THE ROLE OF RACE AND PLACE IN DRUG USE AND MORTALITY IN THE UNITED STATES

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ABSTRACT

Background: Much of the research on the emergence and recent trends in the opioid epidemic in the United States examines differences by either race or place. Yet, the few studies which assess the intersection of these dimensions reveal unexpected findings, which challenge initial assumptions about the uniformity of the epidemic's impact. As such, this thesis aims to better describe differences in trends of drug overdose mortality and drug-use outcomes for non-Hispanic Blacks and Whites across three metropolitan categories: large metro, small metro, and nonmetro.

Objectives: This thesis aims to 1) present trends in all-drug and opioid- related mortality rates between 2003-2018; 2) highlight differences in changes in drug-related mortality before and after the peak of the epidemic in 2015; 3) delineate time trends in illicit drug use and prescription pain reliever misuse between 2003-2018; and 4) describe recent patterns in access to and source of drugs, for Blacks and Whites based on their metropolitan status.

Methods: Drug mortality data was obtained from the Centers for Disease Control and Prevention (CDC) WONDER database for national and population level data. Drug use data was obtained from the National Survey for Drug Use and Health (NSDUH), a nationally representative annual survey.

Results: For Blacks, drug-related mortality rates between 2003 to 2018 were consistently higher in large and small metro areas than in non-metro areas; such disparities by metro status did not emerge among Whites until 2011. In 2018, opioid-related deaths continued to rise for Blacks in large and small metro areas, but declined for Blacks in nonmetro areas, and for Whites in all metro categories. In contrast to drug-related mortality trends, self-reported drug use trends did not vary greatly between 2003-2018. Despite similar mortality rates prior to 2011, metro-based differences in illicit drug use and prescription pain reliever misuse among Whites were apparent over the entire time period. Among Blacks, illicit drug use was always higher in large and small metro areas; however, there were no metro-based differences in trends in prescription pain reliever misuse. Although reported drug use rates are generally lower, Blacks in all metro categories were more likely than Whites to report being approached by someone selling drugs, and this likelihood was highest among Blacks in large and small metro areas.

Conclusions: The findings demonstrate that many of the common narratives in drug use and mortality trends cannot be applied across racial and metropolitan groups. In contrast to common narratives, in recent years the opioid drug overdose epidemic is worsening for Blacks in both large and small metro areas, while it is declining for Whites. Thus, recent intervention efforts may be overlooking a particularly vulnerable subpopulation. Moreover, efforts to address drug use and its outcomes among Blacks should not be limited to large-urban areas, as patterns of drug use and mortality between small and large urban areas are consistently similar. Among rural Blacks, drug-related mortality and illicit drug use were consistently lowest, in spite of heightened risks for drug use for this population. The persistence of this trend is significant and not explained by just barriers in access to prescription opioids. Empirical research is needed to better understand why rates are escalating among more urban Blacks, while remaining low for rural Blacks and declining for Whites in all metro categories. Overall, studying drug-related mortality

and drug-use outcomes by race and metropolitan category reveals important differences which may otherwise be masked, and may inform more targeted and effective intervention and policy.

RÉSUMÉ

Contexte: Les recherches existantes sur l'émergence et les tendances de l'épidémie d'opioïdes aux États-Unis portent surtout sur les différences basées sur la race ou la place. Pourtant, le peu de recherches qui ont évalué l'intersection de ces dimensions révèlent des résultats surprenants, qui démentent les hypothèses initiales sur l'uniformité de l'impact de l'épidémie. Ainsi, cette thèse a pour but de préciser les différences dans les tendances concernant la mortalité par surdose de drogue et aux conséquences de l'usage de drogues pour les Noirs non-hispaniques et les Blancs à travers trois catégories métropolitaines: grande métro, petite métro et non-métro.

Objectifs: Le but de cette thèse est de 1) présenter les tendances des taux de mortalité dus à n'importe quelle drogue et les taux de mortalité liée aux opioïdes entre 2003-2018; 2) mettre en lumière les différences en terme de changement par rapport aux décès reliés à la drogue avant et après l'apogée de l'épidémie en 2015; 3) définir les tendances temporelles dans l'usage de drogues illicites et dans l'abus d'analgésiques sous ordonnance entre 2003-2018; et 4) décrire les tendances par rapport à l'accès aux drogues ainsi qu'à ses sources, chez les Noirs et les Blancs, basé sur leur statut métro.

Méthodes: Les données sur la mortalité due à la drogue proviennent de la base de données des Centres de prévention et de contrôle des maladies. Les données sur l'usage de drogues ont été obtenues à travers l'Enquête nationale sur l'usage de drogues et la santé.

Résultats: Chez les Noirs, les taux de mortalités liées aux drogues entre 2003 et 2018 étaient constamment plus élevés dans les petites et dans les larges régions métro; ces disparités par statut métro n'ont pas émergé chez les Blancs avant 2011. En 2018, les morts associées aux opioïdes continuaient d'augmenter pour les Noirs des grandes et petites régions métro; pour les Noirs des régions non-métro et pour les Blancs, le taux de mortalité était à la baisse. En comparaison aux tendances de mortalité liée à la drogue, celles rapportées sur l'usage de drogues varient peu entre 2003 et 2018. En dépit de taux de mortalité similaires avant 2011, les différences entre les régions métro dans l'usage de drogues illicites et dans l'abus d'analgésiques sur ordonnances chez les Blancs étaient apparentes durant toute cette période. Parmi les Noirs, l'usage de drogues illicites étaient toujours plus élevé dans les grandes et petites régions métro. Cependant, il n'y avait pas de différences par rapport aux régions métro dans l'abus d'analgésiques sous ordonnance. Même si les taux d'usage de drogues sont généralement plus faible, les Noirs de toutes les catégories métro étaient plus enclins que les Blancs à être approché par une personne vendant de la drogue. Cette éventualité était d'autant plus probable pour les Noirs dans les petites et grandes régions métro.

Conclusions: Contrairement à la croyance populaire, depuis les années passées, le problème de surdoses d'opioïdes empire chez les Noirs vivant dans des régions métro petites et grandes, tandis qu'il diminue chez les Blancs. Cela suggère que les récentes interventions ont ignoré une

sous-section vulnérable de la population. De plus, les efforts pour se pencher sur l'usage de drogues et ses conséquences chez les Noirs ne devraient pas se limiter aux grandes régions urbaines. Chez les Noirs des régions rurales, le taux de mortalité liée à la drogue et l'usage de drogues illicites était constamment le plus bas, en dépit des risques plus élevés d'usage de drogues à travers cette population. Des recherches empiriques sont nécessaires pour mieux comprendre ces tendances. Étudier les conséquences de l'usage de drogues par race et catégorie métropolitaine peut non seulement révéler d'importantes différences qui peuvent rester dissimulées si aucune attention n'y est portée, mais permet également de développer des politiques et des interventions plus ciblées et efficaces.

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FRONT MATTER

Contribution of Authors

I am the primary author of this thesis. Dr. Shelley Clark and Dr. Sam Harper provided inputs and revisions throughout this thesis and were instrumental in conceptualizing the research plan and focus.

Definitions

The following terms are used frequently throughout this thesis[1]:

All-drug mortality: unintentional overdose mortality from all kinds of drugs
Opioid-related mortality: overdose mortality from all opioids (prescription, illicit, synthetic)
Drug-related mortality: both all-drug mortality and opioid-related mortality
Illicit drug use: use of any illicit drug (e.g. marijuana, cocaine, heroin, sedatives etc.)
Opioid misuse: use of an opioid without a prescription or just for the feeling caused
Prescription pain reliever misuse: use of a prescription opioid in a way that was not directed by the doctor, or just for the feeling caused
Lifetime drug use: any experience using the drug in the lifetime
Past-year drug use: any experience using the the drug in the past-year

List of Abbreviations

The following abbreviations are used throughout this thesis:

US – United States
Whites – Non-Hispanic Whites
Blacks – Non-Hispanic Blacks/African Americans
Nonmetro – Non-metropolitan area
Small metro – Small-metropolitan area
Large metro – Large-metropolitan area
RUCC – Rural Urban Continuum Code
NCHS – National Center for Health Statistics
NSDUH – National Survey for Drug Use and Health
CDC – Center for Disease Control
AAPC – Average Annual Percent Change
CI – Confidence Interval

[1] These terms are defined in detail in the Methods section of this thesis. They are briefly defined here for context.

INTRODUCTION

Rationale

Drug abuse in the United States (US) is multifaceted, with complex political, geographic, historic, and contextual factors at play. As such, research on drug use and drug overdose epidemics must consider the interplay of these factors. The current opioid overdose epidemic is no different. On one hand, the traditional discourse on this epidemic shone an important light on the often overlooked rural/urban dynamic that exists in the US, as it is largely understood to have its origins in rural America (Peters et al. 2019; Paulozzi and Xi 2008; S. M. Monnat and Rigg 2016; M. J. Alexander, Kiang, and Barbieri 2018). However, as the epidemic transitioned from a prescription opioid crisis (late 1990s to 2010s) into an illicit and synthetic opioid epidemic (late 2010s to present), it became increasingly widespread and its effects were seen across the country (Peters et al. 2019). This transition into the 'second phase' of the opioid epidemic drove overdose death rates to record heights in recent years, becoming the worst drug overdose epidemic in US history. Consequently, the traditional view of this epidemic as a predominantly rural, White, prescription drug problem, became quickly outdated, and was no longer representative of the entirety of this crisis (NIMHD 2019).

This traditional view of the opioid epidemic has several limitations: first, it views rural/urban status as a dichotomy, when it is in fact a ranging continuum; second, it views rural America as a monolith, and does not consider the important regional and racial variations which exist and directly impact drug use outcomes (S. Monnat 2019). In reality, rural counties vary in demographic composition, but the experiences of rural minorities are largely overlooked (Probst et al. 2004; C. V. James et al. 2017; Burton et al. 2013; Caldwell et al. 2016; D. T. Lichter 2012). These variations are also reflected in the disparities observed in drug mortality and drug use rates amongst different racial/ethnic groups within rural areas (Rigg, Monnat, and Chavez 2018; Keyes et al. 2014; S. Monnat 2019; Van Gundy 2006; NIMHD 2019). Rural minorities, particularly non-Hispanic Blacks, are considered to be "doubly jeopardized", being both racial and geographic minorities (Jensen 2019). In general, they have lower median incomes, higher poverty rates, and worse health outcomes than rural non-Hispanic Whites and urban Blacks, all of which are characteristics understood to be risk factors for drug use (Jensen 1994; 2019; C. V. James et al. 2017; Burton et al. 2013; Snipp 1996). Surprisingly, however, there is some data to indicate the opposite. It has been reported that rural Blacks had the lowest opioid-related mortality in recent years, and that rural Black adolescents had the lowest self-reported drug use (Rigg, Monnat, and Chavez 2018; Van Gundy 2006). These findings, which have been described as an "epidemiologic anomaly", have not been well characterized (Keyes et al. 2014). That is to say, it is unclear whether these findings represent longstanding trends in drug use and mortality among rural Blacks, and how these patterns fit into the larger context of the more recent opioid crisis. In addition, these findings consider a binary view of rural/urban status and may not be entirely representative of the drug use outcomes of Blacks along the rural/urban continuum.

In the traditional narrative of the opioid crisis, many researchers explained that Blacks were "perversely shielded" from the opioid epidemic, due to systemic barriers in access to prescription opioids (K. James and Jordan 2018; Friedman et al. 2019). However, when the opioid epidemic shifted to its second stage beginning in 2010, which was characterized by the

widespread availability and consumption of cheaper, more accessible, and ultimately deadlier illicit and synthetic opioids, opioid-related overdose deaths spiked amongst Blacks as well (Peters et al. 2019; K. James and Jordan 2018). In fact, opioid-related mortality rates among Blacks exceeded those of Whites in several states in 2015 (K. James and Jordan 2018). Evidently, Blacks were no longer shielded from the dangers of the opioid crisis. Despite some reports on the recent development in the opioid epidemic among Blacks, these patterns are not well examined at the rural/urban level. As such, it remains unclear how patterns of drug use and overdose mortality have developed for Blacks based on their metropolitan status – a dimension which played an important role in the origins of the crisis among Whites. Moreover, while some racial patterns in access to and source of drugs (and opioids in particular), such as the barriers in access to prescription opioids for Black Americans, are well documented in the literature, changes to these patterns in the recent years of the opioid epidemic are not well documented. Furthermore, metro-based differences in access to and source of drugs by race are unclear, and it is uncertain whether these patterns may be related to resultant drug use and mortality outcomes.

Contributions to the Literature

To address the aforementioned gaps in the literature, this thesis will examine the trends and patterns in drug overdose mortality and drug use among non-Hispanic Blacks and Whites in the United States, within three categories of metropolitan status: large metropolitan, small metropolitan, and non-metropolitan (hereafter referred to as large metro, small metro, and nonmetro). Examining drug mortality and drug use across a trichotomous categorization of metropolitan status will offer more insight into how outcomes varied for Blacks and Whites along the rural/urban continuum than traditional binary analyses. In order to establish how trends in drug mortality and use varied over time, I will examine data from 2003-2018 (i.e. the main timeframe of the opioid epidemic). First, I will delineate the trends for both 'all-drug' overdose mortality and opioid-only drug overdose mortality. This will demonstrate how opioid-related overdose mortality varied from the general patterns of illicit drug mortality, for Blacks and Whites based on their metropolitan status. Then, I will hone in on the recent trends in drug mortality (i.e. 2015-2018) to understand how patterns of later years compared to the those observed in the earlier years of the epidemic, particularly across specific race and metropolitan subgroups. Next, I will document the trends in both illicit drug use and prescription pain reliever misuse for Blacks and Whites based on their metropolitan status, to determine how these trends related to the observed patterns in drug overdose mortality by race and place, and whether drug use patterns may inform our understanding of variations in drug overdose mortality by race and place. Finally, I will examine how drug accessibility and drug source varied in recent years for Blacks and Whites, based on their metropolitan status, to determine whether these variables may be related to drug mortality and drug use patterns observed.

Research Questions

1) How do trends in opioid-specific and all-drug mortality from 2003-2018, vary between Whites and Blacks based on their metropolitan status?

    a) How different are recent changes (2015-2018) in drug mortality rates between these groups?

2) How do trends in opioid-specific and all illicit drug use from 2003-2018, vary between Whites and Blacks based on their metropolitan status?

3) How do access to drugs and source of drugs vary for Whites and Blacks, based on their metropolitan status?

LITERATURE REVIEW

1. Drug abuse and race in the US: An historic perspective

1.1. An overview of past drug epidemics in the US

Evidence of non-medical use of drugs, as well as measures to curb this type of substance use, can be traced back throughout US history. While substance abuse in the US is endemic, certain time periods have been marked by epidemic levels of use. The past century alone has seen several cycles of different drug epidemics, including the LSD epidemic in the 1960s; the heroin epidemic in the 1960s-1970s; the crack cocaine epidemic in the 1980s-1990s; the methamphetamine epidemic in the 2000s, and most recently, the opioid epidemic (Elaine 1978; Hamid 1992; Hughes et al. 1972; Peters et al. 2019; K. James and Jordan 2018; Pacula and Powell 2018). Certainly, there are distinct features to each of these drug epidemics, beyond just the main drugs implicated. Such differences include the main demographic of users, the outcomes of use including morbidity and mortality rates, the spread of the epidemics, and the underlying sequence of factors which contributed to their proliferation. However, many parallels can be drawn between these epidemics, including their cyclical nature, their progression through similar stages, and the general timespans they cover (Hamid 1992). Additionally, responses to these different epidemics – at the federal, public, and media levels – have historically been racially disparate (Fellner 2009; Netherland and Hansen 2016; Donnelly et al. 2020; Schore, Brown, and Lavin 2003). Specifically, responses aimed to 'curb' drug use have disproportionately negatively impacted Black Americans, resulting in their higher rates of arrest, incarceration, and criminalization (Fellner 2009; Donnelly et al. 2020; Schore, Brown, and Lavin 2003; O'Donnell 2017; K. James and Jordan 2018).

1.2. Similarities and differences in drug use patterns among Whites and Blacks

The racially disparate approaches to addressing substance abuse in the US are not reflective of different rates of use by race. In actuality, rates of illicit drug use have consistently been comparable between Whites and Blacks (K. James and Jordan 2018; Nicholson and Ford 2018), and changes in patterns of drug use by race are often attributable to the same exogenous factors. For example, military conflict often resulted in increased rates of illicit drug use. Both World War 2 and the Vietnam War saw marked increases in rates of marijuana, heroin, amphetamine, and barbiturate use among both young Whites and Blacks, and resultant 'poly-drug epidemics' were documented (Elaine 1978; Hughes et al. 1972; National Institute on Drug Abuse 2003). Additionally, regional and contextual differences – including drug supply factors,

drug availability, and socioeconomic distress – have direct impacts on drug use outcomes irrespective of race (S. Monnat 2019). Nevertheless, it is true that there are some general differences in patterns of drug use by race. For instance, there are differences between Blacks and Whites in drug-dealing behaviours, which may be reflective of differences in sources of drugs or in perceived ease of access to drugs. As well, some differences in the types of drugs most frequently used within each racial group have been documented. These differences became particularly apparent in the context of the opioid crisis, which highlighted the significant barriers in access to prescription opioids facing Black Americans (Friedman et al. 2019; Tamayo-Sarver et al. 2003; Schore, Brown, and Lavin 2003). These details are explained in detail later in the literature review (section 2.3); the next section focuses on racial differences in drug sources and accessing behaviours more generally, outside of the context of the opioid epidemic.

1.2.1. Drug type, source, and accessing behaviours among Whites and Blacks

Drug dealing occurs among all racial and ethnic groups and across socioeconomic classes. However, 'publicly visible' drug-dealing happens mostly in socially and economically deprived Black communities (Floyd and Brown 2013; Murji 2007). Blacks, particularly those in economically disadvantaged urban communities, are more likely to witness drug activity in their neighbourhoods and to be involved in street-level retail drug markets (Floyd and Brown 2013; Murji 2007). In contrast, drug-dealing among Whites is more covert; Whites tend to obtain their drugs from individuals within their own racial group, and more specifically, from friends and networks of kin in indoor settings (Floyd and Brown 2013; K. James and Jordan 2018; Crawford 2016; Jewell 2012; Singer 2017). Still, the clandestine nature of drug dealing among Whites does not imply its lower prevalence. In fact, Fairlie (2002) found that in the 1980s, at the height of the War on Drugs which led to the mass incarceration of Blacks for drug-related offences, Whites were 45% more likely to sell drugs than Blacks. Thus, it appears that while there may be differences in drug-dealing behaviours between Blacks and Whites, this may not be related to levels of drug-dealing or perceptions of drug availability. Furthermore, while it is true that Whites and Blacks tend to differ in the types of illicit drugs that they most frequently use, these differences are not known to be related to the lethality or dangerousness of the drugs (K. James and Jordan 2018). Problematically, however, the rhetoric around the differences in the types of drugs used by each racial group has often been exaggerated to imply more sinister implications. A striking example of this occurred in the crack-cocaine epidemic of the 1980s, the era which arguably served as the height of the racial disparity in treatment of substance abuse by race.

1.3. Responses to drug epidemics are racially disparate

Prior to the 1980s, the US government had already began a concerted legislative effort aimed to reduce the use and distribution of illicit drugs (The Global Comission on Drug Policy 2011; Fellner 2009). In 1971, President Richard Nixon publicly declared a "War on Drugs" (The American Presidency Project n.d.). Later, The Rockefeller Laws (1973) were passed in New York in response to the heroin epidemic of the 1960s, mandating severe minimum sentences for drug-related offences (K. James and Jordan 2018). While outwardly this legislation was stated to be targeting drug "kingpins", the result was that the majority of those incarcerated were first-time, low-level offenders – and disproportionately Black (K. James and Jordan 2018). This racial disparity in punishment over drug-related offences became exacerbated in the 1980s, during the

crack cocaine epidemic. In 1981, crack – a freebase, smokable version of powder cocaine – was developed and its consumption and distribution quickly grew in popularity (Hamid 1992). Crack's popularity was due in large part to its low cost but near-identical purity to powder cocaine, which was limited to exclusive and affluent circles (Hamid 1992). Importantly, crack cocaine use was more prevalent among Blacks, while powder cocaine use was more prevalent among Whites (K. James and Jordan 2018; M. J. Alexander, Kiang, and Barbieri 2018).

In response to the growing rates of crack cocaine use in this decade, more severe drug laws were instituted which instilled significantly harsher sentences for crack cocaine use and distribution in comparison to powder cocaine – despite their nearly identical pharmacological nature (K. James and Jordan 2018; Fellner 2009). Famously, the Anti-Drug Abuse Act of 1986 mandated a 100:1 disparity in sentencing disparity for crack cocaine relative to powder cocaine (K. James and Jordan 2018; Fellner 2009). Lawmakers falsely justified these disparities by claiming that crack was more addictive and caused violence in its users, in comparison to powder cocaine (K. James and Jordan 2018; Hamid 1992). Resultantly, the rates of arrest and incarceration of Blacks for drug-related offences became strikingly higher than that of Whites, and until today, Blacks continue to be disproportionately policed, arrested, and overrepresented in the prison population, particularly for drug-related offences (Rosenberg, Groves, and Blankenship 2017; Donnelly et al. 2020; K. James and Jordan 2018; Fellner 2009). Overall, this decade consolidated an era of racially disparate criminalization of drug use and drug enforcement for Blacks in comparison to Whites, which would be further propagated by media representations, and ultimately shape the approach and outcomes of future drug epidemics in the US.

The discourse surrounding the most recent drug epidemic in the US, the opioid epidemic, distinctly highlighted the differential approach to substance abuse by race. This was especially evident in the media's divergent representation of the opioid crisis, which played a large role in shaping the discourse and resultant political strategies implemented to address it. Before the opioid epidemic, drug users and addicts were portrayed as ethnic minorities in urban 'inner cities', and drug abuse among Blacks in particular was depicted as criminal and dangerous (Netherland and Hansen 2016; K. James and Jordan 2018). This racial coding helped to justify the federal response of criminal intervention and increased policing in urban areas, by creating a culture of fear and urgency around the dangers of these 'criminal' drug users. In stark contrast, the opioid epidemic ushered the portrayal of a "new face of addiction" – that of rural and suburban White drug users, who were the first main demographic affected by the crisis (Netherland and Hansen 2016; K. James and Jordan 2018). Resultantly, media representations of opioid users were sympathetic and expressed a "blameless etiology" of opioid addiction and abuse (Netherland and Hansen 2016; K. James and Jordan 2018). Undoubtedly, this served to frame the opioid epidemic as a public health crisis, which necessitated social and public health policies centered on treatment and help, rather than arrest and incarceration (Netherland and Hansen 2016; K. James and Jordan 2018). However, despite the clear shift towards a public health framework in the national response to the opioid epidemic, minorities – particularly Blacks – remained marginalized (K. James and Jordan 2018; Donnelly et al. 2020; Netherland and Hansen 2016). To better understand the role of race in the context of the opioid crisis, the next section will detail its origins and developmental cycle.

2. The current opioid epidemic in the US

2.1. Origins of the opioid crisis

The modern day opioid epidemic marks the most recent, as well as the largest, drug overdose epidemic in US history (K. James and Jordan 2018; NIMHD 2019). Between 1999 to 2018, nearly 450,000 people died from an opioid-related drug overdose (CDC 2020b). During this decade, opioid-related drugs became the leading cause of drug overdose deaths, and in 2017, the opioid epidemic was declared a national emergency (NIMHD 2019). The origins of this epidemic are widely understood to be due to opioid supply factors, which ultimately caused widespread prescribing and availability of opioid analgesics (S. Monnat 2019; Pacula and Powell 2018; Paulozzi and Xi 2008). This was sparked by a growing collaborative effort in the late 1990s to push for improved treatment of pain, which was advocated for first by individuals and then by medical and patient associations, some of whom were financially backed by pharmaceutical stakeholders (Pacula and Powell 2018; S. Monnat 2019; Keyes et al. 2014). One particular pharmaceutical company, Purdue Pharma, capitalized off of this growing demand, and would become an important and culpable player in the development of the opioid crisis. In 1996, Purdue introduced a controlled-release oxycodone called Oxycontin, and began an aggressive and unprecedented marketing campaign for the use of this opioid in the treatment of chronic non-cancer pain (Van Zee 2009; Pacula and Powell 2018). Purdue marketed Oxycontin directly to health care professionals across the country at all-expenses-paid conferences, and specifically targeted physicians known to be high-prescribers of opioids (Van Zee 2009). Importantly, Purdue focused their marketing campaigns in areas where manual labor jobs, disability, and chronic pain were high – specifically, in economically deprived vulnerable areas in rural Appalachia (S. Monnat 2019; Van Zee 2009; DeWeerdt 2019). Indeed, opioid prescribing in many rural counties in this region was five to seven times higher than the national average (S. Monnat 2019; Van Zee 2009). At the same time, the movement advocating for improved treatment of pain continued to grow. As a result, pain treatment branched beyond the realm of specialized care to that of primary care, contributing to even higher rates of opioid prescribing from non-traditional venues, and high-prescribing clinics known as ‘pill-mills’ proliferated (S. Monnat 2019). Additionally, federal financial incentives were offered to hospitals and clinicians for good performance in pain management – which was measured through volume of prescribing, rather than its appropriateness (Pacula and Powell 2018). As these supply factors magnified, they were met with increased demand for prescription opioids, which was heightened by the increased health care coverage for opioid analgesics as well as their lowering costs (Pacula and Powell 2018).

Certainly, Purdue’s marketing and promotional efforts were extremely effective, as they accrued more than three billion dollars in sales from Oxycontin between 1996 to 2002, and rates of oxycodone and medical morphine distribution saw unprecedented increases (Van Zee 2009; Pacula and Powell 2018). However, this financial success would soon be eclipsed by the rising rates of prescription opioid abuse and addiction, which were in large part attributable to Purdue’s own actions. It would come to be known that Purdue was intentionally misleading about the true risk of addiction to Oxycontin (Van Zee 2009; DeWeerdt 2019). Publicly, Purdue asserted that the risk of addiction to Oxycontin was less than one percent; however, these claims were not reflective of risk from daily and prolonged use, which was how Oxycontin was typically

marketed (Van Zee 2009). Furthermore, while Oxycontin was developed as a 'controlled-release' opioid, many users quickly discovered that crushing the tablet before consumption would allow for an immediate, potent, and intense high – a fact that Purdue already knew from their own testing in 1995 (Van Zee 2009; Pacula and Powell 2018; DeWeerdt 2019). The impacts of this lack of transparency about the true risk of addiction from Oxycontin were exacerbated by the reality that many medical professionals already lacked training on strategies to minimize risk of opioid addiction (Pacula and Powell 2018; Paulozzi and Xi 2008; DeWeerdt 2019). Thus, areas with high availability of Oxycontin and other prescription opioids, such as rural counties in Maine, West Virginia, Kentucky, and Alabama, saw sharp increases in rates of opioid abuse, addiction, treatment seeking, diversion, and overdose deaths (Rigg, Monnat, and Chavez 2018; Paulozzi and Xi 2008; S. Monnat 2019; Keyes et al. 2014; Van Zee 2009). These effects were first noticed between 1999 to 2004, but continued well into the next decade (Pacula and Powell 2018; Van Zee 2009; Paulozzi and Xi 2008).

2.2. Transitions in the opioid crisis

As the prescription opioid crisis worsened, reflected by the rising rates of opioid abuse and opioid-related overdose deaths, various supply-side interventions were introduced with the goal of reducing opioid prescribing (Pacula and Powell 2018). Facing particular pressure and scrutiny, in 2010, Purdue Pharma reformulated Oxycontin to make it more difficult to crush and ingest (Pacula and Powell 2018; S. Monnat 2019). Beyond this, important federal supply-side interventions were implemented, including the enforced closure of many known pill mills, and the creation of prescription drug monitoring programs to oversee prescribing behaviours (Pacula and Powell 2018; S. Monnat 2019). These interventions were undoubtedly effective in reducing the supply and widespread availability of prescription opioids, making them much more difficult to obtain. However, they did not account for the remaining pervasive demand for prescription opioids by the many dependent users. Rather, a gap in the supply market was created, which would be capitalized on by illicit drug distributors and black markets (S. Monnat 2019; Pacula and Powell 2018). Specifically, heroin and synthetic opioids would fill the gap in the demand for prescription opioids, resulting in a 'substitution effect' (Pacula and Powell 2018; Hernandez et al. 2020; M. J. Alexander, Kiang, and Barbieri 2018; Rigg, Monnat, and Chavez 2018). Out of necessity, addicts and dependent users substituted prescription opioid for illicit opioids in order to satiate their needs. However, many of these individuals were first-time users of illicit 'hard' drugs, and this unfamiliarity resulted in more drug-related complications including poisonings and overdoses (Pacula and Powell 2018). This was especially true in the case of fentanyl, a powerful synthetic opioid which was often used to lace other narcotic drugs, due to its low cost and high potency in small quantity (S. Monnat 2019; K. James and Jordan 2018). As the availability of heroin, fentanyl, and other illicit opioids spread, opioid-related overdose rates increased even more drastically. Between 2010 and 2015, drug overdoses from heroin quadrupled, and illicit and synthetic opioids replaced prescription opioids as the leading causes of opioid-related deaths (Pacula and Powell 2018; K. James and Jordan 2018). This transition from prescription opioids to illicit and synthetic opioids, which began in 2010, marked the second phase of the opioid epidemic (Pacula and Powell 2018). Since 2014, synthetic and multiple-opioid mixtures became more prevalent in many regions than even heroin (Peters et al. 2019). Overall, there has been great geographic variation in the main type of opioid implicated. Peters et al. (2019) divided counties' specific opioid epidemics into three different categories –

prescription; synthetic and prescription mixed; and opioid syndemic – and outlined how variations in counties' region, rural/urban status, socioeconomic status, and demographic factors, are associated with the differences observed in the layered opioid crisis. Particularly, both rural/urban status and race have been important indicators in the context of the opioid epidemic.

2.3. Geographic and racial disparities in the opioid crisis

The earliest research and reporting on the growing prescription opioid crisis drew attention to a distinctive aspect of this drug epidemic – its proliferation in rural areas, which were not stereotypically associated with problems of drug abuse and overdose (Paulozzi and Xi 2008; Netherland and Hansen 2016). In fact, the epidemic was once considered to be disproportionately rural. Paulozzi et al. (2008) reported that between 1999 to 2004, drug overdose mortality rates from opioid analgesics increased 371% in nonmetropolitan noncore counties, compared to 52% in large central metro counties. The disproportionately higher rates of increase in rural or nonmetropolitan counties helped build the 'rural' narrative of the opioid epidemic (Paulozzi and Xi 2008; Keyes et al. 2014). These rural counties were considered to be "left behind"; they were economically depressed as their industrial economies declined, and they tended to be remote, have an older population, and to be predominantly White (Peters et al. 2019; Lenardson, Gale, and Ziller 2016). In these areas, economic distress predicted drug mortality deaths, which were characterized as "deaths of despair" (Peters et al. 2019; Rigg, Monnat, and Chavez 2018; S. Monnat 2019). Furthermore, since drug abuse and drug epidemics were typically considered to be urban problems, the geographic and demographic distinction of this epidemic was especially emphasized. Specifically, the shocking and rapid rise of overdose deaths among White, middle-class, female, suburban and rural users – a 'non-traditional' demographic – became a persistent focal point in the discourse on the epidemic (K. James and Jordan 2018; Netherland and Hansen 2016). However, it would become clear that this 'rural' label was not entirely accurate, as there was great regional heterogeneity in rates of opioid addiction and overdose deaths (Rigg, Monnat, and Chavez 2018; K. James and Jordan 2018). While rates of opioid-related overdose deaths and hospital visits were especially high in many rural states in Appalachia, rates were among the lowest in rural areas of other states in the Delta South, and in Iowa and Nebraska (Rigg, Monnat, and Chavez 2018). Moreover, later research would clarify that the opioid epidemic was not conclusively worse in rural areas than urban areas. Some studies reported higher or comparable rates of opioid-use disorders, treatment seeking and hospital visits, and overdose deaths in urban areas (Rigg, Monnat, and Chavez 2018; Rigg and Monnat 2015). Notwithstanding these inconsistencies, the rural, White characterization of the epidemic would linger, despite becoming increasingly discordant with the developing changes of the epidemic.

As the epidemic transitioned into its second phase beginning in 2010 (illicit and synthetic opioid phase), opioid-related treatment seeking and overdose death rates in urban areas exceeded rates in rural areas (Mack, Jones, and Ballesteros 2017; Peters et al. 2019; Mosher et al. 2017). Indeed, counties experiencing illicit, synthetic, and mixed opioid epidemics were larger and more urban (Peters et al. 2019). The higher rates of illicit and synthetic opioid-related abuse and overdose deaths in urban areas were due to the greater availability of illicit opioid drug markets (e.g. heroin, fentanyl) in large metropolitan and micropolitan cities (Peters et al. 2019; Rigg, Monnat, and Chavez 2018; S. Monnat 2019). Monnat (2019) explains that in urban counties,

opioid supply factors better predicted drug mortality rates. These urban counties fit the characteristics familiar to previous drug epidemics; they were more densely populated, connected to infrastructure and transportation (and thus drug networks), and more racially diverse (Peters et al. 2019; Galea, Rudenstine, and Vlahov 2005). Though many rural counties, and thus rural opioid users, did transition to using heroin and other illicit and synthetic opioids in place of prescription opioids, this uptake was more heavily concentrated in urban areas (Kuehn 2014; Mack, Jones, and Ballesteros 2017; Peters et al. 2019; Rigg, Monnat, and Chavez 2018). Notably, in this second phase of the opioid epidemic, opioid-related mortality rates began to increase among Blacks in a manner which was not previously seen (K. James and Jordan 2018; Om 2018; Mosley and Hagan 2020; M. Alexander, Barbieri, and Kiang 2017; M. J. Alexander, Kiang, and Barbieri 2018).

James and Jordan (2018) described the opioid crisis in black communities, and explained that opioid-related overdose deaths among Blacks more than doubled since 2000; however, they received little to no media attention (Shiels et al. 2018; Netherland and Hansen 2016). Alarmingly, in 2015, rates of opioid-related mortality among Blacks actually exceeded rates among any other racial group in the states of West Virginia, Wisconsin, Missouri, Illinois, and Minnesota (K. James and Jordan 2018). The sudden increase in opioid-related overdose deaths among Blacks occurred during the second phase of the opioid epidemic, the illicit and synthetic opioid phase, and thus was largely driven by heroin and fentanyl-laced narcotic drugs (M. Alexander, Barbieri, and Kiang 2017; K. James and Jordan 2018). However, the increase in rates of opioid abuse and overdose deaths among Blacks did not fit the traditionally White narrative of the opioid epidemic. While this narrative was partly due to misconceptions about the racial composition of rural areas where it first proliferated, it was also furthered by another prominent reasoning. That is, that Blacks were "perversely shielded" from the opioid epidemic, due to systemic barriers in accessing prescription opioids driven by racial bias (K. James and Jordan 2018; Friedman et al. 2019; Mosley and Hagan 2020).

There has been extensive research documenting the disparate undertreatment of pain received by Black Americans in comparison to their White counterparts (Hoffman et al. 2016; Bateman and Carvalho 2019; Gaither et al. 2018; Friedman et al. 2019; Om 2018; Mosley and Hagan 2020). Many medical professionals hold false beliefs about biological differences between Blacks and Whites, including misconceptions about Black people having higher pain tolerances, or misrepresenting their own pain; often, these beliefs are implicit biases which have been cemented by a scholarly history perpetuating 'fundamental' biological differences between Whites and Blacks (Hoffman et al. 2016; Om 2018). Materially, this has resulted in documented disparities in pain treatment for Black Americans. These disparities include the lower likelihood to be prescribed appropriate pain medications; higher likelihood to be discontinued from long-term opioid therapies; less accurate postpartum pain assessment and management; and lower availability of prescription opioids in pharmacies in minority communities (Hoffman et al. 2016; Om 2018; Gaither et al. 2018; Bateman and Carvalho 2019; Tamayo-Sarver et al. 2003). For these reasons, it was believed that Blacks were not affected by the opioid crisis, particularly during its first prescription opioid phase – because they lacked access to prescription opioid drugs. However, it is unclear whether the early trends in the opioid epidemic applied equally to Blacks living in rural areas, particularly as opioid prescribing proliferated in many rural counties. Generally, most of the research on the opioid epidemic in rural areas focused on the non-

Hispanic White population. Furthermore, as the opioid epidemic transitioned into its second phase, and rates of opioid-related overdose deaths among Black and other racial minority drug users began to rise, they were not afforded the same attention and nuance as their White counterparts. Indeed, few studies have described the experience of Blacks in the opioid crisis, and no study has solely focused on documenting rural/urban differences in these patterns. As mentioned, the rural/urban dynamic of the opioid epidemic was an important indicator of opioid-related abuse and mortality outcomes, and thus the drug-use outcomes of racial minorities along the rural/urban continuum must be better understood. To explore this further, the next section details important rural/urban differences in the US, as well as the experiences of racial minorities in rural areas.

3. Rural/urban differences in the US

3.1. Rural communities 'left behind'

Many of the observed differences in opioid use and opioid-related mortality outcomes between rural and urban areas can be attributed to their differing contextual factors. In particular, the characterization of many rural communities as "left behind" explained why these communities were particularly vulnerable to the emergent prescription opioid epidemic. This description was coined in 1967, from a report on rural poverty commissioned by President Lyndon Johnson, entitled *The People Left Behind* (Institute for Research on Poverty 2020). The report noted that rural poverty rates (25%) doubled urban poverty rates (Institute for Research on Poverty 2020). While rural poverty did sharply decrease in the 1960s, it has remained relatively stable since, and is characteristically persistent (Institute for Research on Poverty 2020; D. T. Lichter and Schafft 2016; Burton et al. 2013). Poverty rates in nonmetropolitan areas continue to exceeded rates in metropolitan areas, and in the late 2000s, over 35 percent of those living in nonmetropolitan areas lived in poor communities (D. T. Lichter and Schafft 2016; Weber et al. 2005; Institute for Research on Poverty 2020). In addition, rural poverty is highly spatially concentrated, specifically in Appalachia, the Southern Black Belt, the Mississippi Delta, the Rio Grande Valley, and Native American reservations in the Southwest and Great Plains – many of which have high concentrations of racial minorities (D. T. Lichter and Schafft 2016; Ziliak 2012; Weber et al. 2005; Burton et al. 2013).

The persistence of rural poverty in these regions is maintained by demographic processes and intergenerational patterns of poverty (D. T. Lichter and Schafft 2016). These demographic processes include the selective outmigration of young, highly skilled and educated individuals to urban areas in search for better opportunities, due to the restructuring of the economy concentrating high paying jobs in urban cores (a phenomenon termed 'brain drain') (D. T. Lichter and Schafft 2016; Carr and Kefalas 2009; Albrecht and Albrecht 2000). Similarly, difficulties in attracting individuals to rural areas due to the lack of job opportunities have allowed for poverty to persist in these areas (D. T. Lichter and Schafft 2016). As a result, these rural areas have been characterized by economic disadvantage and decline. In turn, this economic disadvantage contributes to collective feelings of frustration and hopelessness; anxiety and stress; community disinvestment; infrastructural decay; family instability; poor health; crime; and substance use (Burton et al. 2013; D. T. Lichter and Schafft 2016; Lenardson, Gale, and Ziller 2016; Brown and Swanson 2004). Indeed, research has demonstrated that these

characteristics act as risk factors for opioid misuse, as well as opioid-related overdose mortality, among rural residents (Lenardson, Gale, and Ziller 2016; Rigg, Monnat, and Chavez 2018; S. Monnat 2019).

In addition, a distinctive characteristic of rural areas helped to propagate the spread of opioid analgesics. That is, the tighter kinship and social networks in rural areas, which allowed for faster diffusion of prescription opioid misuse (Keyes et al. 2014). To an extent, increased social capital in rural areas has been shown to act as a buffer against substance use. For instance, the greater presence of multigenerational family structures which allow for greater contact, connection, and opportunities for intervention (Dew, Elifson, and Dozier 2007). As well, higher involvement and perceived importance of organized religion (e.g. churches), as well as greater school involvement (e.g. sports, extracurricular activities), have been shown to create social linkages which contribute to resiliency against drug use among rural adults and adolescents (Dew, Elifson, and Dozier 2007; Gibbons et al. 2007; S. M. Monnat and Rigg 2016; Rigg, Monnat, and Chavez 2018). However, other consequences of increased social capital have facilitated the development of the opioid epidemic in these areas. Research has shown that much of the spread of prescription opioids was through diverted prescriptions, often from parents, relatives, or peers (Keyes et al. 2014; S. M. Monnat and Rigg 2016). The tighter kinship networks in rural areas allow for increased access to prescription opioid drugs, as well as avenues for initiation for new users, through peer pressure or curiosity. Moreover, the sharing and trading of prescription opioids can serve to increase individuals' own social capital, as they can be used as a sort of currency (Rigg, Monnat, and Chavez 2018). Conversely, tighter social ties within rural communities can also increase stigma surrounding treatment-seeking for drug abuse (Rigg, Monnat, and Chavez 2018; Anderson and Reinsmith-Jones 2017; Dew, Elifson, and Dozier 2007; Keyes et al. 2014). Unable to maintain anonymity in communities where most people are familiar with each other, rural drug users may avoid seeking help for their addiction out of fear or shame, increasing the risk for adverse outcomes (Rigg, Monnat, and Chavez 2018; Anderson and Reinsmith-Jones 2017; Dew, Elifson, and Dozier 2007; Keyes et al. 2014).

The dangers of increased rates of opioid misuse in these persistently poor rural areas, are exacerbated by the limited infrastructure and capacity to handle the crisis (Anderson and Reinsmith-Jones 2017; Rigg, Monnat, and Chavez 2018). Many of these rural areas lack adequate drug treatment programs and providers, detoxification programs, medication-assisted treatments (ex. methadone), harm reduction programs, and primary and emergency health care services (Rigg, Monnat, and Chavez 2018; Faul et al. 2015; Borders and Booth 2007). In many instances, rural patients experiencing drug poisonings had to be transported to urban methadone clinics, which is costly and often impossible (Rigg, Monnat, and Chavez 2018). Indeed, many of the regions where the opioid epidemic proliferated were considerably remote, and thus had limited care options for drug users experiencing overdose, ultimately resulting in many more overdose deaths. Overall, these socioeconomic, infrastructural, and contextual factors of the rural environment where the opioid epidemic proliferated contributed to the rise and spread of adverse opioid misuse outcomes, and opioid-related overdose deaths.

3.2. Characteristics of the urban environment

Generally, it is less difficult to associate characteristics of the urban environment with drug use, since it has traditionally been conceptualized as an urban problem (Galea, Rudenstine, and Vlahov 2005). In reality, though, illicit substance use and drug addiction occur in both rural and urban areas, and often at the same rates (Galea, Rudenstine, and Vlahov 2005; Wang, Becker, and Fiellin 2013). Indeed, as aforementioned, even studies on the differences in prevalence of prescription opioid misuse between urban and rural areas have shown comparable prevalence rates (Rigg, Monnat, and Chavez 2018). Additionally, individual's motivations for drug use in rural and urban areas are often similar. For instance, psychological distress, economic distress, and use of other drugs all predict a higher likelihood to misuse opioids in both rural and urban areas (Wang, Becker, and Fiellin 2013; S. M. Monnat and Rigg 2016). Galea et al. (2005) described in detail characteristics of the urban environment which are associated with increased risk for drug use and misuse, these include: area-level disadvantage and deprivation; poor physical and mental health; reduced access to health care in economically deprived urban areas; and increased psychosocial stress. Many of these characteristics contribute to socioeconomic distress, which as demonstrated, was a defining feature of the 'left behind' rural areas where the opioid epidemic burgeoned. That being said, a distinctive aspect of the urban environment which contributes to higher drug use and abuse rates is the increased drug supply networks in urban areas (S. Monnat 2019). The higher presence of illicit drug distribution networks in large urban cores explains why many drug epidemics have been heavily concentrated in urban areas, and indeed why the second phase of the opioid epidemic (illicit and synthetic opioid phase) worsened more severely in these areas. In addition to this, another feature commonly attributed to urban drug epidemics is their overrepresentation of racial minorities. Urban drug epidemics are stereotypically ascribed to "ghettos" and the "inner cities" – often regions where racial minorities are more heavily concentrated (Netherland and Hansen 2016; K. James and Jordan 2018). Moreover, drug use among racial minorities is often viewed through this narrow lens; that is, being centered in the inner cities of large urban areas, and as previously discussed, being associated with criminality and delinquency (Netherland and Hansen 2016; K. James and Jordan 2018; Donnelly et al. 2020; Fellner 2009). Indeed, much of the research on drug use outcomes among racial minorities lacks nuance, particularly an analysis of rural/urban differences. In fact, rural racial minorities are characteristically overlooked in research, which is especially problematic given that they are widely considered to be doubly disadvantaged due to their geographic and racial minority status (Snipp 1996; Jensen 2019; Probst et al. 2004). To better understand common characteristics of rural racial minorities, the next section details their geographic spread, acknowledgement in extant research, and their general socioeconomic and health outcomes.

4. Geographic and racial minorities in the US

4.1. Rural minorities are spatially clustered and largely overlooked

Despite misconceptions about the racial homogeneity of rural America, there are in fact sizeable communities of rural racial minorities throughout the US (Snipp 1996; Rigg, Monnat, and Chavez 2018; Jensen 2019). Moreover, a growing body of research has documented the upward trend in ethno-racial diversity in rural America, which continues to grow today (Burton et al. 2013; Sharp and Lee 2017; D. T. Lichter 2012; C. V. James et al. 2017). Still, in comparison to urban areas, rural areas are less racially diverse, and racial minorities in rural

areas tend to be spatially concentrated. Rural Hispanics are clustered in *colonias* in the South and West, as more than half live in Texas, New Mexico, California, Arizona, and Colorado; rural American Indians/Alaska Natives are clustered in *reservations*, and more than half live in the 5 states of Oklahoma, Arizona, New Mexico, Alaska, and North Carolina; and rural Blacks are clustered in the region known as the Black Belt, and 75% of rural Blacks live in the states of Mississippi, Georgia, North Carolina, South Carolina, Alabama, Louisiana, and Texas (Snipp 1996; C. V. James et al. 2017; Burton et al. 2013; D. Lichter and Johnson 2007; D. T. Lichter 2012). Outside of these areas, the remainder of rural counties are largely White (Probst et al. 2004; C. V. James et al. 2017). As a result, 'rural' is often wrongly equated to 'White' (Rigg, Monnat, and Chavez 2018), and the experiences of rural racial minorities are largely overlooked (Snipp 1996; Jensen 2019). Indeed, rural racial minorities are a particularly understudied and underserved group, and aggregate statistics on rural areas often reflect outcomes among the non-Hispanic White population, which are rarely equally representative (Probst et al. 2004; D. T. Lichter 2012; C. V. James et al. 2017; Burton et al. 2013). Even in the context of the opioid epidemic, which placed an important emphasis on rural/urban disparities in the US, the experience of rural racial minorities has not been heavily documented. This pattern of overlooking rural racial minorities is particularly problematic because they constitute a disproportionately disadvantaged group.

4.2. Rural minorities are doubly jeopardized

Extensive research has documented the disadvantages rural communities experience, reflected by worse socioeconomic outcomes, health outcomes, and less access to care. Similarly, it is widely acknowledged that many racial minorities, particularly Black Americans, also face disadvantages and poorer socioeconomic and health outcomes compared to the general population. It is unsurprising, then, that rural racial minorities (and indeed rural Blacks) are doubly disadvantaged across a variety of measures (Caldwell et al. 2016; Jensen 1994; Slack and Jensen 2002; Jensen 2019). Especially, because most rural Blacks live in the South, in the same areas which contain the historic institutions established for their oppression (Snipp 1996). Indeed, research has shown that racial/ethnic minorities in the US earned significantly less income, relied more on public health insurance, were significantly less likely to see a doctor because of the cost, and reported using health-related services significantly less often when compared to their urban counterparts, and to both rural and urban non-Hispanic Whites (Bonnar and McCarthy 2012; Probst et al. 2004; C. V. James et al. 2017). Moreover, rural racial minorities are heavily disadvantaged in educational attainment and job opportunities (Probst et al. 2004; Burton et al. 2013; Jensen 1994; D. Lichter and Johnson 2007; Slack and Jensen 2002). Jensen (1994) explained that the jobs available to rural minorities tend to be in the secondary labor market, where prospects for upward mobility are dim. Furthermore, they are more likely to live in poverty than rural Whites; Dew et al. (2007) wrote that while 12% of nonmetro Whites were below the poverty rate in 2004, the poverty rate for rural Blacks was 29%. Undoubtedly, unemployment and poverty confer many disadvantages, including poorer physical and mental health, less health insurance and access to health care, and increased psychosocial stress – all of which act as significant risk factors for substance abuse in any community (Dew, Elifson, and Dozier 2007; Lenardson, Gale, and Ziller 2016; Brown and Swanson 2004). Yet, of the limited research that exists on substance use patterns and outcomes among rural Blacks, surprising findings have been reported.

4.3. Drug use outcomes among rural Blacks

It has been reported that rural Blacks had the lowest rates of alcohol abuse and binge drinking, drug abuse, and suicide rates, compared to all other racial groups in rural areas (with the exception of rural Asians/Pacific Islanders, who reported similarly low rates of substance abuse) (Gibbons et al. 2007; Van Gundy 2006). These findings are especially consistent among rural Black adolescents (Gibbons et al. 2007; Stanley, Henry, and Swaim 2011; Van Gundy 2006). Furthermore, in the context of the opioid epidemic, some studies have stated that rural Blacks had the lowest opioid-related mortality rates (Rigg, Monnat, and Chavez 2018; Keyes et al. 2014). Notably, the studies which reported these findings have commented on their paradoxical nature, given the disproportionately elevated stressors and risk factors for this subpopulation (Rigg, Monnat, and Chavez 2018; Keyes et al. 2014). For instance, Keyes et al. (2014) described the lower opioid-related mortality rates among rural Blacks as an "epidemiological anomaly". Some researchers have hypothesized about the protective factors that may contribute to greater resilience against substance use among rural racial minorities. Kozhimannil et al. (2018) note that rural Black communities hold cultural, historical, and spiritual significance, and that contextual aspects of these settings may produce culturally protective factors that confer resilience against adverse health behaviours. Indeed, higher religiosity and involvement in organized religion (e.g. churches) are often purported to be buffers for rural Blacks against substance use (K. James and Jordan 2018). Ultimately, though, knowledge on mediating factors between racial and geographic minority status, and substance use and mortality outcomes, is limited. Even the findings on lower rates of opioid-related mortality among rural Blacks are only reflective of limited time periods. That is to say, they do not inform on trends over time in drug use, opioid misuse, or drug-related mortality. Given the evolving nature of the opioid epidemic, and how it has varied across rural, urban, and racial categories, it is important to clearly delineate how these changes have transpired among Blacks in different metropolitan categories.

5. Summary

From the above, it is clear that the dimensions of both race and rural/urban status are complexly related to drug use and drug overdose mortality outcomes. The differing contextual features of rural and urban settings affect drug-related outcomes in distinctive ways. Similarly, drug use patterns vary between different race groups, and there is a historic legacy of differential responses to drug epidemics between Whites and Blacks. To an extent, the onset of the opioid epidemic ushered a change in policy approaches to drug epidemics, shifting from a carceral and punitive agenda to a public health framework, and focusing attention on deprived rural areas which have long been underserved and disadvantaged. While these changes are certainly promising, it appears that they have not yet benefited some of the most traditionally marginalized subgroups. Indeed, research on the experience of racial minorities in the opioid epidemic is somewhat limited, and information on outcomes among rural racial minorities even more so. Given the growing evidence of increasing rates of opioid-related abuse and mortality among Blacks, it is necessary to thoroughly investigate these trends and to delineate changes over time based on metropolitan status among Blacks. Building upon the research presented and discussed in this literature review, this thesis aims to fill some of the remaining knowledge gaps.

METHODS

Drug Overdose Mortality

Data Source

The drug overdose mortality data for the years 2003-2018, referenced in this paper, was obtained from the Centers for Disease Control and Prevention Wide-ranging ONline Data for Epidemiologic Research (CDC WONDER) database. CDC Wonder is an online resource which makes government health data publicly accessible, including providing county-level national mortality and population data. Specifically, the mortality data is based on all filed U.S death certificates of residents in the fifty states and the District of Columbia, and population count data is based on U.S Census Bureau estimates of county, state, and national resident populations. The specific data examined in this paper is Multiple Cause of Death (MCD), wherein the death certificates lists one underlying cause of death identified as having directly led to the death or the sequence of events resulting in death of the individual, and up to twenty additional contributing causes. These causes of death are classified using the International Classification of Disease (ICD) 10th revision coding scheme. The specific cause-of-death codes used in this paper will be detailed in the Variables section. More information on the technical documentation of the mortality data can be found on the CDC WONDER website and associated appendices (CDC Wonder 2020) (https://wonder.cdc.gov/wonder/help/mcd.html).

Variables

In order to examine how all-drug mortality and opioid-related mortality varied by race and place from 2003-2018, the following variables were selected for analysis: cause of death, race, Hispanic origin, urbanization, and year of death. Cause of death represents the main outcome variable of this analysis, and it is divided into death from all-drugs and death from only opioid-related drugs. All-drug mortality encompasses overdose deaths from all drugs, classified by ICD-10 codes X40-X44, which were considered unintentional. That is, it does not include intentional deaths (i.e. suicide, homicide) nor does it include overdose deaths with undetermined intents. The specific list of the drug classes covered by the X40-X44 ICD-10 codes can be found online (WHO 2019). Opioid-related mortality is defined here as drug overdose deaths from any opioid drugs, classified by MCD ICD-10 codes, and include opium (T40.0), heroin (T40.1), other opioids (T40.2), methadone (T40.3), other synthetic narcotics (T40.4), and other and unspecified narcotics (T40.6) (CDC Wonder 2020). Similar to the aggregate definition of all-drug mortality, opioid-related mortality was not broken down by type of opioid, but rather reflected mortality from any kind of opioid.

The primary exposure variables in this thesis are race and metropolitan status. Pursuant to the research objectives of this thesis, analyses were restricted to non-Hispanic Blacks and Whites. The race and ethnicity information of the deceased were reported on the death certificate by the funeral director and provided either by an informant related to the deceased or determined by the funeral director. Population-level race and ethnicity data were obtained from the census, and presented as estimates of population size by race/ethnicity and metropolitan status (CDC Wonder 2020). The metropolitan status of the deceased's resident county was determined using

the urbanization variable and based on the 2013 National Center for Health Statistics (NCHS) Urban-Rural Classification Scheme for Counties. Using CDC WONDER, it was possible to use the 2013 NCHS scheme for the entirety of the study period (2003-2018), which allowed for continuity in this measure. This coding scheme classifies counties into one of six possible categories, based on the population size of the resident county: large central metro, large fringe metro, medium metro, small metro, micropolitan (nonmetro), and noncore (nonmetro), (CDC Wonder 2020; NCHS 2017). For the purposes of this paper, the six categories were collapsed into three: large metro (which combines the large central metro and large fringe metro categories), small metro (which combines medium metro and small metro), and nonmetro (which combines micropolitan and non-metro categories). The large metro category includes all counties in metropolitan statistical areas (MSA) with a population of one million or more; the small metro category includes all counties in MSAs with a population less than one million; and the nonmetro category includes all counties in micropolitan statistical areas as well as all nonmetropolitan counties which were not included in micropolitan statistical areas (NCHS 2017). The definitions of the original six metropolitan categories are listed in Appendix 2. The final variable used for this analysis was year of death, in order to present time trends in drug overdose mortality between 2003-2018.

While the NCHS classifies counties into six possible categories, there are two reasons that necessitated a simplification of these into three aggregate categories. First, this grouping offers more simplicity and generalizability in the data analysis. Second, and perhaps more importantly, this grouping is more comparable to the drug use data analyzed later in this paper, which uses an alternate rural-urban coding scheme The details of their differences and the implications they have on the parameters of this paper will be clearly outlined later in this section.

Data Analysis

To recall, the first objective of this thesis is to present trends between 2003 to 2018 in all-drug mortality and opioid-related mortality for Blacks and Whites based on their metropolitan status, and to highlight how recent patterns in overdose mortality (2015-2018) varied from older patterns (2003-2015). To this extent, the analyses are entirely descriptive in nature, and do not purport to identify causal associations.

All-drug overdose mortality was calculated as the number of unintentional drug overdose deaths within each race and metro subgroup divided by the total population of that race and metro subgroup in each year. Similarly, opioid-related mortality was calculated as the number of opioid-related deaths per race and metro subgroup, divided by the population of that race and metro subgroup in each year. Both all-drug overdose mortality rates and opioid-related mortality rates were calculated and presented for Blacks and Whites in large metro, small metro, and nonmetro areas, for the years 2003-2018. All death rates presented reflect crude death rates and were not adjusted for age or region.

To highlight how recent trends of all-drug and opioid-related overdose mortality (2015-2018) compared to older patterns (2003-2015) for Blacks and Whites based on their metropolitan status, the following measures were calculated for both time periods: absolute difference, percent

change, and the average annual percent change. These two time periods were chosen largely because they reflect the two distinct phases of the opioid crisis, the first being the prescription opioid epidemic phase (2003-2015), and the second being the illicit and synthetic opioid phase (2015-2018). The absolute difference reflects the crude difference in death rates for each race/metro subgroup from the start to end of each time period. The percent change represents the difference in death rates within each time period, relative to the death rate at the start of the time period. The average annual percent change (AAPC) reflects the average of the annual percent change in overdose mortality rates between each successive year in the time period (12 years and 3 years). The AAPC was used as the main unit for analysis for this research objective, because it is a summary measure which allows for a single number to describe the change in trends over multiple years, and accounts for the unequal length of time between the two time periods (National Cancer Institute 2020).

Drug Use

Data Source

The drug use data for the years 2003-2018, referenced in this paper, were obtained from the National Survey for Drug Use and Health (NSDUH), which is an annual and nationally representative survey of the non-institutionalized population in the US, aged 12 and older. The survey implements a 50-state independent multistage area probability sample for each of the 50 states and the District of Columbia (SAMHSA 2020). Target samples are devised based on state population sizes and are thus state specific. In addition, some groups are oversampled to ensure that they are well represented in the survey (e.g. youth and young adults, special-interest metropolitan statistical areas), which can be accounted for using the corresponding sample weights (NSDUH 2017). Details on the specific design components of the survey can be found on the Substance Abuse and Mental Health Services Administration (SAMHSA) website. The specific analytical methods used in this paper are described in the Data Analysis below. Lastly, as this paper makes use of data from 2003 to 2018, it is important to note that there are inevitable differences in each survey year. For example, the specific sample sizes and response rates varied each year. On average, the target sample size was 70,000 per year, and in 2018, the weighted interview response rate was 66.56% (SAMHSA 2020; NSDUH 2018). There were also certain changes made to the survey design and definition of variables in some of the years included in these analyses. The relevant changes to variables used in this paper will be outlined below.

Variables

The second research objective of this thesis is to explore how trends in drug use varied between Blacks and Whites based on their metropolitan status between 2003-2018. To accomplish this, the main outcomes selected for analysis included: lifetime illicit drug use, past-year illicit drug use, and lifetime prescription pain reliever misuse. Lifetime use refers to any use of an illicit drug, or misuse of a prescription pain reliever, at some point in the respondent's lifetime. Past-year use refers to any use of an illicit drug, by the respondent, at some point in the past one year. It is important to keep in mind that these variables were binary response outcomes (i.e. yes/no). As such, the responses did not provide additional insight into the frequency, recency, or number of drugs used. The illicit drugs variables are aggregate categories and include

marijuana, hallucinogens, inhalants, methamphetamine, tranquilizers, cocaine, heroin, pain relievers, stimulants, or sedatives. It is important to note that this category is inclusive of lethal and non-lethal drugs. Similarly, prescription pain reliever misuse does not specify type or class of prescription pain reliever. For the most part, there were little to no changes in how these outcome variables were measured over the study period (2003-2018). However, in 2015, there was a slight change to the definition of the prescription pain reliever misuse variable. Prior to 2015, misuse of a prescription pain reliever was defined simply as "use without a prescription, or taken just for the feeling caused" (NSDUH 2015). After 2015, when many changes in the NSDUH at large were introduced to include more questions on prescription pain reliever misuse and opioid use, the definition of the lifetime prescription pain reliever misuse was revised and expanded. In these survey years, it was re-written to emphasize "behaviours which constituted misuse, and included the following descriptions: a) use without a prescription of the respondent's own; (b) use in greater amounts, more often, or longer than told to take a drug; or (c) use in any other way a doctor did not tell respondents to take a drug" (NSDUH 2015). These changes may have implications on how respondents answered this variable starting in 2015 onwards.

The third and final research objective of this thesis is to identify how access to drugs and source of drugs varied by race and place in recent years (2016-2018). To answer this, the main outcome variables selected were: 1) whether a respondent was approached by a drug dealer in the past month (yes/no); 2) the respondent's perception of the difficulty of obtaining drugs (fairly easy/otherwise), and 3) the respondent's source of drugs last used (friend or relative/ doctor or health care source/ other). The source of drug outcome was comprised of many variables, which asked respondents about drug source dependent on drug class (i.e. source of prescription pain relievers, stimulants, sedatives, and tranquilizers). If a respondent reported having obtained their drugs from a friend or relative, then the friend or relative's source was also examined (possible sources: friend or relative/ doctor or health care source/ other).

The main exposures for the aforementioned research objectives, and indeed throughout this thesis, are race/ethnicity and metropolitan status. As stated, analyses were restricted to non-Hispanic Blacks and Whites, a metric self-reported by survey respondents. Metropolitan status was coded based on the self-reported county of residence of the respondent. The NSDUH uses the United States Department of Agriculture's (USDA) Rural-Urban Continuum Codes (RUCC), which is a 9-level classification scheme that categorises counties' metropolitan status based on population size. Due to confidentiality, however, the publicly available NSDUH data only provides a pre-collapsed three-level categorisation of metropolitan status: large metro, small metro, or nonmetro. Large metro counties include counties in metro areas of a million or more population, small metro counties include counties in metro areas with a population less than a million, and nonmetro counties include all other nonmetropolitan counties. The details of these definitions, as well as the classification by county, can be found on the USDA website (ERS 2019). Finally, between 2003 to 2018, there were some changes to the coding scheme during this time period. The 2003 version of the RUCC was used to classify counties metropolitan status for NSDUH years 2003-2014. However, from 2015-2018, the updated 2013 version of RUCC was used. It is important to note that there were no changes to the definitions of the metropolitan categories in the 2003 and 2013 RUCC schemes. Rather, there were differences in how some counties were classified in the updated RUCC, to reflect changing population sizes over the

years. These changes, as well as any implications they have on the results, are detailed in the Notes section below and further in Appendix 2.

Data Analysis

All of the drug use data examined was managed and analyzed within R. To account for the complex sampling design of the survey, svydesign commands were used to identify the strata, replicate, and person-level weights. This ensured that all estimates were weighted and therefore representative of the actual population subgroups they described. However, it is important to note that while the surveys were nationally representative, breaking the results down into specific categories (e.g. race or metropolitan category) inevitably resulted in small sample sizes for certain subgroups. To account for this, the data was pooled into two and three-year intervals, thereby increasing the sample sizes for analysis. Specifically, time trend data on drug use outcomes were pooled between 2003-2018 into two-year aggregates. To analyze recent trends in drug access and drug source by race and metropolitan status, NSDUH data was pooled for the years 2016-2018. Accordingly, the person-level weights of the observations were adjusted based on the number of years pooled, as recommended by NSDUH methods (NSDUH 2017).

Notes

It was noted earlier that the drug mortality data from the CDC, and the drug use data from NSDUH, were derived using different coding schemes which categorise county metropolitan status. The CDC drug mortality data used the 2013 NCHS scheme; through CDC WONDER, it was possible to select the 2013 NCHS scheme for the duration of the study period (2003-2018). In contrast, there was less flexibility with the NSDUH, which used the RUCC scheme for classifying counties. As a result, the 2003 RUCC scheme was used for NSDUH years 2003-2014, and the 2013 RUCC scheme for NSDUH years 2015-2018. In order to effectively explore trends between drug mortality and drug use outcomes between Blacks and Whites based on metropolitan status, parallels between drug use and drug mortality data within these metropolitan categories need to be drawn. However, to ensure that such parallels can accurately be drawn, it is necessary to examine whether there are significant differences in the definitions of large metro, small metro, and nonmetro used in the two coding systems. Specifically, the 2013 NCHS scheme must be compared with both the 2003 RUCC and the 2013 RUCC, and the 2003 RUCC must be compared with the 2013 RUCC, in order to identify what percentage of counties, if any, are categorized differently between the different coding schemes. Comparing the 2013 NCHS scheme with the 2003 and 2013 RUCC schemes is important to assess how closely these different classifications parallel each other. Comparing the 2003 and 2013 RUCC schemes is also necessary to identify the percentage of counties coded differently between the updated schemes, to determine the impact of the continuity of this measure as it relates to the drug use data. The results of these comparisons will be outlined below and are further detailed in Appendix 2 of this thesis.

As mentioned, the NCHS scheme employs a six-level coding scheme for counties' metropolitan status, and the RUCC employs a nine-level coding scheme. However, for the purposes of this thesis, I collapsed both coding schemes into three-level categories, where 1 designated a large metro county, 2 designated a small metro county, and 3 designated a nonmetro

county, as previously defined. Following this, each pair of coding systems was matched on the county FIPS codes, and the metropolitan category code designated by each scheme was compared.

Overall, it was found that the percentage of counties coded differently across the 3 categories (large metro, small metro, and nonmetro), between the different schemes was minimal. Comparing the 2013 NCHS scheme with the 2013 RUCC scheme revealed that only 4 of 3143 counties were coded differently between the two systems (0.19%). 6 counties were missing from the 2013 RUCC but recognized and categorized in the 2013 NCHS scheme. When comparing the 2013 NCHS scheme with the 2003 RUCC scheme (which was used for NSDUH years 2003-2014), it was found that 2981 of 3142 counties were coded identically (95%). Only 161 counties were coded differently between the two systems (5%), and 7 counties were only coded by the NCHS scheme (0.22%) and missing from the 2003 RUCC coding system. Finally, a comparison of the 2003 RUCC with the more recent 2013 RUCC found that 2980 of 3138 counties were categorized identically (95%). 5 counties in the 2013 RUCC were not defined in the 2003 RUCC, and 4 counties in the 2003 RUCC were not defined in the 2013 RUCC. Further analyses demonstrated that many of the changes between the two versions of the RUCC were due to renaming and redefining of counties' borders. Thus, it is clear that the large majority of counties' metropolitan statuses are categorized identically between the NCHS and RUCC coding schemes, as differences do not exceed 5%. Furthermore, at most, these counties represented less than 4% of the total population. Further details of this analysis can be found in Appendix 2 of this thesis.

RESULTS

The following section of this thesis presents the main results of the analyses conducted. These results are separated into three sections, based on the three main research objectives of this study. Brief annotations are provided here alongside the figures and tables, however, the results are examined and interpreted in detail in the Discussion section.

1. Patterns and trends in drug overdose mortality

1.1. All-drug mortality, 2013-2018

Figure 1

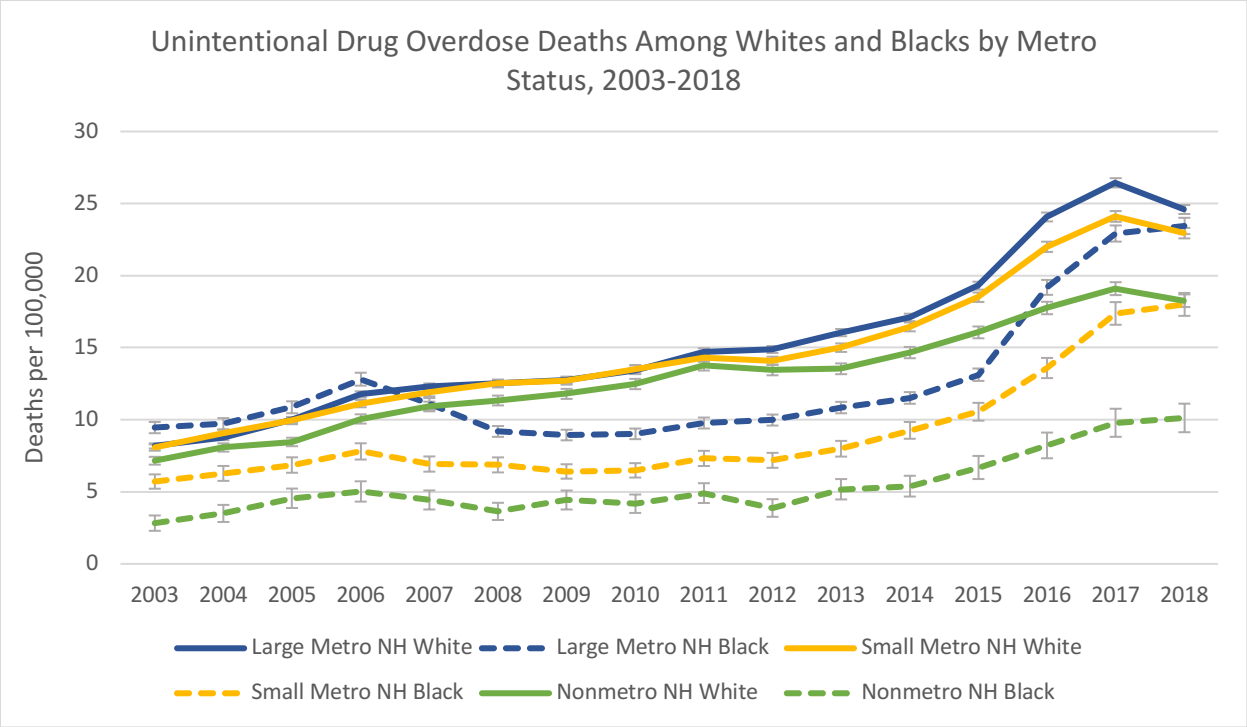

Fig 1. Unintentional Drug Overdose Deaths, by Race and Metropolitan Status, 2003-2018.
All unintentional overdose deaths (MCD ICD-10 codes X40-X44) for non-Hispanic Whites and Blacks in the US population. Data reflects crude death rates per 100,000 population. Error bars represent 95% CI.
Metropolitan status categories are based on the 2013 NCHS Urban-Rural Scheme for Counties; the six categories were collapsed into three (large metro groups large central metro and large fringe metro; small metro groups medium metro and small metro; nonmetro groups micropolitan and noncore metro).
Data source: Centers for Disease Control and Prevention, National Center for Health Statistics. Multiple Cause of Death 1999-2018 on CDC WONDER Online Database, released in 2020.

1.2. Opioid-related mortality, 2013-2018

Figure 2

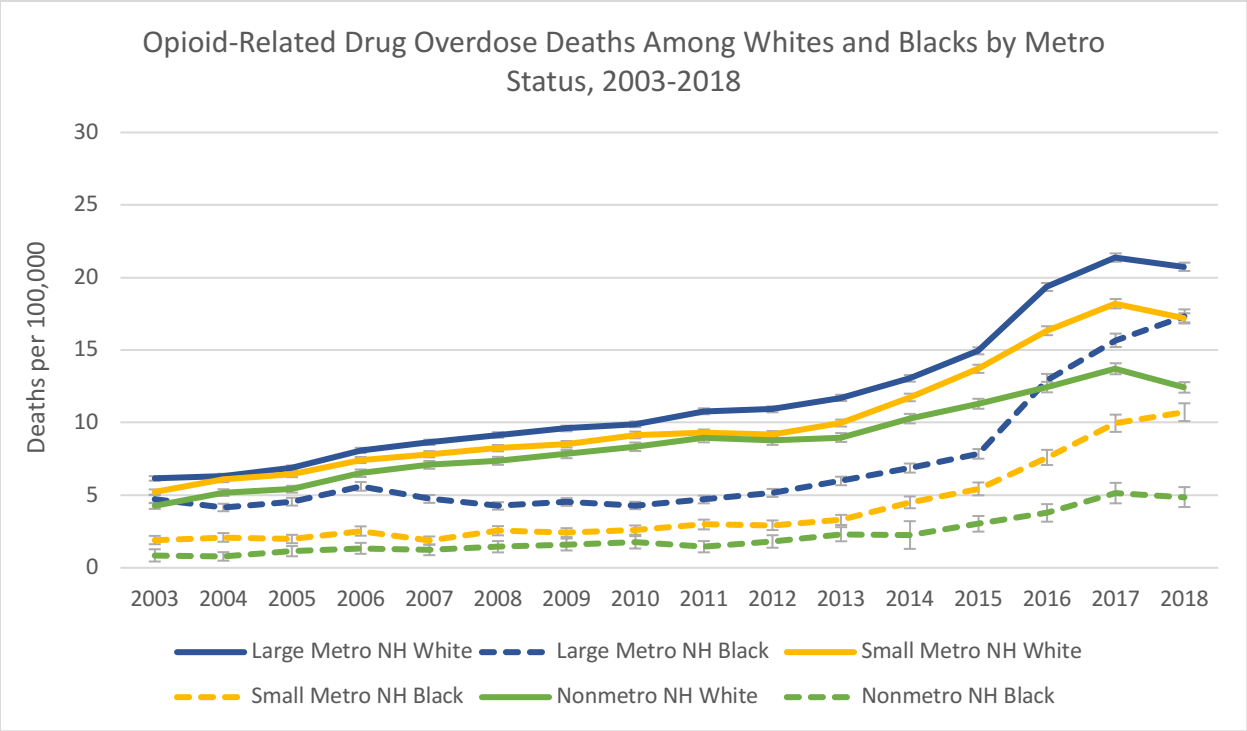

Fig 2. Opioid-Related Overdose Mortality Rates, by Race and Metropolitan Status, 2003-2018.
Opioid-related drug overdose deaths (MCD ICD-10 codes T40.0-T40.4; T40.6) for non-Hispanic Whites and Blacks in the US population. Data reflects crude death rates per 100,000 population. Error bars represent 95% CI.
Metropolitan status categories are based on the 2013 NCHS Urban-Rural Scheme for Counties; the six categories were collapsed into three (large metro groups large central metro and large fringe metro; small metro groups medium metro and small metro; nonmetro groups micropolitan and noncore metro).
Data source: Centers for Disease Control and Prevention, National Center for Health Statistics. Multiple Cause of Death 1999-2018 on CDC WONDER Online Database, released in 2020.

Overall, comparing Figures 1 and 2 demonstrates that there is great similarity in the general trends in all-drug overdose mortality and only opioid-related mortality from 2003-2018, for Blacks and Whites across metropolitan categories. Drug-related overdose mortality rates are similar for Whites across metropolitan categories from 2003 to 2011, and they are steadily increasing. However, drug-related mortality rates are consistently slightly lower in nonmetro areas than in metro areas. Starting in 2012, though, drug-related mortality rates begin to diverge across metropolitan groups, as they begin to increase more rapidly in large and small metro areas than nonmetro areas. In 2015, there is a spike in overdose mortality across all metropolitan categories, but again this is steeper for metro than non-metro areas. After hitting a peak in 2017, there is evidence of a significant decline in drug-related mortality for Whites in all metropolitan groups. Between 2017 to 2018, opioid-related overdose mortality rates for Whites in large metro areas decreased from 21.4 [21.1-21.7] to 20.7 [20.5-21.0]; in small metro areas from 18.2 [17.9-18.5] to 17.2 [16.9-17.5]; and in nonmetro areas from 13.7 [13.3-14.1] to 12.4 [12.1-12.8] deaths per 100,000. Given the lack of overlap in the 95% CI for these estimates, these declines appear to be significant.

The trends in drug-related mortality for Blacks are notably different to those of Whites. For Blacks, metro-based differences in drug-related mortality are apparent throughout the time period. From 2003-2018, drug overdose mortality is consistently highest amongst large metro Blacks and lowest for nonmetro Blacks. Furthermore, from 2003 to 2012, drug-related mortality rates are relatively unchanging across metro categories, with the exception of a slight peak in 2006 seen across metro groups. Drug-related overdose mortality rates among Blacks only begin to increase in 2012, and this is observed across metropolitan groups. These increases spike sharply between 2015 to 2017 across metro categories. In contrast to Whites, though, opioid-related mortality rates continued to increase between 2017 to 2018 for Blacks in large and small metro areas, but declined slightly for Blacks in nonmetro areas. From 2017 to 2018, opioid-related mortality rates among Blacks in large metro areas increased significantly, from 15.7 [15.2-16.1] to 17.3 [16.8-17.8] deaths per 100,000. Opioid-related mortality rates among Blacks in small metro areas also decreased, however this increase does not appear to be significant (from 10.0 [9.4-10.5] to 10.7 [10.1-11.3]). Finally, rates decreased for Blacks in nonmetro areas 5.1 [4.4-5.9] to 4.9 [4.2-5.6] deaths per 100,000, however, given the overlap in the 95% CIs, this decline does not appear to be significant.

1.3. Percentage of drug overdose deaths attributable to opioids, 2003-2018

Figure 3

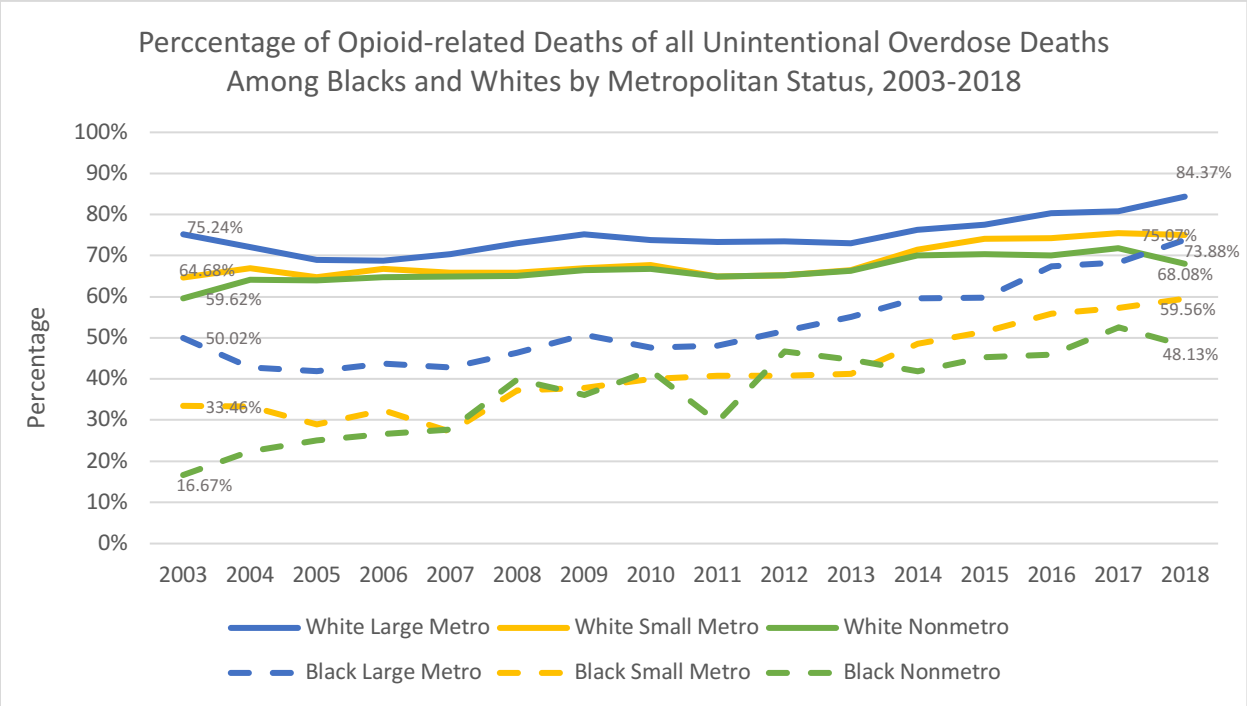

Fig 3. Percentage of opioid-related deaths of all unintentional drug overdose deaths, by Race and Metropolitan Status, 2003-2018.
Opioid-related drug overdose deaths (MCD ICD-10 codes T40.0-T40.4; T40.6); unintentional overdose deaths (MCD ICD-10 codes X40-X44), for non-Hispanic Whites and Blacks in the US population.
Data reflects crude death rates per 100,000 population.
Metropolitan status categories are based on the 2013 NCHS Urban-Rural Scheme for Counties; the six categories were collapsed into three (large metro groups large central metro and large fringe metro; small metro groups medium metro and small metro; nonmetro groups micropolitan and noncore metro).
Data source: Centers for Disease Control and Prevention, National Center for Health Statistics. Multiple Cause of Death 1999-2018 on CDC WONDER Online Database, released in 2020.

Given the similarity between the trends in opioid-related mortality and all-drug overdose mortality depicted in Figures 1 and 2, it was worthwhile to assess the extent to which opioid-related drugs were responsible for all drug overdose deaths. Between 2003-2018, opioids were responsible for the overwhelming majority of drug overdose deaths for Whites across metropolitan categories. Moreover, while this percentage did increase from 2003 to 2018, across metro categories, the increases were slight[2]. For the duration of the time period, the percentage of drug overdose deaths attributable to opioids was consistently slightly higher among Whites in large metro areas, compared to those in small metro and nonmetro areas. From 2017 to 2018, the percentage of drug overdose deaths attributable to opioids increased among Whites in large metro areas, remained steady for Whites in small metro areas, and decreased for Whites in nonmetro areas.

In contrast, the percentage of overdose deaths attributable to opioids increased much more notably for Blacks across metro categories. In 2003, opioids were responsible for the majority of overdose deaths for Blacks in large metro areas, but not for those in small and nonmetro areas. In fact, they only made up 16.7% of overdose deaths for rural Blacks. However, these patterns continued upwardly throughout the time period, as opioids began to represent the leading cause of overdose deaths for Blacks across metro-categories. However, the percentage of overdose deaths attributable to overdoses was always highest for Blacks in large metro areas, compared to small and nonmetro areas. From 2017 to 2018, the percentage of drug overdose deaths attributable to opioids increased among Blacks in large and small metro areas, but decreased for those in nonmetro areas.

1.4. Recent patterns in drug-related mortality, 2015-2018

Table 1

Table 1. Patterns of Change in Opioid-Related Drug Mortality between 2003-2015 and 2015-2018

		Crude death rates			AD	PC	AAPC	AD	PC	AAPC
Metro status	Race	2003	2015	2018	**2003-2015**			**2015-2018**		
Large Metro										
	White	6.16	14.95	20.74	8.79	143%	**7.77%**	5.78	39%	**12.86%**
	Black	4.73	7.85	17.32	3.12	66%	**5.03%**	9.47	121%	**27.67%**
Small Metro										
	White	5.22	13.71	17.23	8.49	163%	**8.55%**	3.52	26%	**10.50%**
	Black	1.91	5.44	10.72	3.53	184%	**10.57%**	5.28	97%	**24.78%**
Nonmetro										
	White	4.27	11.30	12.43	7.03	165%	**8.66%**	1.13	10%	**5.23%**
	Black	0.86	3.03	4.87	2.17	254%	**12.62%**	1.84	61%	**22.46%**

AD = Absolute Difference; PC = Percent Change; AAPC = Annual Average Percent Change

Source: CDC Wonder. Years 2003, 2015, 2018.
Opioid-related MCD causes; ICD codes T40.0-T40.4, T40.6.

a: Only opioid-related mortality patterns are presented here, however, the patterns in all-drug mortality (2015-2018) are included in Appendix 1.

[2] NB: No statistical tests for significance were conducted for this analysis.

Table 1 compares recent changes (2015-2018) in opioid-related mortality patterns to previous patterns (2003-2015) by race and metro status, as these time periods reflect the two distinct phases of the opioid epidemic. Between 2003-2015, opioid-related mortality rates greatly increased for Whites in all metro categories, reflected by both large increases in the absolute difference in mortality rates. During this time, the greatest increase is seen in large metro areas, followed by small metro areas, and least in nonmetro areas. Still, the rates of increase are somewhat similar across metropolitan categories. However, in contrast, the greatest annual average increases in opioid-related mortality rates during this time period were seen among nonmetro Whites, closely followed by small metro Whites, and then large metro Whites. In the later years, between 2015-2018, the average annual increase in opioid-related mortality rates among Whites increases slightly for those in large and small metro areas, but decreases for those in nonmetro areas.

For Blacks, patterns of opioid-related mortality between the two time periods change more notably than among Whites. During the first time period (2003-2015), the absolute difference in opioid-related mortality rates are low across metropolitan categories. Similar to Whites, these differences are greatest in large metro areas, followed by small metro areas, and lowest in nonmetro areas. The rate of average annual increase is highest in nonmetro areas, then small metro areas, and least in large metro areas – however, this measure is likely slightly inflated due to the low value of the opioid-mortality rate in 2003 for Blacks in nonmetro areas. Importantly, the average annual increase in opioid-related mortality rates increased drastically in the last three years (2015-2018) for Blacks across metro categories, far exceeding rates in the first time period. In addition, the absolute differences in the 3-year time period exceeded differences in the 10-year time period, for Blacks in large and small metro areas. Both absolute differences, and average annual percent changes, in opioid-related mortality rates between 2015-2018 among Blacks are highest in large metro areas, followed by small metro areas, and lowest in nonmetro areas. Furthermore, the average annual increase in opioid-related mortality rates among Blacks across metro categories far exceeded rates among their White counterparts, in recent years.

2. Patterns and trends in drug use

2.1. Trends in illicit drug use, 2013-2018

Figure 4

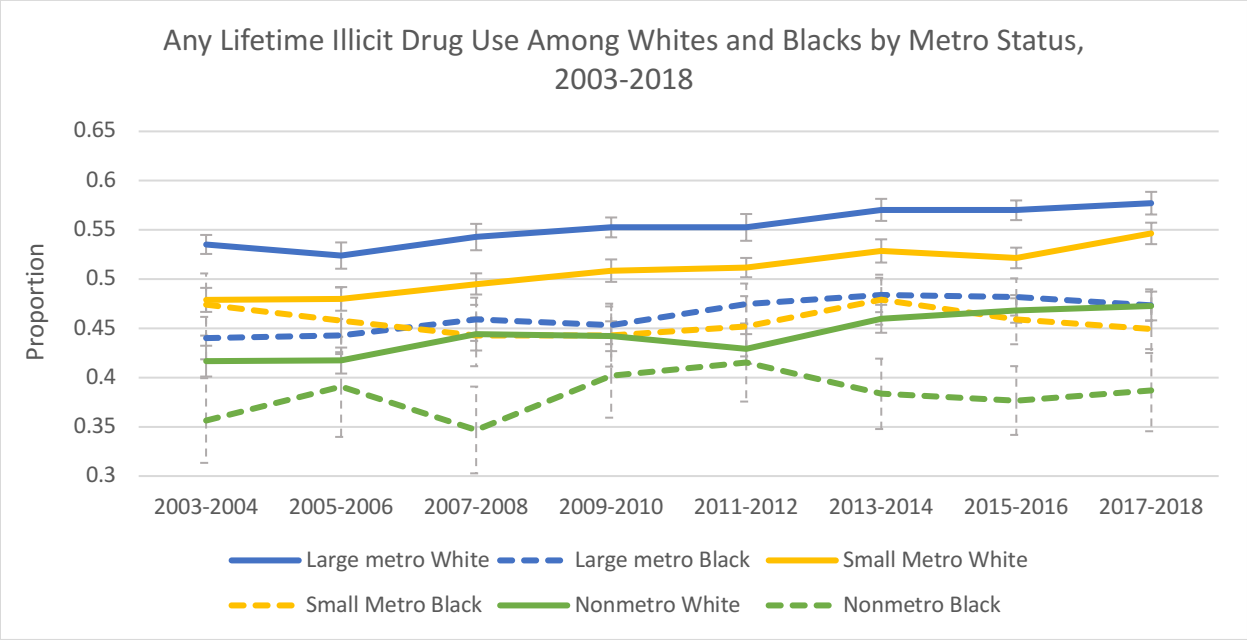

Fig 4. Trends in any lifetime illicit drug use amongst non-Hispanic Whites and Blacks in the United States, by Metropolitan status, for the years 2003-2018.
Data are pooled in 2-year intervals. Proportions are reported; weighted. Error bars represent 95% CI.
Data source: National Survey for Drug Use and Health, 2003-2018.

Overall, reported rates of lifetime illicit drug use are relatively stable over time, for Whites and Blacks across metropolitan categories. While rates did increase from 2003-2018, across race and metro groups, these increases were slight, reflected by the parallel trend lines in Figure 4. For Whites, lifetime use of an illicit drug was consistently highest in large metro areas, closely followed by rates in small metro areas, and lowest in nonmetro areas. This metro-based pattern is consistent throughout the time period (2003-2018). Furthermore, patterns of increase in lifetime illicit drug are similar across metropolitan categories for Whites. In contrast, for Blacks, metro-based patterns are slightly different. Lifetime illicit drug use patterns are almost identical from 2003-2018 in large metro and small metro areas. Conversely, rates are significantly lower in nonmetro areas. Still, similar to patterns among Whites, there is little fluctuation in rates over time, and lifetime illicit drug use appears to be a relatively stable pattern. Interestingly, comparing patterns across race groups shows that lifetime illicit drug use is notably higher for Whites than Blacks within each metropolitan category.

Figure 5

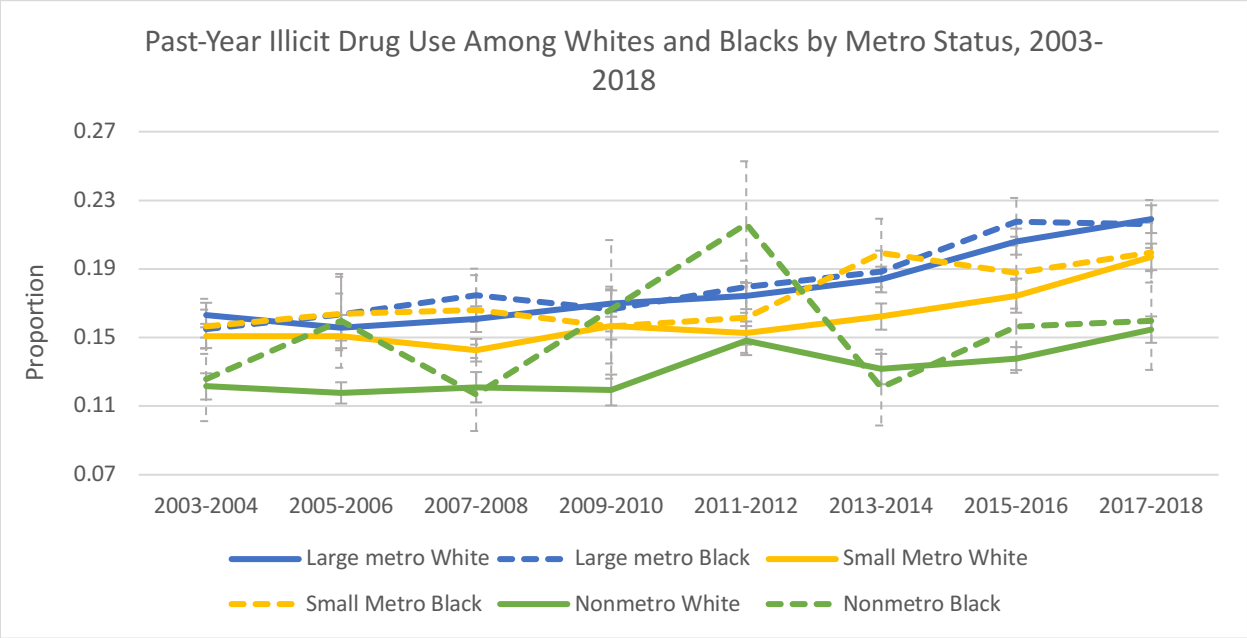

Fig 5. Trends in past-year illicit drug use amongst non-Hispanic Whites and Blacks in the United States, by Metropolitan status, for the years 2003-2018.
Data are pooled in 2-year intervals. Proportions are reported; weighted. Error bars represent 95% CI.
Data source: National Survey for Drug Use and Health, 2003-2018.

Interestingly, past-year illicit drug use patterns between 2003-2018 were different to patterns in lifetime illicit drug use, for Blacks and Whites across metro categories. Generally, rates of past-year illicit drug use were similar across race groups, within metro categories. In contrast, metro-based patterns consistent across racial groups were more apparent. For both Blacks and Whites, reported use of an illicit drug in the past year was highest in large metro areas, closely followed by small metro areas, and lowest in nonmetro areas. While rates were similar in large and small metro areas for both Whites and Blacks, these similarities were more pronounced among Blacks, evidenced by the repeatedly overlapping trend lines and 95%CI error bars. Consistently, though, past-year illicit drug use was lowest in nonmetro areas. Additionally, between 2003-2018, rates of past-year illicit drug use increased across race and metro subgroups.

2.2. Trends in prescription pain reliever misuse, 2013-2018

Figure 6

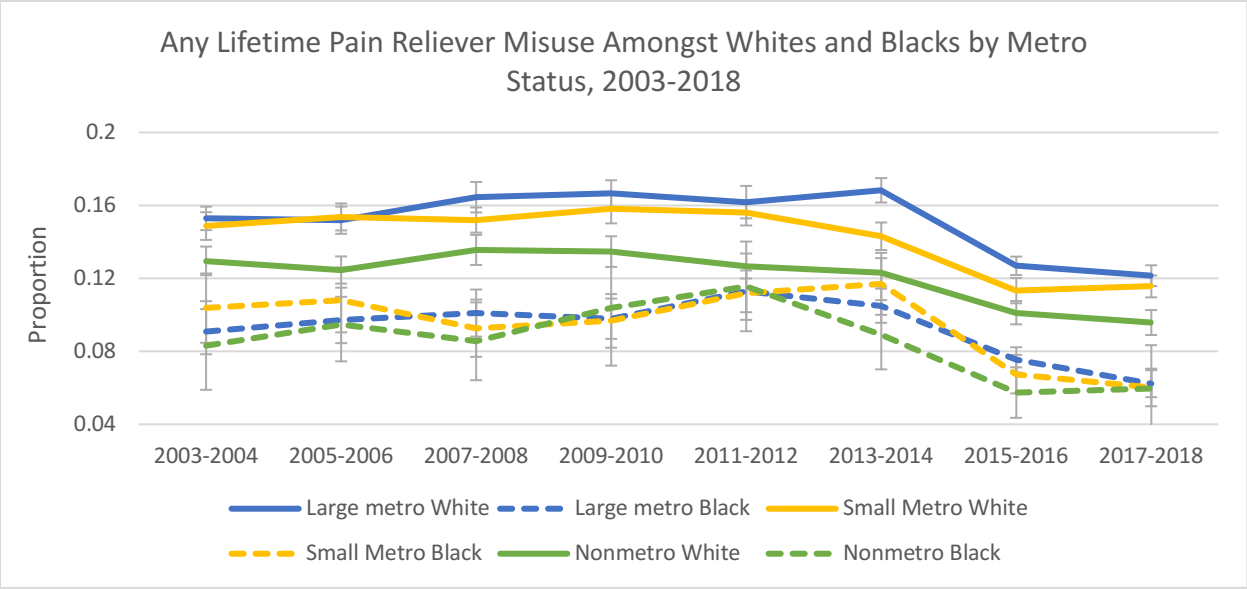

Fig 6. Trends in any lifetime misuse of a prescription pain reliever amongst non-Hispanic Whites and Blacks in the United States, by Metropolitan status, for the years 2003-2018.
Data are pooled in 2-year intervals. Proportions are reported; weighted. Error bars represent 95% CI.
Data source: National Survey for Drug Use and Health, 2003-2018.

From 2003-2012, trends in reported lifetime misuse of a prescription pain reliever are similar and relatively unchanging for Whites in large and small metro areas; though they are slightly higher in large metro areas, this difference only appears to be significant between 2013-2016. For Whites in nonmetro areas, prescription pain reliever misuse rates are also stable between 2003-2012, however they are significantly lower than rates among their large and small metro counterparts. In 2015, rates of prescription pain reliever misuse decrease sharply for Whites across metropolitan categories, and this trend continues until 2018. In contrast, for Blacks, there is no metro-based disparity in prescription pain reliever misuse between 2003-2018 and reported rates are generally similar across metropolitan categories. Notably, though, rates are significantly lower for Blacks compared to Whites throughout the time period (2003-2018). Interestingly, rates of reported prescription pain reliever misuse dropped in 2015 for Blacks across metropolitan categories as well, and this pattern also continued until 2018.

3. Source/Access

3.1. Measures of drug access and drug source, 2016-2018

Figure 7

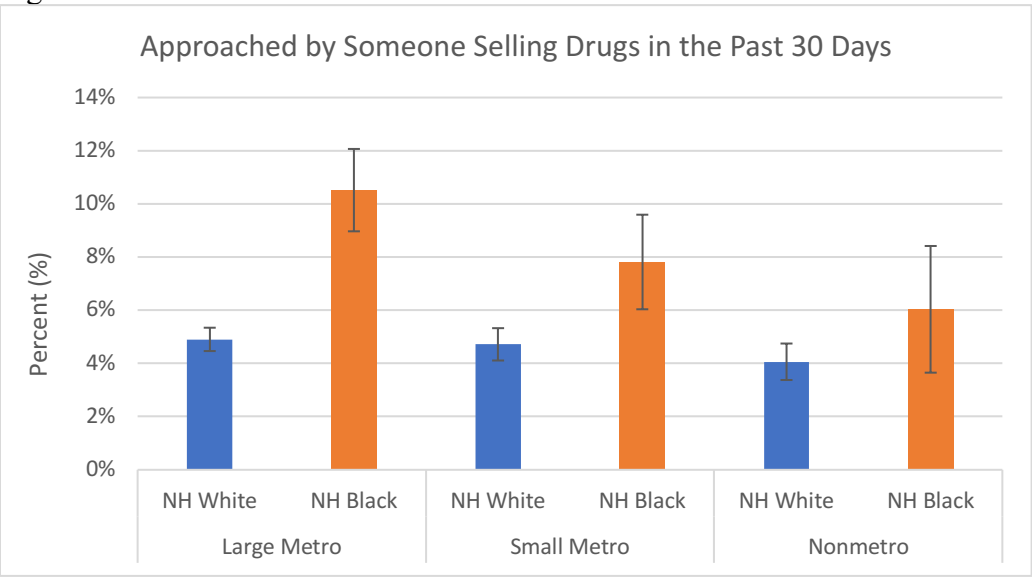

Fig 7. Recent patterns in access to illicit drugs amongst Whites and Blacks, based on their metropolitan status.
Access is determined by respondents answers to the question: Have you been approached by someone selling drugs in the past 30 days? Data are pooled. Percentages are reported; weighted. Error bars represent 95% CI.
Data source: National Survey for Drug Use and Health, 2016-2018 (pooled).

In 2016-2018, Blacks in all metropolitan categories were more likely to report having been approached by someone selling drugs in the past month than Whites. Furthermore, this likelihood was highest among Blacks living in large metro areas, followed by small metro areas, and lowest in nonmetro areas. In contrast, among Whites, there was no significant metropolitan-based disparity in reporting being approached by someone selling drugs in the past month.

DISCUSSION

The overarching objective of this thesis is to examine both if and how the intersection of race and metropolitan status is related to drug overdose mortality and drug-use outcomes for non-Hispanic Blacks and Whites in the United States between 2003-2018. The data demonstrates metro-based differences in drug-related mortality and drug-use outcomes between Blacks and Whites, which vary over time. These findings highlight the need to study drug-related mortality and drug-use by both race and metropolitan category, as statistics at the national level conceal important differences by race and metropolitan status. Similarly, estimates of only racial disparities in drug mortality and drug-use mask important differences by metro status, while analyses by metropolitan status alone ignore notable differences by race. For example, in 2020, the CDC reported significant progress being made in the fight against the opioid epidemic within the US because national-level opioid-related overdose death rates decreased by 4.1% from 2017 to 2018 (CDC 2020a). Overall, this report appears encouraging. However, the findings of this thesis, which will be reviewed in detail below, demonstrate that this characterization does not tell the whole story. While overdose death rates are declining for Whites in all metropolitan categories, they are increasing for Blacks, particularly those in large and small metro areas. Though the CDC does note increases in overdose deaths among Blacks, their reference to this is minimal and does not convey metro-based differences. Given that rates of both drug-related mortality and illicit drug use for Blacks living in large and small metro areas far exceed rates among Blacks in nonmetro areas, it is evident that assessing metropolitan-based differences is also necessary for identifying the subgroups most at risk.

Drug-related mortality trends by race and place, 2003-2018

While the time period examined in this thesis (2003-2018) is considered to be part of the key timeframe of the opioid epidemic, where opioids were increasingly implicated as the leading cause of most drug overdose deaths, Figure 3 demonstrates that the opioid epidemic began much later for Blacks, across metropolitan categories, than Whites. This finding is consistent with explanations reported in the literature about the two phases of the opioid epidemic; the first phase (1990s to late 2010s), which was characterized by prescription opioid overdoses and disproportionately impacted White Americans, and the second phase (late 2010s to present) which is characterized by illicit and synthetic opioids and has much more widespread impacts (K. James and Jordan 2018; M. Alexander, Barbieri, and Kiang 2017; Pacula and Powell 2018; Peters et al. 2019). The literature review recounted in detail published findings on the opioid-related mortality trends among Whites across metropolitan categories, and how these trends changed through the opioid epidemic's transitions; the findings of this thesis are consistent with these reports. Importantly, the results also demonstrate that there was little metro-based disparity in drug-related mortality for Whites during the first phase of the epidemic, supporting recent research countering beliefs that the opioid epidemic was disproportionately rural (Keyes et al. 2014; Paulozzi and Xi 2008; Lait et al. 2014; Mack, Jones, and Ballesteros 2017). While it is known that the opioid epidemic did not impact Blacks in the same way until its second phase, it is unclear what the metro-based patterns of opioid-related mortality are for Blacks in this second phase of the epidemic, and it is unclear what the drug-related mortality patterns, based on metropolitan status, were for Blacks prior to the opioid epidemic. As such, this discussion section will focus on the findings relevant to these knowledge gaps, as well as on the most recent

trends observed in opioid-related mortality for both Whites and Blacks based on their metropolitan status (2017-2018), which have not yet been well-documented in the literature.

As mentioned, during the first phase of the opioid epidemic (2003 to 2010s), Blacks were not known to be experiencing an opioid epidemic (Figure 3). As such, opioid-related mortality rates among Blacks were markedly lower than all-drug mortality rates until the late 2010s, across metro categories (Figures 1-2), despite increasing among Whites. Furthermore, there was little metro-based variation in opioid-related mortality rates among Blacks during this time. While opioid-related mortality rates were significantly higher among Blacks in large metro areas, previous studies have reported that these deaths were more attributable to heroin rather than prescription opioids(M. J. Alexander, Kiang, and Barbieri 2018; M. Alexander, Barbieri, and Kiang 2017). For Blacks in small and nonmetro areas, opioid-related mortality rates were similar and low, including those living in nonmetro (rural) areas where the opioid epidemic was considered to be concentrated[3]. Moreover, for Blacks across metro categories, opioid-related mortality rates were relatively unchanging during this time period, despite increasing among their White counterparts. Together, these findings support the narrative that Blacks were 'perversely shielded' from the opioid epidemic due to systematic barriers in access (K. James and Jordan 2018; Om 2018). That is to say, regardless of metropolitan status, it appears that Blacks were not dying from prescription opioids and hence not affected by the first phase of the opioid epidemic, because they were simply not using them at the same rates as Whites.

In addition, drug overdose deaths in general among Blacks during this time period were actually relatively low and stable (Figures 1-2), and they were overwhelmingly due to cocaine (Shiels et al. 2018; K. James and Jordan 2018; Hernandez et al. 2020). However, metro-based patterns in all-drug mortality differed to patterns of opioid-related mortality during this time. While rates of opioid-related mortality during this time were low among Blacks in small metro areas, rates of all-drug mortality for this subgroup were notably higher, due to non-opioid drugs (chiefly cocaine). All-drug mortality was still low for Blacks in nonmetro areas during this time period. These findings suggest a metro-based disparity in drug mortality among Blacks that is not related to opioids, whereby Blacks in large and small metro areas experienced higher rates of drug overdose mortality than those in nonmetro areas, with rates being significantly and consistently highest for those in large metro areas.

As the epidemic transitioned into its second phase after 2012, and illicit and synthetic opioids replaced prescription opioids and became widely available, opioid-related overdose deaths spiked for Whites and Blacks across metro categories. For Blacks, this represented the beginning of their opioid epidemic, as they did not have the same barriers in access to illicit drugs such as heroin and fentanyl-laced cocaine, as they did to prescription opioids (K. James and Jordan 2018; Om 2018; Mosley and Hagan 2020; M. Alexander, Barbieri, and Kiang 2017; M. J. Alexander, Kiang, and Barbieri 2018) Now, opioid-related mortality rates began to increase among Blacks and represent most of the mortality from drug overdoses in general, mirroring what was seen earlier among Whites (Figure 3). Moreover, for both Blacks and Whites, opioid-related overdose death rates were now distinctly highest in large metro areas, followed by small metro areas, and lowest in nonmetro areas. The higher availability of heroin markets in large

[3] This is another reason why the 'rural' label given to the opioid epidemic was problematic, as it essentially excluded rural Blacks, who at the time were not succumbing to opioid-related mortality.

metro and small metro areas likely contributed to the more rapid increase in deaths witnessed in metrpolitan areas compared with nonmetro areas (M. Alexander, Barbieri, and Kiang 2017; Pacula and Powell 2018; S. Monnat 2019; Peters et al. 2019). Evidently, this second phase of the opioid epidemic brought forth many changes to metropolitan based patterns of overdose mortality for Whites and Blacks. Below, I will further detail these later changes, and discuss to what extent they differed from previous understandings.

In stark contrast to the trends observed before 2015, opioid-related mortality rates were now increasing more rapidly among Blacks than Whites in all metropolitan categories. To illustrate, Table 1 shows that the average annual increase from 2015 to 2018 in opioid-related mortality rates among Whites was 12.86% on average in large metro areas, 10.5% in small metro areas, and only 5.23% in nonmetro areas (Table 1). In contrast, rates increased much more drastically among Blacks in all metro categories. In large metro areas, the average annual increase in opioid-related mortality rates from 2015-2018 was 27.67% in large metro areas, 24.78% in small metro areas, and 22.46% in nonmetro areas (Table 1). While the absolute rates of drug-related mortality between 2015-2018 were still higher for Whites than Blacks within each metropolitan category, the rates of increase for Whites at this time are notably lower, which suggests that the opioid epidemic is worsening for Blacks compared to Whites in recent years. Indeed, James and Jordan (2018) previously reported that in 2015, rates of opioid-related mortality among Blacks actually exceeded rates among Whites and the general population in the states of West Virginia, Wisconsin, Missouri, Illinois, and Minnesota. Thus, while absolute rates of opioid-related mortality are lower for Blacks in all metro categories than Whites at the national level, this does not reflect the reality at the state level. Importantly, this signals that overlaying a state-based or regional analysis on an analysis by race and metropolitan status can lead to even further and more nuanced insights on drug mortality patterns. Moreover, it further aids in identifying and targeting the subgroups that are most vulnerable.

As echoed throughout this thesis, national or single-category interpretations of data often mask important differences in patterns and trends of drug mortality among specific subgroups. The consequences of this can be especially problematic when pre-existing generalized narratives exist, and new data that may counter them and draw attention to particularly vulnerable groups, is not thoroughly investigated. Examining the trends in opioid-related mortality between 2017-2018 provides an example of this. As mentioned earlier, in 2020, the CDC reported that significant progress was made as a result of efforts to combat the opioid crisis (CDC 2020a). In their report, they do briefly note that rates increased among non-Hispanic Blacks, as well as Hispanics and those aged 65 years and older, and briefly suggested that more culturally tailored interventions may be needed (CDC 2020a). While this is an important step, their observation is brief and associated recommendation is hollow. Blacks are not a monolith, and various other factors, including metropolitan status, impact drug-mortality outcomes for Blacks as demonstrated throughout this paper. Specifically, that drug-mortality rates among Blacks in nonmetro areas are consistently lower than rates of their large and small metro counterparts, indicates that interventions should not only be culturally tailored, but considerate of metropolitan-based differences. To demonstrate this further, if we consider Figure 2, it can be observed that opioid-related mortality rates declined significantly from 2017-2018 for Whites in all metro categories. This finding is encouraging and shows that federal strategies to combat the opioid epidemic, including improved treatment options and availability, and increased and

improved data collection and dissemination (CDC 2020a), are resulting in tangible improvements for Whites in all metro categories. However, importantly, Figure 2 also shows that opioid-related mortality rates actually increased between 2017-2018 for only Blacks in large and small metro areas[4]. Further, for Blacks in nonmetro areas, opioid-related mortality rates, which were always consistently lower than their counterparts in large and small metro areas, actually began to decrease. This highlights a few critical points: First, that current interventions to combat rising opioid-mortality rates are not impacting Blacks in both large and small metro areas as they are for Whites. If we continue with a national and non-nuanced narrative, a whole and already marginalized subgroup will essentially be left behind. Second, empirical research should be pursued to investigate why opioid-related mortality rates have continued to increase only for Blacks in large and small metro areas, while they declined for those in nonmetro areas, and for Whites in all metro categories. It is only with a continued effort to nuance and detail, that research can effectively enact policies that may decrease the drug-death rates for all groups.

Overall, analyzing drug-related mortality trends by race and place provided important insights on how all-drug mortality and opioid-related mortality trends varied between 2003-2018 for Blacks and Whites based on their metropolitan status. While some information from existing literature helped to illuminate factors associated with the racial and metropolitan based differences observed in the drug-related mortality trends, many questions remain. For instance, did patterns of drug use by race and metropolitan status vary accordingly with the patterns of drug mortality observed between 2003-2018? Or, did differences in self-reported access to and source of drugs by race and metropolitan status, mirror the observed differences in drug-mortality? To ascertain whether trends in drug use may inform some of the remaining gaps, I next examined trends and patterns in drug use by race and place, from 2003-2018.

Drug-use trends by race and place, 2003-2018

In contrast to the significant increases in drug-related mortality rates seen across race and metro categories between 2003-2018, self-reported drug use rates did not vary as greatly in magnitude over this time period. Rates of reported illicit drug use, both at any point in the lifetime or in the past-year, increased slightly for both Blacks and Whites across metropolitan categories between 2003-2018. Furthermore, there were no significant differences in the rate of increase by metropolitan categories, for neither Whites nor Blacks. The explanation for the lack of increase in rates of illicit drug use between 2003-2018, compared to the significant increases in drug-related mortality during the same time period, may be found by considering the definition of this measure of illicit drug use. Here, illicit drug use is inclusive of the use of any type of illicit drug, many of which are not lethal and thus have extremely low mortality rates. Since the drastic increase in drug-related mortality between 2003-2018 was a measure of overdose deaths, resultant from the use of lethal drugs or the use of drugs in lethal amounts, measures of illicit drug use which include non-lethal drug use may conceal these differences. Additionally, the measures of both lifetime illicit drug use and past-year illicit drug use do not reflect the frequency of drug use. As such, they do not differentiate between one-time or

[4] This increase was significant for Blacks in large metro areas, but not significant for Blacks in small metro areas, due to some overlap in the 95% CIs between 2017-2018. This finding is outlined in detail in section 1.2 of the results.

experimental use, and regular use. Depending on the toxicity of the illicit drugs being used, frequency of use may impact the corresponding mortality risk.

While rates of illicit drug use did not increase throughout the time period in the same pattern as rates of drug mortality, there were some similar metropolitan-based trajectories. For Blacks and Whites, rates of lifetime illicit drug use and past-year illicit drug use were generally highest in large metro areas, closely followed by rates in small metro areas, and notably lowest in nonmetro areas. This points to metro-based similarities in drug use patterns across racial groups, whereby rates of illicit drug use in both large and small metro areas tend to exceed rates of use in small metro areas. Interestingly, rates of reported lifetime use of an illicit drug were consistently significantly higher for Whites than Blacks within each metro category, whereas reported rates of past-year illicit drug use did not vary significantly by race. Still, these findings do offer some insights on the metropolitan-based trends recounted earlier. Namely, that illicit drug use was found to be higher in metro areas than nonmetro areas for both Blacks and Whites, is consistent with findings on higher drug mortality in metro areas compared to nonmetro areas across race groups. This may support the findings from the literature, reported earlier in this thesis, on the higher availability of illicit drugs in metropolitan areas (M. Alexander, Barbieri, and Kiang 2017; Pacula and Powell 2018; S. Monnat 2019; Peters et al. 2019; Galea, Rudenstine, and Vlahov 2005).

What may provide more clarity on the observed trends in drug-related mortality, though, is an examination of the trends in opioid use between 2003-2018. Given that most overdose deaths during this time period were attributable to opioid-related drugs, use of opioid drugs may be more reflective of trends in opioid-related mortality. Unfortunately, since a measure of any opioid use was not available from the NSDUH until 2015, when the opioid epidemic reached its peak, analyses on opioid use were restricted to prescription pain reliever misuse, as it was available as a stable variable for the duration of the study period (2013-2018). Still, these data provide important insights on the trends in opioid-related mortality observed, particularly during the first phase of the opioid epidemic, which was characterized as the ‘prescription opioid’ phase. As such, trends in any lifetime misuse of a prescription pain reliever between 2003-2018 among Blacks and Whites based on their metropolitan categories were examined; these findings will be discussed next.

Rates of reported prescription pain reliever misuse are significantly higher for Whites in all metropolitan categories compared to Blacks, for the duration of the study period (2003-2018). Given that Blacks systematically experience barriers in access to prescription pain relievers, as reported earlier in this thesis, this finding is to be expected. That is, Blacks report lower rates of prescription pain reliever misuse because they have less access to them (Nicholson and Ford 2018; M. Alexander, Barbieri, and Kiang 2017; K. James and Jordan 2018; Hernandez et al. 2020). Second, there are distinct metro-based patterns between Blacks and Whites, in the trends in lifetime prescription pain reliever misuse. Among Blacks, there is no difference in reported rates of pain reliever misuse by metropolitan status (Figure 6). This suggests that the racial barriers in access to prescription pain relievers among Blacks hold true across metropolitan categories. In contrast, surprisingly, there are distinct metro-based disparities in prescription pain reliever misuse among Whites throughout the study period. Among Whites, reported rates of prescription pain reliever misuse are consistently higher among those in large and small metro

areas compared to those in nonmetro areas. Intuitively, this finding seems to contradict the trends on opioid-related mortality during the first phase of the opioid epidemic (2000s to 2010s), reported earlier in this thesis. To recall, during the first phase of the epidemic, when opioid-related overdose deaths were known to be driven by prescription opioids among Whites, opioid-related overdose mortality rates were similar across metro categories. Indeed, they were slightly higher in metro areas than nonmetro areas, but the disparity was very minimal (Figure 2). The findings in Figure 6, though, suggest that the similarities in opioid-related mortality rates may not have been due to similar rates of prescription pain reliever misuse across metropolitan categories. Rather, this conflicting finding may be best explained by the lower availability of drug treatment facilities, reduced access to health care, and the lower utilization of drug abuse services, in nonmetropolitan areas (Peters et al. 2019; Lenardson, Gale, and Ziller 2016; Borders and Booth 2007). For example, Faul et al. (2015) reported that naloxone, the leading medication used to treat opioid complications including overdose, is less often administered in rural areas. This is because in many rural areas, emergency medical technicians (EMTs) are more common medical service providers, and in many states, EMTs are prohibited from administering naloxone. Thus, reduced access to care and medical interventions in nonmetropolitan areas may explain why rates of opioid-related mortality in these areas were similar to rates in metropolitan areas between 2003-2013 (Figure 2), despite lower use (Figure 6).

Notably, there is a sharp and distinctive decrease in rates of prescription pain reliever misuse for Blacks and Whites in all metro categories in 2015 (Figure 6). Consequently, rates of prescription pain reliever misuse in 2017-2018 are notably lower than they were in 2003-2004. This trend may reflect the decrease in availability of prescription opioids, as a result of supply-side interventions aimed to combat the worsening opioid epidemic (Pacula and Powell 2018; M. J. Alexander, Kiang, and Barbieri 2018; M. Alexander, Barbieri, and Kiang 2017; Guy 2017; K. James and Jordan 2018). While the implementation of these measures slowly began in 2010, Guy (2017) found that the most significant decreases in annual prescribing rates and high dose prescribing rates were in 2015, compared to years prior. Thus, the pattern of decreasing rates of reported prescription opioid use seen after 2015, and higher spikes in opioid-related mortality driven by illicit and synthetic opioids, are consistent with other research findings (Han et al. 2015; Hernandez et al. 2020).

Clearly, analyzing the trends in prescription pain-reliever misuse between 2003-2018 helped to inform many of the corresponding trends in opioid-related mortality presented earlier in this thesis (Figure 2), particularly those during the first phase of the epidemic (2000s to 2010s). Additionally, they demonstrated the metro-based similarities in drug use and drug mortality, particularly for Blacks. Specifically, that among Blacks, both drug-related mortality and illicit drug use rates are consistently lowest among in nonmetro areas. In fact, drug-related mortality and illicit drug use rates among Blacks in nonmetro areas are lower than the rates of all other subgroups. While some prior studies have previously reported similar findings, namely that rural Black adolescents had the lowest self-reported drug use and that rural Blacks had the lowest opioid-related mortality in recent years, they were not reflective of trends over time (Van Gundy 2006; Rigg, Monnat, and Chavez 2018; Keyes et al. 2014). My results add, then, that these findings are reflective of long-standing patterns of drug-use and drug mortality among rural Blacks, which cannot just be explained by barriers in access to prescription opioids. Moreover, since rural Blacks may actually experience heightened risks for drug-use, these findings are

certainly positive yet paradoxical (Jensen 2019; Rigg, Monnat, and Chavez 2018; Keyes et al. 2014; Gong et al. 2019; Slack and Jensen 2002; Murray et al. 2006).

Importantly, this further underscores the importance of considering metropolitan differences in conjunction with racial differences in drug use outcomes, and that it may not be sufficient to consider one category alone. Evidently, pairing data on drug use with drug-related mortality by race and metropolitan status, and comparing them against each other, leads to important insights on the trends observed. From the literature, details about the availability of drugs in the different metropolitan areas helped to provide context to some of these findings. To build upon this, the final analyses in this thesis explored how the source of drugs and access to drugs varied by race and place.

Recent patterns in access to and source of drugs by race and place, 2016-2018

At first glance, the initial findings regarding drug access appear to offer a contradiction. While reported rates of illicit drug use (Figure 4) and prescription pain reliever misuse (Figure 6) are generally lower for Blacks in all metro categories than Whites, Blacks reported a significantly higher likelihood of being randomly approached by a person selling drugs within the past month in all metro categories compared to their White counterparts (Figure 7). For example, among Whites, the percentage of those who reported experiencing a random offer of drug purchase was 4.9% in large metro areas compared to 10.5% for Blacks in large metro areas. What is interesting is that there was insignificant difference by metropolitan status for Whites (4.9% in large metro, 4.7% in small metro, and 4.1% in nonmetro), evidenced by the significant overlap of the 95% confidence intervals of the estimates (Figure 7). In contrast, the difference by metropolitan status for Blacks appears to be significant (10.5% in large metro, 7.8% in small metro, and 6.0% in nonmetro) (Figure 7). It is reasonable to conclude that there is indeed a difference in this measure of drug access for Blacks compared to Whites, and that there is also a metro-based difference within Blacks but not Whites. However, these results do not explain the apparent contradiction of higher reported access among Blacks compared to Whites, yet lower reported illicit drug use.

To make sense of this inconsistency, it is necessary to clearly understand the variable being measured. Ultimately, this measure of drug access is solely a measure of ‘street access’ to drugs. The variable asked whether respondents were approached by some random person selling an illegal drug in the past month, and in this specific case the disparity between Blacks and Whites is significant. That is, Blacks report having more access to illicit drugs from strangers or drug dealers compared to Whites. But, since rates of both illicit drug use and prescription pain relief misuse are generally lower for Blacks in all metro categories than Whites (Figures 3 and 5), it is more likely that these results speak to different racial patterns of drug access, rather than the actual perceived availability of drugs. This supports ethnographic research on drug accessing behaviours between Blacks and Whites which explains that drug dealing among Whites is more covert, while ‘publicly visible’ drug-dealing is more concentrated in socially and economically deprived Black communities (Floyd and Brown 2013; Crawford 2016; Jewell 2012; Singer 2017). Additionally, this may explain why this measure of drug access corresponded to metro-based patterns in illicit drug use among Blacks but not Whites. As seen, illicit drug use was also reported to be higher for Blacks in large and small metro areas, where the reported perception of

drug accessibility was also higher, than nonmetro areas. This suggests that level of 'street access' to drugs may inform on drug use patterns among Blacks, but not Whites. That being said, while Blacks may report having more random opportunities to obtain drugs than Whites, this does not necessarily predicate higher levels of use. Other factors, such as economic pressures, may disproportionately drive Blacks to be involved with drug sale and possession, resulting in higher opportunities for access and distribution without personal use (Donnelly et al. 2020; Rosenberg, Groves, and Blankenship 2017). This may explain why although Blacks in all metropolitan categories are more likely to be approached by a drug dealer than Whites, they may still report lower rates of illicit drug use. Interestingly, findings on the self-reported difficulty of obtaining drugs did not reveal any significant differences by race or metropolitan status (Appendix 1). This may support the explanation that while Whites and Blacks generally access drugs in different ways, this may not be related to the perceived availability of drugs. To this extent, differences in measures of access to drugs may inform on some metro-based patterns of drug use and drug mortality, but they are not enough to paint a clear picture.

Finally, in order to confirm whether differences in drug sources by race and metropolitan category may correspond to trends in drug use, analyses were conducted to examine the differences in reported source of drugs. These analyses were broken down by type of drug (i.e., pain relievers, stimulants, tranquilizers and sedatives) and possible drug sources (i.e., friend or relative, physician or health care, or another unspecified source). As a result of these numerous breakdowns, the remaining sample sizes were extremely small and as such it was not possible to identify reliable trends, evidenced by the large error bars (graphs presented in Appendix 1). Still, these findings were interpreted, but it is important to keep this limitation in context. Ultimately, no significant differences were found in self-reported drug source, either by race or place (Appendix 1). In fact, across metropolitan categories, Blacks and Whites who misused pain relievers, or used stimulants, tranquilizers, or sedatives, were equally likely to report obtaining them from similar sources. Both Blacks and Whites in all metro categories who reported misusing pain relievers most commonly cited obtaining them from a friend or relative, followed by a doctor or other health care provider. Further, in cases where respondents cited a friend or relative as their source for prescription pain relievers, those friends and relatives overwhelmingly cited their own source as a doctor or health care provider. This is important because it adds an additional layer to the to the traditional narrative that exists on prescription opioid misuse by race, which is that while Whites may have more access to prescription opioids than Blacks, due to systemic barriers in access to prescription pain relief (K. James and Jordan 2018; Nicholson and Ford 2018), Blacks who do misuse prescription opioids are actually equally likely as Whites to have obtained them from a physician source. This is demonstrated in Huhn et al. (2018) who found that rates of treatment seeking for opioid use disorder among older Black males were increasing and that they were more likely to get their drugs from physician sources. Similarly, when examining metropolitan status, Wang et al. (2014) also found that there was no difference in reported prescription drug source between rural and urban areas. Alternatively, this may also be due in part to the small sample sizes for analysis of drug source by drug class. This limitation, as well as the other limitations within this thesis, will be detailed next.

LIMITATIONS

There are limitations within this thesis that must be appropriately addressed to ascertain the implications they may have on the conclusions that can be drawn. One important limitation is in the differences in the classification of the three metropolitan categories (large metro, small metro, and nonmetro) between the two datasets used, and compared, on drug mortality and drug use outcomes. Specifically, and as previously outlined, the CDC drug mortality data used the 2013 NCHS scheme to classify counties' metropolitan status, whereas the NSDUH data used the RUCC scheme. Furthermore, for NSDUH years 2003-2014, the 2003 version of the RUCC scheme was used; in contrast, the updated 2013 version of the RUCC was used for NSDUH years 2015-2018. Fortunately, it was possible to use the 2013 NCHS scheme for the duration of the study period for the drug mortality data and maintain continuity in this measure. The primary difference to understand between the two different schemes is that because of differences in their definitions of metropolitan categories, some counties may have been coded differently across the two schemes. For the RUCC scheme, the 2003 and 2013 versions did not result in any changes to the definition of metropolitan codes, but rather in the reclassification of some counties metropolitan status. Ultimately, since the analyses of this thesis are at the population-level rather than county-level, the implications of these differences impact the list of counties included within the three designated metropolitan categories (large metro, small metro, and nonmetro). That is to say, the list of counties included in these categories may be different between the schemes. In turn, this could impact the kind of parallels that can be drawn between drug mortality and drug use within each metropolitan category, and of drug use over time. However, it was possible to examine whether these differences should be considered significant by conducting a comparison of the percentage of counties coded differently between the NCHS and RUCC schemes. The results of these analyses are detailed in the Methods section, and further detailed in Appendix 2. The data analyses favorably revealed that only 5% of counties were coded differently between the NCHS and RUCC schemes. Further, these counties represented less than 4% of the population in 2010. Therefore, despite the initial differences observed between the schemes, the analyses conducted confirmed that the large majority of the counties' metropolitan statuses were coded equivalently, thus allowing for reasonable comparisons to be drawn between the findings on drug mortality and drug use within each metropolitan category.

Another limitation that arose from making use of two datasets to draw conclusions about drug death and drug use outcomes by race and metropolitan status is the difference in scope of representation between the two sets. The CDC drug mortality data is national level data and is comprised of all filed deaths for Blacks and Whites in the three metropolitan categories. Thus, the data is comprehensive and generally reflective of actual drug overdose death rates based on race and metropolitan status. In contrast, the drug use data from the NSDUH was self-reported survey data. Though this data is considered nationally representative, it is undoubtedly subject to the known limitations of survey data, such as self-selection bias, social desirability bias, and recall bias, particularly in the context of self-reported drug use. While these factors are somewhat unavoidable, they may affect the representativeness of the data. The impact of these limitations in the context of this thesis will be discussed below.

One important feature of the NSDUH data which may affect its measures of drug use by race and metropolitan status is in the exclusion criteria of the survey. The target population of the

NSDUH is the civilian, noninstitutionalized population of the US. This thereby excludes individuals in institutional group quarters (e.g. hospitals, prisons, treatment centers etc.), homeless people not living in shelters, and members of active-duty military. These excluded groups make up approximately 3% of the US population (NSDUH 2017). While this represents a small percentage, it is possible that they have differential rates of drug use compared to the rest of the population, leading to a potential underestimation of drug use rates by the NSDUH. Further, there are large disparities in incarceration rates by race due to drug-related offences, particularly possession and dealing, whereby Blacks are disproportionately arrested and sentenced (Donnelly et al. 2020; Kramer, Han, and Booth 2009; Scully 2010). This is important because by excluding institutional group quarters, the NSDUH data may lead to an underestimation of some drug use measures among Blacks, particularly with regards to drug access measures. Alternatively, it may not imply differences in rates of drug use; as Donnelly et al. (2020) write, "arrests loosely correspond with drug involvement among individuals". Still, it leaves potential differences in rates of drug use and access unaccounted for. In addition, racial and geographic disparities affect access to treatment facilities, retention and service utilization. This may result in the overrepresentation of urban White drug users in treatment centers and thus their differential exclusion from the survey data (Acevedo et al. 2012; Niv, Pham, and Hser 2009; Pearlman 2017; Donnelly et al. 2020). While it is currently impossible with the data available to directly assess the impact of the exclusion criteria of the NSDUH, it is important to acknowledge these potential limitations when interpreting the findings.

Other limitations that arise from the survey design aspects of the NSDUH data include the probability of recall bias and social desirability bias. For the duration of the study period (2003-2018), the average annual response rate was 73%, which is relatively low (range 66.6-77.1%). In the 2018 NSDUH, it was reported that 23.1% of sampled individuals refused to interview, 5.4% were not available or never at home, and 4.9% did not participate for other reasons (physical or mental incompetence or language barrier) (NSDUH 2018). However, while the average annual response rate is low, the NSDUH does implement design features to maximize response rates and minimize resultant bias (NSDUH 2018). Further, the NSDUH cites a study which matched 1990 census data to 1990 NSDUH survey responses, and which found that populations with low response rates did not necessarily have higher drug use rates (SAMHSA 2019). Additionally, to examine the validity and reliability of NSDUH data, The Reliability Study was conducted and embedded in the 2006 NSDUH, and found that NSDUH variables measuring lifetime substance use had almost perfect reliability, and past-year use had substantial agreement (SAMHSA 2010). As such, it is reasonable to conclude that the impact of these biases on the findings is minimal.

One final limitation to note is the inevitable sample size constraints, of certain subgroups, that result when examining drug use outcomes overlaid with both race and three categories of metropolitan status. For example, the sample size of Blacks in nonmetropolitan areas was consistently very small; this was especially heightened when examining specific drug-use measures, such as source of drugs by drug type. To counter this, data on time trends in drug use were pooled over two-year periods. While this helped to better identify trends over time by race and metropolitan status for most drug use measures, it made it impossible to identify year-specific changes in drug trends, and to compare drug mortality and drug use outcomes by year. Similarly, it made it difficult to determine any trends in analyses of source of drugs by race and

metropolitan status, as this resulted in many broken down subgroups leaving sample sizes too small to identify trends. Still, pooling the data was necessary to present an accurate picture of the trends in drug use outcomes by race and metropolitan status over time.

CONCLUSIONS AND FUTURE DIRECTIONS

In conclusion, by combining data on drug-related mortality, drug use, and access to and source of drugs, this thesis offered important insights on how drug use and mortality outcomes varied between Blacks and Whites in the United States based on their metropolitan status, between 2003-2018. Doing so revealed important differences in both drug use and drug-related mortality between subgroups, which are often masked by statistics at the national level, or by only one category of analysis. Such statistics often obscure the reality of changes in patterns of drug use and mortality along the intersection of race and metropolitan status and can consequently leave vulnerable subgroups of the population further ignored. Still, due to the limitations in the scope of the thesis, and some important methodological limitations outlined above, several gaps remain in our understanding of the reasons behind these complex differences. Furthermore, the findings presented in this thesis are entirely descriptive, and do not purport to suggest causal relationships between race, metropolitan status, and drug death or drug use outcomes. Future research could build upon these gaps to further improve our understanding of the relationship between race, metropolitan status, and drug use and mortality outcomes.

Additional descriptive analyses could fortify our understanding of the trends in drug-related mortality and drug use by race and metropolitan status. For instance, opioid-related mortality and opioid use could be examined by opioid type. That is to say, opioid-related mortality could be separated into mortality from prescription opioids, synthetic opioids, and illicit opioids; then, these trends can be compared by race and metropolitan status. These findings would serve as evidence for many of the suggested explanations described above. Similarly, since analyses of opioid use in this thesis were limited to prescription pain reliever misuse, they could be expanded to include heroin use, and reported use of other synthetic and illicit opioids. In the same way, trends in illicit drug use and all-drug mortality could be broken down by drug type, to separate patterns in use of and mortality from lethal illicit drugs versus non-lethal drugs. Such analyses would also help inform on differences in the types of drugs used between metropolitan categories and race groups. Beyond this, analyses of drug use and drug mortality outcomes could be examined age distribution. If age distribution varies differentially by race and/or metropolitan status, this may be associated with some of the observed differences in drug use and drug mortality. While these analyses were outside the scope of this thesis, pursuing them would be fruitful in contributing to our understanding of the differences in drug use and drug mortality outcomes associated with the intersection of race and metropolitan status.

Alternatively, empirical methods to test the relationship between race, metropolitan status, and other mediating factors, on drug use and drug mortality outcomes, could also provide important explanations into some of the variations observed. Ultimately, both race and metropolitan status are complex constructs of interconnected factors which work together to influence health outcomes. That is to say, it is not race or place of living alone which influence drug use and drug mortality outcomes. Rather, it is the connectedness of these categories to other individual, contextual, environmental, and systemic factors, which ultimately affect drug use

outcomes. Therefore, future analyses could investigate the association of these factors and other moderating variables. This could include education, employment, household composition, self-rated health, mental health measures, perceived discrimination, neighbourhood segregation, access to care, social capital etc. Future research could capitalize on some of the sociodemographic variables included in the NSDUH to investigate whether these factors mediate the relationship between race and metropolitan status, and drug use outcomes. Similarly, analyses of drug-related mortality could include measures of the aforementioned characteristics at the county level, as well as county-level measures of drug availability and opioid prescribing, to investigate their impact on the relationship between race and metropolitan status, and drug mortality outcomes. Ultimately, the relationships between race, metropolitan status and drug use outcomes are complex, and influenced by an interconnected network of factors. As such, future research should be guided by acknowledgement of these intricacies, and a commitment to their consideration. Indeed, the findings of this thesis highlight an urgency for nuance to be applied when studying drug-related mortality and drug-use outcomes, so that the narratives and healthcare policies developed are comprehensive and therefore equitable in their treatment and efficacy.

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APPENDIX I: ADDITIONAL FIGURES

Table 2

Table 2. Patterns of Change in All-Drug Overdose Mortality between 2003-2014 and 2015-2018

		Crude death rates			AD	PC	AAPC	AD	PC	AAPC
Metro status	Race	2003	2015	2018	**2003-2015**			**2015-2018**		
Large Metro	White	8.19	19.30	24.59	11.11	136%	**7.52%**	5.29	27%	**10.11%**
	Black	9.46	13.13	23.45	3.67	39%	**3.28%**	10.32	79%	**20.48%**
Small Metro	White	8.07	18.50	22.95	10.43	129%	**7.24%**	4.45	24%	**9.05%**
	Black	5.71	10.56	18.00	4.85	85%	**24.64%**	7.44	71%	**102.02%**
Nonmetro	White	7.16	16.06	18.26	8.90	124%	**7.10%**	2.20	14%	**5.82%**
	Black	2.83	6.69	10.13	3.86	137%	**9.06%**	3.44	51%	**17.36%**

AD = Absolute Difference; PC = Percent Change; AAPC = Annual Average Percent Change

Source: CDC Wonder. Years 2003, 2015, 2018.

All multiple cause of death (MCD) unintentional drug overdose deaths; ICD codes X40-X44.

Figure 8

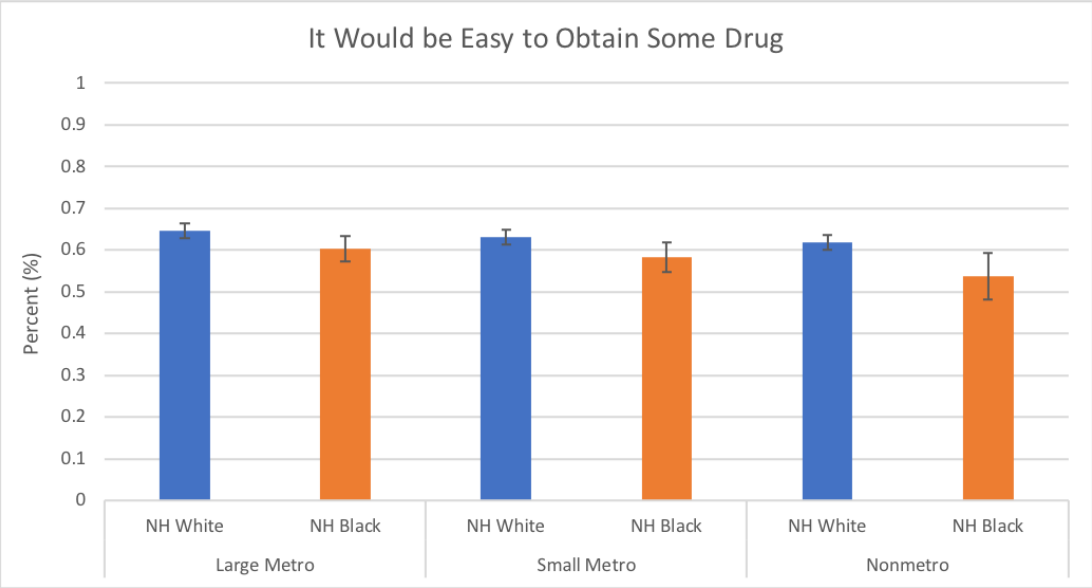

Fig 8. Self-reported perception of difficulty of obtaining some drug among Whites and Blacks, based on their metropolitan status. Data are pooled for years 2016-2018. Percentages are reported; weighted. Error bars represent 95% CI.
Data source: National Survey for Drug Use and Health (2016-2018).

Figure 9

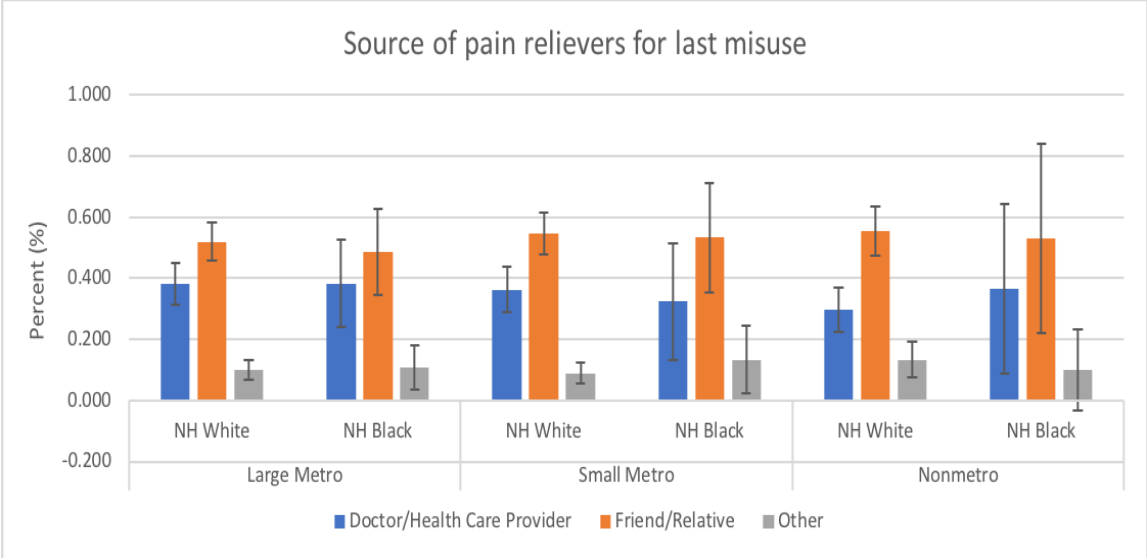

Fig 9. Reported source of pain reliever for last misuse among Whites and Blacks, based on their metropolitan status.
Among respondents who reported misusing a pain reliever at some point, what was the source of the pain reliever?
Possible sources: doctor/health care provider; friend or relative; other.
Data are pooled for years 2016-2018. Percentages are reported; weighted. Error bars represent 95% CI.
Data source: National Survey for Drug Use and Health (2016-2018).

Figure 10

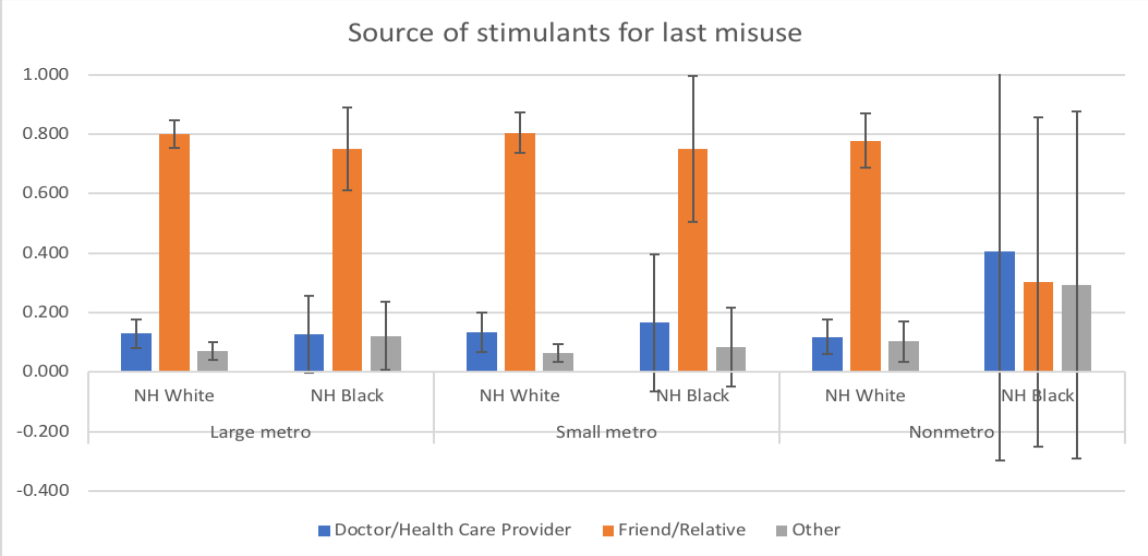

Fig 10. Reported source of stimulants for last use among Whites and Blacks, based on their metropolitan status.
Among respondents who reported using a stimulant at some point, what was the source of the stimulant?
Possible sources: doctor/health care provider; friend or relative; other.
Data are pooled for years 2016-2018. Percentages are reported; weighted. Error bars represent 95% CI.
Data source: National Survey for Drug Use and Health (2016-2018).

Figure 11

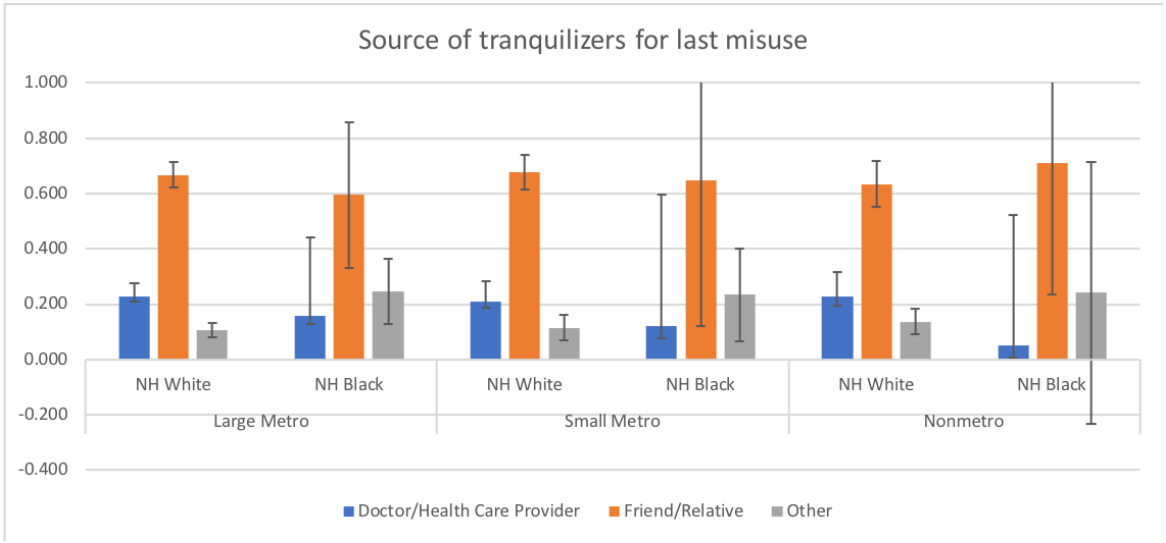

Fig 11. Reported source of tranquilizers for last use among Whites and Blacks, based on their metropolitan status.
Among respondents who reported using a tranquilizer at some point, what was the source of the tranquilizer?
Possible sources: doctor/health care provider; friend or relative; other.
Data are pooled for years 2016-2018. Percentages are reported; weighted. Error bars represent 95% CI.
Data source: National Survey for Drug Use and Health (2016-2018).

Figure 12

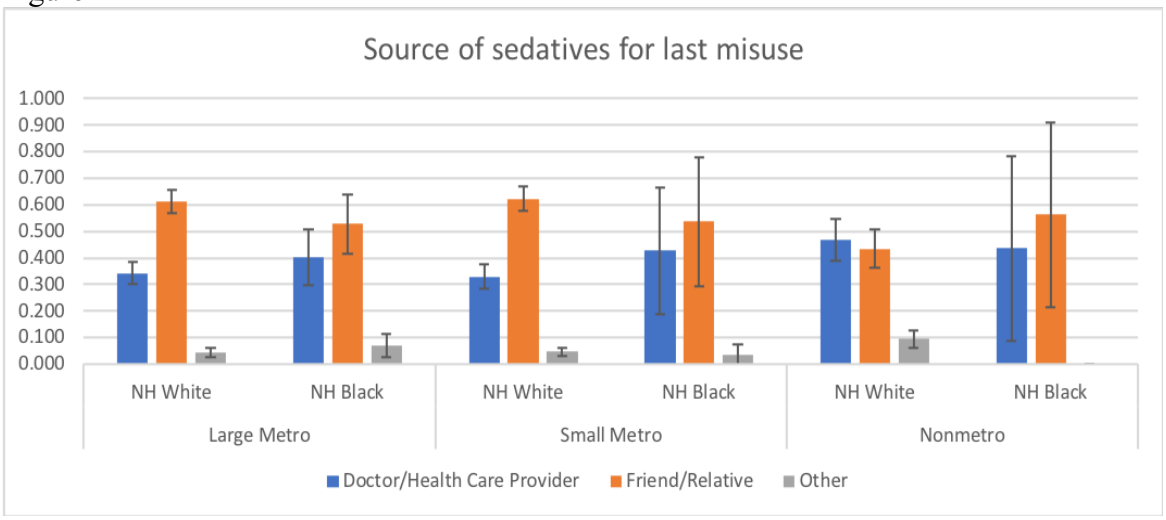

Fig 12. Reported source of sedatives for last use among Whites and Blacks, based on their metropolitan status.
Among respondents who reported using a sedative at some point, what was the source of the sedative?
Possible sources: doctor/health care provider; friend or relative; other.
Data are pooled for years 2016-2018. Percentages are reported; weighted. Error bars represent 95% CI.
Data source: National Survey for Drug Use and Health (2016-2018).

APPENDIX 2: COMPARING THE RUCC AND NCHS

This appendix compares in detail the NCHS and RUCC coding schemes for counties' metropolitan status. It first presents the full list and definitions of county metropolitan categories in each coding system (NCHS = 6 categories; RUCC = 9 categories), and then it presents aggregated 3-level categories for each coding system (1 = large metropolitan; 2 = small metropolitan; 3 = nonmetropolitan). Then, it identifies the list of counties which have been coded differently between the two systems. First, the 2013 NCHS is compared with the 2003 RUCC. Next, the 2013 NCHS is compared with the 2013 RUCC, an updated version which was used for NSDUH years 2015-2018. It is important to note that the definition of counties metropolitan categories in the 2003 and 2013 versions of the RUCC are identical; however, the updated 2013 RUCC recoded counties metropolitan categories based on the 2010 census population, whereas the 2003 RUCC coded counties metropolitan categories based on the 2000 census population. As such, lastly, the 2003 and 2013 versions of the RUCC are also compared. Results show the number and percentage of counties coded differently between the two systems, and the percentage of the population these counties represent.

NCHS scheme
https://www.cdc.gov/nchs/data/series/sr_02/sr02_166.pdf
Metropolitan counties:

- 1 = Large central metro: counties in MSAs of 1 million population that: 1) contain the entire population of the largest principal city of the MSA, or 2) are completely contained within the largest principal city of the MSA, or 3) contain at least 250,000 residents of any principal city in the MSA.
- 2 = Large fringe metro: counties in MSAs of 1 million or more population that do not qualify as large central Medium metro counties in MSA of 250,000-999,999 population.
- 3 = Medium metro: counties in MSAs of populations of 250,000 to 999,999.
- 4 = Small metro counties are counties in MSAs of less than 250,000 population.

Nonmetropolitan counties:

- 5 = Micropolitan: counties in micropolitan statistical areas.
- 6 = Noncore: counties not in micropolitan statistical areas.

NCHS collapsed 3-level

- 1 = large metro (1 large central metro & 2 large fringe metro)
- 2 = small metro (3 medium metro & 4 small metro)
- 3 = nonmetro (5 micropolitan & 6 noncore)

RUCC scheme
https://www.ers.usda.gov/data-products/rural-urban-continuum-codes/documentation/
*NB: The definitions of the metropolitan categories listed below apply to the 2003 and 2013 RUCC schemes.
Metropolitan counties:

- 1 = Counties in metro areas of 1 million population or more.
- 2 = Counties in metro areas of 250,000 to 1 million population.
- 3 = Counties in metro areas of fewer than 250,000 population.

Nonmetro counties:

- 4 = Urban population of 20,000 or more, adjacent to a metro area.
- 5 = Urban population of 20,000 or more, not adjacent to a metro area.
- 6 = Urban population of 2,500 to 19,999, adjacent to a metro area.
- 7 = Urban population of 2,500 to 19,999, not adjacent to a metro area.
- 8 = Completely rural or less than 2,500 urban population, adjacent to a metro area.
- 9 = Completely rural or less than 2,500 urban population, not adjacent to a metro area.

RUCC collapsed 3-level

- 1 = large metro (1: counties in metro areas of 1 million population or more)
- 2 = small metro (2&3: counties in metro areas with population less than 1 million)
- 3= nonmetro (4-9: nonmetropolitan counties)

Analyses:

1) Comparing NCHS 2013 & RUCC 2003

Summary:

- To recall, the NCHS 2013 was used for the entirety of the CDC data study period (2003-2018); the 2003 RUCC was used for NSDUH years 2003-2014.
- There are 3149 counties in total, but only **3142** jointly defined. 7 are missing in the 2003 RUCC (present only in 2013 NCHS). **2981** of the 3142 counties are coded identically, and **161** counties are coded differently.
- The total population size of the counties that were coded differently between the two schemes is:
    - 9,428,828/281,421,906 = **3.35%**

2) Comparing NCHS 2013 & RUCC 2013

Summary:

- To recall, the NCHS 2013 was used for the entirety of the CDC data study period (2003-2018); the 2013 RUCC was used for NSDUH years 2015-2018.
- 3149 counties total; 3143 jointly defined; 6 missing in 2013 RUCC (present only in 2013 NCHS)
- **3139** coded identically
- **4** coded differently
- The total population size of the counties that were coded differently between the two schemes is:
    - 988,938 / 312,471,327 = **0.32 %**

3) Comparing RUCC 2013 & RUCC 2003

Summary:

- To recall, the 2003 RUCC was used for NSDUH years 2003-2014; the 2013 RUCC was used for NSDUH years 2015-2018.

- There are 3147 counties in total, but only **3138** are jointly defined. **2980** of the 3138 are coded identically between both versions of the RUCC, and **158** are coded differently. **5** counties are present in 2013 version but NOT in 2003 RUCC, and **4** counties are present in the 2003 version but NOT in 2013 RUCC. These changes largely reflect renaming and redefining of county borders. The **9** counties referred to are listed below.

List of counties coded differently:

- Hoonah-Angoon Census Area, AK; Petersburg Census Area, AK; Prince of Wales Hyder Census Area, AK; Skagway Municipality, AK; Wrangell City and Borough, AK; were present in 2013 RUCC, not 2003 RUCC
- Prince of Wales-Outer Ketchikan Census Area, AK; Skagway-Hoonah-Angoogn Census Area, AK; Wrangell-Petersburg Census Area, AK; Clifton Forge City, VA; were present in 2003 RUCC, not 2013 RUCC.