in Opioid-Related Mortality in the USA, 1999–2019: the Extreme Case of Washington DC

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Abstract In 2019, there were nearly 50,000 opioid-related deaths in the US, with substantial variation across sociodemographic groups and geography. To systematically investigate patterns of racial/ethnic inequities in opioid-related mortality, we used joinpoint regression models to estimate the trajectory of the opioid epidemic among non-Hispanic Black versus non-Hispanic white residents in Washington DC, 45 states, and 81 sub-state areas. We highlight the unique inequities observed in Washington DC. In 2019, the observed opioid-related mortality rate among Black DC residents was 11.3 times higher than white DC residents, resulting in 56.0 more deaths per 100,000 (61.5 vs. 5.5 per 100,000). This inequity was substantially higher than any other jurisdiction on both the relative and absolute scales. Most opioid-related deaths in DC involved synthetic opioids, which was present in 92% (N=198) of deaths among Black DC residents and 69% (N=11) of deaths among white DC residents. Localized, equitable, culturally-appropriate, targeted interventions are necessary to

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reduce the uniquely disproportionate burden of opioid-related mortality among Black DC residents.

Keywords Opioids · Racial/ethnic disparities · Mortality · Inequities

Introduction

In 2019, there were nearly 50,000 opioid-related deaths in the USA.[1] The impact of the opioid overdose crisis has not been equally distributed, however, with wide variation across sociodemographic groups, regions of the country, and by opioid type [2–4]. Despite efforts by national, state, and local governments to reduce opioid overdoses in the general population [5–7], policies and interventions specifically focused on reducing the impact of the opioid overdose crisis in Black communities are lacking [8]. Because effective, equitable interventions require local, culturally appropriate interventions tailored to structurally vulnerable populations [8], it is critical to identify where these communities reflect a substantial portion of opioid deaths [9]. Here, we systematically characterized state-, county-, and local-level trends in opioid-related mortality in the non-Hispanic Black population relative to the non-Hispanic white population for all opioids, natural and semi-synthetic opioids, heroin, and synthetic opioids.

Methods

We used restricted-access multiple cause-of-death data from the National Center for Health Statistics and the corresponding bridged-race population estimates for the period January 1, 1999, through December 31, 2019. The multiple cause-of-death data are derived from all death certificates in the USA, and contain geocoded information about both the underlying cause of death as well as up to twenty contributory causes of death. All causes of death are coded using the International Classification of Diseases Tenth Revision (ICD-10).

Consistent with prior research, we defined opioid-related deaths using a combination of specific ICD-10 codes for both underlying and contributory causes [4]. Specifically, opioid deaths must have one of the following underlying causes of death: accidental poisoning (X40-X44), intentional self-harm (X60-X64), assault by poisoning (X85), and undetermined intent (Y10-Y14). In addition, opioid-related deaths must also contain at least one of the following contributory causes: opium (T40.0); heroin (T40.1); other natural and semi-synthetic (T40.2) such as codeine, morphine, or oxycodone; methadone (T40.3); other synthetic (T40.4) such as fentanyl or fentanyl derivatives; or unspecified opioids (T40.6). Consistent with previous work, this definition is not mutually exclusive since a single death may contain more than one opioid. As a sensitivity analysis, we examined trends in deaths that involved multiple opioids and each opioid alone (but potentially with other non-opioid substances).

To facilitate comparison across areas with large non-Hispanic Black populations, analyses were limited to Washington DC, 45 states with at least one opioid death in at least half the years of observation, and 81 sub-state geographies (i.e., counties, parishes, or cities) with $\geq$ 100,000 non-Hispanic white and non-Hispanic Black residents, hereafter referred to as "white" and "Black" (see Supplemental Materials Table S1 and Table S2). Due to low numbers of deaths from opium or methadone, we limited analysis of deaths due to specific opioids to those involving heroin (T40.1), natural or semi-synthetic opioids (T40.2), or synthetic opioids (T40.4). Age-standardized mortality rates stratified by state, race, and opioid type were estimated using 5-year age groups (0–4, 5–9, … 85 +) with the US 2000 standard population as the referent. Standard errors were estimated by assuming deaths within each age bin are Poisson distributed.[10]

We fitted joinpoint regression models stratified by area, race, and opioid type to estimate the annual percent change (APC) in mortality in 2019. Joinpoint regression models are used to estimate trends which may have one or more changes in their slope ("joinpoints"). The number and placement of joinpoints are fit iteratively until the most parsimonious model is found according to a permutation test [11]. Previous research has found these models to describe trends in opioid-related mortality well [3, 4]. For interpretability, we express the model coefficients in terms of the annual percent change as well as in doubling time, $T_d = 1/\log_2(1 + \text{APC}/100)$.

As we used de-identified, retrospective data on deceased individuals, our study was deemed exempt from review by the Stanford University institutional

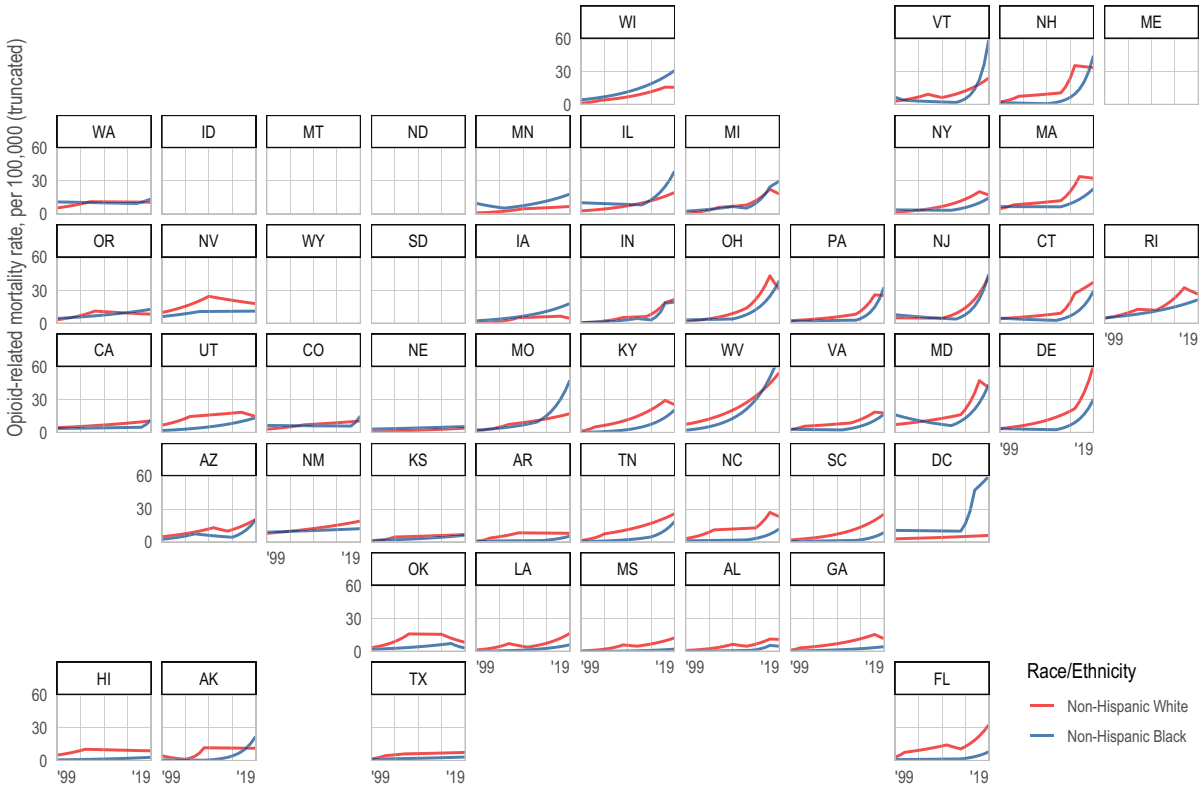

Fig. 1 Smoothed opioid-related mortality by state for non-Hispanic white (red) and non-Hispanic Black (blue) residents, 1999 to 2019. Raw mortality rates fitted using joinpoint regression

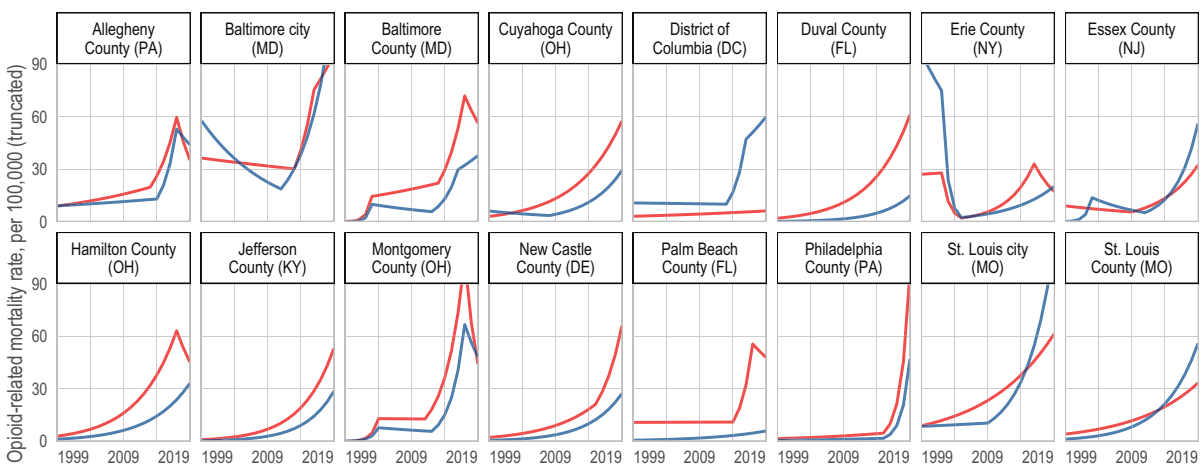

Fig. 2 Smoothed opioid-related mortality by county or city for non-Hispanic white (red) and non-Hispanic Black (blue) residents, 1999 to 2019. Raw mortality rates fitted using joinpoint regression. Here, we show the 16 areas with the highest observed opioid-related mortality rate in any year across either non-Hispanic white or non-Hispanic Black residents. See Figure S2 for all areas

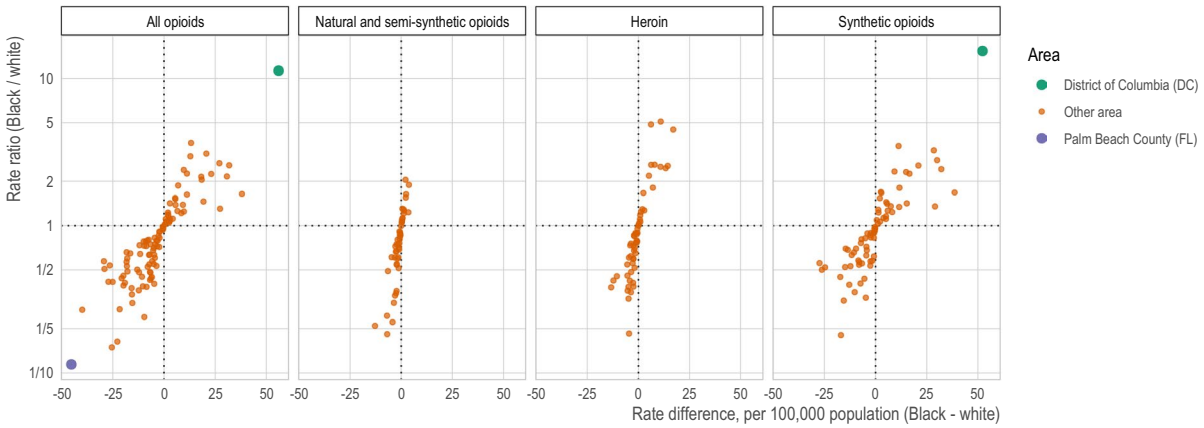

Fig. 3 Observed Black/white rate ratio (*y*-axis) and Black–white rate difference (*x*-axis) by opioid type, 2019. We highlight the extreme inequities observed in Washington DC (green) and Palm Beach County (purple). See Tables S11 and S12 for estimates and confidence intervals of all areas

review board. Analyses were performed in both R 4.1.0[12] and National Cancer Institute's Joinpoint Regression Program 4.9.0 [13]. Figures were generated using R 4.1.0. Reproducible code is available at https://github.com/mkiang/opioid_inequities.

Results

While the opioid-related mortality rate is higher for the white population in the majority of states (Fig. 1 and Figure S1; $N=25$; 56%) and sub-state areas (Fig. 2 and Figure S2; $N=61$; 75%), it is increasing more rapidly in the Black population in most states (34 vs 22) and in most sub-state areas (61 vs 47). Across the 45 states, the median (IQR) observed opioid-related mortality rate was 16.8 (10.6, 25.4) per 100,000 in the white population and 18.8 (10.0, 30.3) in the Black population, and the median (IQR) rate of increase was −0.3% (−3.1, 8.2) per year in the white population and 19.4% (8.2, 31.2) per year in the Black population. For both state-level and sub-state areas, the opioid-related mortality rates for the white and Black populations tend to be at similar levels and increase together at approximately similar rates across different opioid types (Figures S1 to Figure S8; Table S3 to Table S10). For example, in West Virginia, often considered the "epicenter" of the opioid overdose crisis, both populations have similarly high opioid-related mortality rates (70.3 per 100,000 Black residents vs. 54.5 per 100,000 white residents) and similar rates of increase (18% per year [95% CI: 14, 23] among Black residents [$P<0.001$; T_d:4 years] vs. 10% per year [95% CI: 8, 13] among white residents [$P<0.001$; T_d: 7 years]). These patterns are generally true for the cities and counties we examined (Fig. 2 and Figure S2). In the majority of areas, synthetic opioid–related mortality was higher than heroin-related mortality (36 or 71% of states and 69 or 89% of sub-state areas) indicating synthetic opioids are permeating the drug supply outside of fentanyl-adulterated heroin.

Washington DC represents a notable departure from these patterns. Unlike nearly all other areas, the rapid increases observed among Black residents of Washington DC did not coincide with similar increases among their white counterparts (Figs. 1 and 3). In 2019, the observed opioid-related mortality rate in the Black population of Washington DC exceeded that of the white population by a factor of 11 (61.5 vs. 5.5 per 100,000; Figs. 1 and 3). After a 3-year period of extremely rapid increases in synthetic opioid mortality among Black DC residents (APC: 258% from 2013 to 2016; 95% CI: 82, 604; $P=0.001$; T_d: 6 months) compared with a slow, steady increase among white DC residents (APC: 23% from 1999 to 2019; 95% CI: 16, 30; $P<0.001$; T_d: 40 months), synthetic opioid mortality growth decelerated in 2016 to 18% annual percent change (95% CI: 7, 29; $P=0.002$; T_d: 50 months), but remains nearly twelve times higher among Black residents (54.3 per 100,000 vs 4.6 per 100,000; Figure S2).

While the disparate level and rate of increase in opioid-related mortality among Black vs. white residents in Washington DC are unique, other areas such as Baltimore city, Baltimore County, Philadelphia County, and St. Louis city display exceptionally high opioid-related mortality rates (Fig. 2). For example, in Baltimore city, the 2019 opioid-related mortality rate among white residents was 90.2 per 100,000 with no statistically significant increase and among Black residents was 118.0 per 100,000 and increasing at 27% per year (95% CI: 22, 32; $P<0.001$; $T_d=35$ months). In the surrounding area of Baltimore County, the opioid-related mortality rate was 53.7 per 100,000 white residents and 35.4 per 100,000 Black residents, with no statistically significant increase for either population. Conversely, Philadelphia County and St. Louis city are both experiencing statistically significant increases in their opioid-related mortality rates for both the white and Black populations (Fig. 2, Figure S2, and Table S4).

In 2019, two areas, Palm Beach County and Duval County, showed an inverse pattern. Specifically, the opioid-related mortality rate among the white population was dramatically higher than among the Black population (Palm Beach Florida: 51.1 per 100,000 vs 5.8 per 100,000), driven by high synthetic opioid–related mortality in the white population (45.7 per 100,000). Notably, the opioid-related mortality rate is no longer increasing in white Palm Beach residents but increasing in Black residents at 12% per year (95% CI: 6, 19; $P<0.001$; $T_d=73$ months). In Duval County, the opioid-related mortality rate is 54.6 per 100,000 in the white population compared to 14.6 per 100,000 in the Black population with similar rates of growth for both populations (Fig. 2, Figure S2 and Table S4).

Additional results, including all model results, coefficients, and fit statistics, are available in our online repository: https://github.com/mkiang/opioid_inequities. Sensitivity analyses focused on poly-opioid and single-opioid mortality trends are consistent with our findings (Figure S9 to Figure S16).

Discussion

We observed an alarming and sustained acceleration of opioid-related mortality within the non-Hispanic Black population of Washington DC that far exceeded the level and rate of increase within the non-Hispanic white population, and which was driven by recent increases in synthetic opioid deaths. This disproportionate impact of the opioid overdose crisis among non-Hispanic Black residents of Washington DC relative to their non-Hispanic white counterparts was not observed in any other area of the USA with a comparably large non-Hispanic Black population (Figs. 1 and 2, Figure S2; Table S1 and Table S2). The inequity seen in Washington DC is likely the result of its rapidly changing racial landscape resulting in increased segregation and gentrification; however, this gentrification and shifting racial/ethnic composition is beginning to manifest in other areas of the country [14]. While Washington DC is an extreme example, this finding, along with the results from other areas such as Palm Beach County, Duval County, and Baltimore, highlights the need for tailoring interventions to specific areas, contexts, most-impacted populations, and opioid types in order to address and reduce opioid overdoses.

Several suggestions have been made to address the opioid overdose crisis among Black Americans more generally.[15] First, barriers to public health intervention may need to be addressed for all subpopulations. For example, James and Jordan suggest developing culturally tailored programs for the Black community, including the provision of prevention and treatment services through faith-based organizations, formal evaluations of the racial impact of different policy proposals, and consideration of how the criminal justice system has disproportionately enforced and criminalized substance use in the Black community [8]. Similarly, Nicholson Jr. and Rigg found that despite equal prevalence rates, Black and white prescription opioid users have distinct risk profiles, which suggests interventions must be tailored to be effective [16].

Second, public health interventions should address the impact of the opioid overdose crisis on the Black population specifically in the context of historical experiences of racial discrimination, violations of trust by the health care system, and other barriers to care [17, 18]. The opioid overdose crisis specifically is highly racialized in the USA with differential impacts of federal drug policy (e.g., the "War on Drugs"), the criminal justice system, methadone treatment, stigmatization, and even marketing of other opioid use disorder treatments such as buprenorphine

[19, 20]. Continued failure to address the fundamental cause of racism is likely to undermine the effectiveness of public health interventions [21].

Third, officials can ensure equity when delivering interventions. For example, despite scientific consensus of its effectiveness, buprenorphine treatment is less commonly utilized within the Black population, and interventions focused on the expansion of buprenorphine could also increase affordability, accessibility, and equity [22–24]. Local, tailored, community-based programs designed to train and distribute naloxone to people who use drugs have shown promise [25]; however, in a survey of Baltimore residents who inject drugs, Dayton et al. found that Black participants were significantly less likely to have access to naloxone, have naloxone training, or to use naloxone, despite similar levels of need [26].

Limitations of our study include substantial geographic and temporal variation in the quality of reporting for opioid-related deaths.[27] Mortality rate levels would be underestimated in the setting of significant misclassification. At least some of the observed change in mortality rates is due to increased quality and rates of post-mortem drug testing. While the magnitude of this bias is unknown, Washington DC has been designated by the US Centers for Disease Control and Prevention as one of the 27 states with "very good to excellent" opioid reporting.[28]

Those limitations notwithstanding, our findings indicate that localized, equitable, culturally appropriate, targeted interventions may be necessary to reduce the disproportionate burden of opioid-related mortality among Black residents of Washington DC.

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Declarations

Disclaimer The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

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