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Embodiment of Carceral Violence: Solitary confinement, Extreme Heat, and Self-Injury in Deep South Prisons

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Embodiment of Carceral Violence: Solitary confinement, Extreme Heat, and Self-Injury in Deep South Prisons

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An abstract of a dissertation submitted to the Faculty of the James T. Laney School of Graduate Studies of Emory University in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Behavioral Sciences and Health Education 2023

Abstract: Embodiment of Carceral Violence: Solitary confinement, Extreme Heat, and Self-Injury in Deep South Prisons

This dissertation integrates constructs and principles from ecosocial theory of disease distribution, carceral geography, and theories of dehumanization to examine how different forms of carceral violence, solitary confinement and extreme heat, become embodied to shape vulnerabilities to different manifestations of self-injury. Together, these studies build upon an emerging body of scholarship and draw attention to overlapping public health problems arising at the intersection of mass incarceration, an escalating overdose crisis, and environmental calamities due to anthropogenic climate change.

Aim 1 explores possibility that power structures of dehumanization within spaces used for solitary confinement operate as a pathway of embodiment that increases vulnerability to self-injury among people with SMI, and calls attention to punishments, beyond social isolation, that prison staff inflict upon people in solitary confinement as mediating vulnerabilities to self-injury among people diagnosed with serious mental illnesses.

Aim 2 qualitatively examines the lived-experiences of solitary confinement among formerly incarcerated people who use drugs to develop a constructivist-grounded theory of the potential mechanisms through which this carceral practice may create and shape vulnerability to drug-related overdose.

Aim 3 is a longitudinal panel study that explores associations of extreme heat, solitary confinement, and an indicator of suicidality among incarcerated adult men in the Louisiana prison system.

The knowledge generated from these studies bolsters a body of evidence connecting solitary confinement and extreme heat to psychological harm and self-injury, while bringing into focus distinct public health and human rights issues for future research, arising in the entanglements of mass incarceration, an escalating overdose crisis, and environmental calamities created by anthropogenic climate change. These studies shed light on several important avenues for applying ecosocial theory to expose and address the effects of carceral systems on health outcomes, at multiple social-ecological levels, to help convey the collateral calamities likely to arise from interplays between the climate crisis, overdose epidemic, and mass incarceration.

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Chapter 1. Introductory Literature Review

Mass incarceration as a socio-structural driver of health inequities

Mass incarceration is among the most pressing civil rights, human rights, and social justice issues in modern history. The mass incarceration era is broadly defined as a system of retributive sentencing laws, prosecutorial policies, and policing practices that resulted in a forty-year stretch of sustained growth in the nation's incarcerated population since the 1970s(Clear & Frost, 2015; Garland, 2001; Loï Wacquant, 2017; Western & Muller, 2013). Today, with 2.1 million people behind bars, the United States(US) incarcerates more of its population than any other nation. While comprising 5 percent of the global population, the U.S. accounts for a quarter of the world's prisoners (Sawyer & Wagner, 2022; Travis, Western, & Redburn, 2014). Racial inequities--rooted in and shaped by sociopolitical, geographic, and economic aftermaths of slavery, labor exploitation and racial discrimination— pervade every corner of the nation's carceral system (Alexander, 2011; Hinton & Cook, 2021; H. A. Thompson, 2010a, 2010b; Loïc Wacquant, 2002b). Indeed, the rate of imprisonment among Black adults is currently about 5.1 times the rate of whites (Nellis, 2016). The lifetime odds of incarceration are by far the greatest for Black men; for example, one study found that black men born in 2001 have a 32% chance of spending time in prison during life, a Latino male has a 17% chance, while a white male has a 6% chance (B. Pettit & Western, 2004).

Since the 1970s, the prison population in the U.S. has expanded to such a degree that mass incarceration is recognized as a socio-structural driver of health inequities(D. H. Cloud, Garcia-Grossman, Armstrong, & Williams; D. H. Cloud, Parsons, & Delany-

Brumsey, 2014b; Wildeman & Wang, 2017). A growing body of research links mass incarceration to inequitable distributions of disease, despair and death along lines of race and ethnicity, class, gender, and geography (D. H. Cloud, Bassett, Graves, Fullilove, & Brinkley-Rubinstein, 2020; D. H. Cloud, Parsons, & Delany-Brumsey, 2014a; Wildeman & Wang, 2017). Broadly, this body of work shows that mass incarceration's toll manifests not only in the bodies of people who directly experience the "pains of imprisonment" (Crewe, 2011; De Viggiani, 2007; Sykes, Chavez, & Strong, 2021), but is further measured in the morbidity and diminished life expectancy (Nosrati, Ash, Marmot, McKee, & King, 2018; Sundaresh et al., 2021; Weidner & Schultz, 2019b)at multiple social-ecological levels, especially among Black, Indigenous, People of Color (Bovell-Ammon, Xuan, Paasche-Orlow, & LaRochelle, 2021; Wildeman & Wang, 2017).

Since 1980, the U.S. Department of Health and Human Services (HHS) has published a decennial report, Healthy People, as a blueprint for identifying nationwide priorities to improve population health, educating the public on scientifically established determinants of health, establishing metrics for monitoring progress, and motivating the mobilization of solutions. It was not until 2010, however, the year after the U.S. jail and prison population reached a historic peak after forty years of sustained growth, that HHS recognized incarceration as a determinant of health for the field(D. H. Cloud, Garcia-Grossman, Armstrong, & Williams). Public health is awakening to the ways through which mass incarceration operates as a socio-structural driver of health inequities (D. H. Cloud et al.; D. H. Cloud et al., 2014b). This is evident in the proliferation of research and special issues of prominent health journals devoted to linking carceral practices to diminished societal health(D. H. Cloud et al., 2020;

Massoglia & Remster, 2019), integration of police violence and mass incarceration into curriculums at schools of public health (McCauley, LeMasters, Behne, & Brinkley-Rubinstein, 2022; Przybyla & Kruger, 2022), and the chorus of public health scholars and activists are calling for decarceration and abolition as structural imperatives to address the intergenerational harms of carceral violence (D. H. Cloud et al., 2020)

Extant research suggests multiple, intersecting pathways through which exposures to incarceration contributes to excess morbidity and mortality at the individual, (Brinkley-Rubinstein, 2013; Haskins & McCauley, 2019; Massoglia & Remster, 2019; Schnittker & John, 2007) family,(Wildeman, Goldman, & Lee, 2019; Wildeman, Goldman, & Turney, 2018) county,(J. C. Thomas & Torrone, 2008; Weidner & Schultz, 2019a) neighborhood,(Clear, 2009; Hatzenbuehler, Keyes, Hamilton, Uddin, & Galea, 2015; Lynch & Sabol, 2004) and population levels (Wang, Macmadu, & Rich, 2019; Weidner & Schultz, 2019a; Wildeman, 2016; Wildeman & Wang, 2017). For example, at a system-level, hyper-incarceration of Black adults has resulted in a direct and collateral consequences that have ruptured the social and economic fabrics of communities by contributing to diminished educational opportunities (Haskins, 2014; Wakefield & Wildeman, 2013), fractured family structures (R. D. Lee, Fang, & Luo, 2013; Lopoo & Western, 2005; Western & Wildeman, 2009; Wildeman et al., 2019; Wildeman, Goldman, et al., 2018), unemployment and economic immobility (Apel & Sweeten, 2010; Clear, 2009; Kling, 2006; Lynch & Sabol, 2004; Pager, 2008; E. M. Pettit & Lyons, 2007; Segall, 2011; Sykes & Maroto, 2016; Wakefield & Uggen, 2010; Western, 2007; Western & Muller, 2013), housing insecurity (Moschion & Johnson, 2019; Muentner et al., 2019), restrictions or denial of social entitlements (Testa &

Jackson, 2019; Uggen, Manza, & Thompson, 2006), and disenfranchisement (Uggen et al., 2006). In turn, these consequences plausibly are among the forces underlying widened health inequalities along racial and socioeconomic lines. At a household level, for instance, incarceration of a parent or loved one can cause emotional distress, perpetuate economic insecurities, and increase vulnerabilities to homelessness, which are each associated with an array of negative health outcomes (R. D. Lee et al., 2013; Lopoo & Western, 2005; Wildeman et al., 2019; Wildeman, Goldman, et al., 2018).

Several studies link the titanic expansion of incarceration rates to premature mortality at a population level (Nosrati et al., 2019, 2021; Pridemore, 2014). One study found that had the U.S. incarceration rate remained at its 1973 level, then the infant mortality rate would have been 7.8 percent lower than it was in 2003, and disparity between black and white infant deaths nearly 15 percent lower (Wildeman, 2012). Another study suggests that each year spent behind bars accounted for a 15.6% increase in odds of death among formerly-incarcerated people; and that each year spent in prison was associated with a 2-year reduction in life expectancy (Patterson, 2013).

The built environments within carceral institutions are another pathway through which incarceration affects health (D. H. Cloud et al.; Haney, 2012). The millions of people who cycle through the nation's jails and prisons experience chronic health conditions, infectious diseases, substance use, and mental illness at much higher rates than the general population (D. H. Cloud et al.; Fazel & Baillargeon, 2011; Fazel, Hayes, Bartellas, Clerici, & Trestman, 2016; Rich, Wakeman, & Dickman, 2011). Overcrowding, violence, low quality medical care, social isolation, lack of educational programming, poor nutrition, and sexual victimization characterize the living conditions for many

behind bars(Haney, 2012). Exposure to such conditions of confinement can engender significant and lasting harms to the health of people during imprisonment and after their release (Crewe, 2011; Haney, 2006, 2012, 2015; Restum, 2005; Rocheleau, 2013; Sibley & Van Hoven, 2009; Wildeman, Fitzpatrick, & Goldman, 2018). Noxious living conditions in carceral settings have been described extensively in socio-legal scholarship, civil litigation, social justice activism, government investigations, and by incarcerated people themselves (Armstrong, 2014; Gibbons & Katzenbach, 2006; Mushlin, 2012). However, few public health researchers have applied theories and methods of social epidemiology and behavioral science to explore how features of prison environments, as forms of structural violence, shape the health and behavior of currently and formerly incarcerated people (Wildeman, Fitzpatrick, et al., 2018).

Defining Carceral violence

State-sanctioned violence (SSV) is broadly defined as government entities' reliance on violence to control or punish individuals and communities, and/or inaction, indifference, or willful ignorance to remedy human suffering that is produced from social, economic, and political conditions created and governed by state entities (Delgado, 2020). SSV is deeply embedded in the nation's criminal legal system, in a multitude of manifestations molded from structures of enslavement, racial oppression, and labor exploitation that underpin the foundations of capitalism (Delgado, 2020). A diverse and global body of research conveys the profound harms different forms of SSV on marginalized communities, damage that ripples far beyond the individuals who directly endure it (Pellow, 2021; Pulido, 2017).

For this dissertation, “carceral violence” refers to social, economic, political, and spatial components of the criminal legal system that culminate to create psychological and physiological injuries to the bodies, minds, and spirits of directly and indirectly impacted people and their communities. Thus, carceral violence can be viewed as a subdomain of structural violence and state-sanctioned violence that is specific to exertions of state power for purposes of punishment and control over people suspected, accused, convicted, or sanctioned for an action labeled as illegal or set of circumstances that is criminalized by the state. Police hyper-surveillance, brutality, and killings of Black and Brown communities, people who use drugs, those with mental health-related impairments, and other marginalized communities are prime examples of carceral violence at the front end of the criminal legal continuum(Bustamante, Jashnani, & Stoudt, 2019; Mitchell & Aronson, 2022).

Prisons are sites of structural violence, that routinely rely on various forms of state-sanctioned violence. As Carlton and Russel (2018) explain, “prison is a violent institution. . . predicated upon and sustained by the constant threat and occurrence of coercive violence. . . [and] enlivened by disciplinary power that reproduces terror, alienation but also resistance.” Furthermore, carceral violence involves state actors who produce extreme, as well as more mundane forms of dehumanization, in the sense that carceral violence is“ not exceptional or abnormal; it is routine… and further sustained and legitimated by the surrounding culture of institutional secrecy and punitiveness” (Carlton & Russell, 2018).

The studies in this dissertation focus on two forms of carceral violence that often operate in the deepest, most hidden spaces of the carceral state: solitary confinement

and extreme heat. Solitary confinement, as discussed throughout the entirety of this dissertation, is a form of SSV that is produced by and interwoven into structural forces that result in "social death" (Guenther, 2013)but bounded into lineages of enslavement, anti-Blackness, and systemic oppression of and "colonial violence" against marginalized people (Chavez, 2021). Extreme heat is an exposure that is particularly perilous for marginalized populations who are susceptible to heat-related stress due to underlying health issues, and less ability to access resources to mitigate such exposure. A growing body of research and civil litigation focuses on the implications of extreme heat or "thermal inequity" for incarcerated people on public health and human rights grounds (Colucci, Vecellio, & Allen, 2021; Golembeski, R Dong, & Irfan, 2021; Hess, 2023; Holt, 2015; Pellow, 2021; Skarha, Peterson, Rich, & Dosa, 2020). As discussed below, heat has been shown to positively influence incidence of various indicators of violence, as well as associated psychological and behavioral antecedents. Thus, as others have suggested, because environmental injustices are often produced from SSV, there is a clear rationale for considering extreme heat exposures, and the lack of policies and protocols for mitigating harms in carceral settings, as a form and product of carceral violence (Colucci et al., 2021; Pellow, 2021).

Chapter 1 reviews of what is known about the relationships between each of these types of carceral violence and self-injury. First, we define solitary confinement, provide a brief history of the practice in the U.S. prison systems, recap what is known about its effects on health and behavior, and more specifically, its influence on self-injury and overdose, and call attention to a growing social movement seeking to reduce or abolish it. We then turn to defining and contextualizing extreme heat as a form of

carceral violence that is a mounting threat to health and human rights, as the climate crisis unfolds in the wake of decades of mass incarceration in the United States. This review discusses extant literature linking heat to self-injury and suicidality in diverse settings, and highlights emerging scholarship examining health-related harms of extreme heat for incarcerated populations.

Solitary confinement in the age of mass incarceration

Solitary confinement is broadly defined as a penal practice characterized by continuous exposure to extreme social isolation, restrained movement and idleness, and material and sensory deprivation (Shalev, 2008). People are locked in a small cell about the size of a parking spot with a bed, toilet, sink, sometimes a window, and sometimes a small desk bolted to the wall, for 22 to 23 hours per day (Browne, Cambier, & Agha, 2011; Rhodes, 2004; Sakoda & Simes, 2021). Access to educational, vocational, and clinical programming is highly restricted or non-existent. Visits and phone calls with family are also restricted. Exercise is typically offered 3-5 times weekly for 30-60 minutes in caged enclosures, alone and without equipment. In many facilities, cells have a steel door with a small slot for delivering meals (D. H. Cloud, Drucker, Browne, & Parsons, 2015; Rhodes, 2004). People eat meals alone in their cells and lack opportunities to participate in meaningful congregate activities (Browne et al., 2011; Haney, 2018b; Rhodes, 2004). The physical environments people inhabit are perceptually monotonous and routine. The walls are usually bare and painted with dull colors, such as white or grey. Most units operate on a precise daily schedule for meals, showering, and recreation, which along with limited access to sunlight, can alter circadian rhythm and how people perceive the passage of time (O'Donnell, 2022). At

other times, people are subjected to adverse sensory stimuli that they are essentially powerless to control or avoid. These include aversive sights (e.g. fluorescent lights, people experiencing mental health emergencies); cacophonous sounds (e.g. slamming doors; blaring televisions; screaming) and odious smells (e.g. human waste, potent cleaning chemicals) (D. H. Cloud et al., 2015; Gallagher, 2014; Haney, 2018a).

Correctional institutions place people in solitary confinement for a variety of reasons, rationalized within multiple carceral logics. Most commonly, guards impose it on people accused or convicted of violating prison rules (Browne et al., 2011; D. H. Cloud et al., 2015; Haney, 2018b). It is often misconceived that solitary confinement is reserved for people who pose an imminent risk of violence. In reality, solitary confinement is used less frequently as a short-term and last resort response to a violent few, and more frequently as a punishment to control the masses (D. H. Cloud et al., 2015; D. H. Cloud, Kang-Brown, Jacob, Vanko, Elena, 2016). Prison officials also use it administratively to isolate people based on "classification factors", such the nature of a conviction and perceived or verified affiliation with a prison gang (Browne et al., 2011; Shames, 2015). Less commonly, people are placed in solitary after requesting protective custody status (i.e. they do not feel safe in the general population) (Browne et al., 2011). The durations of time that people spend in solitary confinement range from days to months to years to decades; and vary based on policies and practices of specific states and institutions.(Browne et al., 2011; Resnik et al., 2018). As Haney (2018) has noted, the definition of solitary confinement " turns less on the exact amount of in-cell time to which a prisoner is subjected and more on the deprivation of normal, direct, and

meaningful social contact and access to positive environmental stimulation"(Haney, 2018b).

People in solitary confinement.

At least 60,000-80,000 people (~4.5% of people incarcerated in U.S. state prisons) are held in solitary confinement on a given day (Resnik et al., 2018; School, 2020). Solitary confinement units hold a disproportionate share of people who are especially vulnerable in prison settings, such as those with a serious mental illness, traumatic brain injuries, cognitive or developmental disabilities, transgender persons, as well as adolescents and younger adults (Browne et al., 2011; Shames, 2015). People with serious mental illness, cognitive or developmental disabilities, racial, ethnic, sexual and gender minorities are all overrepresented in solitary confinement (Dellazizzo, Luigi, Giguère, Goulet, & Dumais, 2020; Pullen-Blasnik, Simes, & Western, 2021; Reiter et al., 2020).

Correctional facilities are among the largest providers of publicly-funded psychiatric services for people with serious mental illnesses (SMI) (Harcourt, 2007; Prins, 2014; Rich, Allen, & Williams, 2015). The prevalence of SMI is at least two to four times higher in state prisons than in the community (Prins, 2014). Yet, correctional institutions lack sufficient clinicians and therapeutic environments to meet the needs of this population. As a result, people with SMI are especially vulnerable to exploitation and victimization by other incarcerated people, and mistreatment by prison staff (Fellner, 2015). Correctional officers generally lack the training needed to recognize mental health symptoms, and often perceive behaviors stemming from psychiatric conditions as willful violations of prison rules, resulting in punishment and, sometimes,

violence(Pannell, Howells, & Day, 2003). People with SMI are also more likely to experience placement in long-term solitary confinement, where they are highly vulnerable to its harms.

Nurses, social workers, and case managers commonly consult with their patients at a cell door, often speaking through cracks, without privacy for confidential conversation (Ahalt, Rothman, & Williams, 2017b; Shalev, 2017). Moreover, clinicians working in solitary confinement units often face dual loyalties in their ethical obligations: advocate for one's patient who is experiencing torture or allegiance to one's employer (Ahalt, Rothman, & Williams, 2017a; Hurst, Castañeda, & Ramsdale, 2019). National surveys also report that younger adults, between the ages of 18 and 36, are also more likely to be housed in solitary confinement units than older adults (Resnik et al., 2018). Additionally, many of the 95 000 adolescents in adult jails and prisons are housed in solitary cells, either to protect them from being victimized by adults or as a result of often minor disruptive behavior (Browne et al., 2011; Shames, 2015).

In many systems, racial and ethnic minorities are overrepresented in solitary confinement units, while white people are underrepresented (Allen-Bell, 2011; Chavez, 2019; Pullen-Blasnik et al., 2021; Shaylor, 1998). A national survey conducted in 2015, found that while Black men comprised 40 percent of the total prison population among 43 states that responded, they constituted 45 percent of those in solitary confinement (Resnik et al., 2018). Black women are also disparately subjected to solitary confinement compared to white women. Recent surveys suggest that among 40 jurisdictions reporting data (38 states, the federal system, and the Virgin Islands), Black women comprised 24% of the total population of incarcerated women, but 41% of those in

solitary confinement (Resnik et al., 2018). Legal scholars and social scientists attribute these inequities to a range of factors, including implicit and explicit forms of racial bias among correctional officers and vaguely defined and inconsistently enforced disciplinary rules (Cochran, Toman, Mears, & Bales, 2018; Davis, 2001; Olson, 2016; Reiter, 2016; Keramet Ann Reiter, 2012; Shaylor, 1998). Others point to practices that prison officials use to categorize people as "gang-members" or "security-threat groups" (e.g. tattoos, clothing, political beliefs, social networks) as contributors to racialized inequities in solitary confinement practices (Allen-Bell, 2011). Historians and anthropologists point to legacies of corporal punishment and racialized violence against Black men and women that arose during slavery and evolved in the criminal legal system's use of labor exploitation after the Civil War namely convict leasing and chain gangs(Davis, 2001; Gottschalk, 2015; Reiter, 2016).

A Brief History of Solitary Confinement In The United States

Solitary confinement has been a part of the American penal system from the "birth of the prison to the rise of mass incarceration" (Rubin & Reiter, 2018). While its prevalence has waxed and waned, solitary confinement has persisted as part of the carceral landscape, even as the philosophical and sociopolitical premises undergirding state-sanctioned punishment shifted from periods grounded in rehabilitation to eras defined by retribution, in response to catalytic events in U.S. history, such as Emancipation, the Cold War, and the Civil Rights Movement.(Rubin & Reiter, 2018; Shalev, 2017). Below, is an abbreviated summary of distinct eras in solitary confinement's rise, fall, and reemergence of the past two centuries (D. H. Cloud et al.,

2015; Gottschalk, 2015; Haney, 2018b; Rubin & Reiter, 2018; Shalev, 2008; Wachtler & Bagala, 2013).

Silence and Solitude in the Pennsylvania System

Solitary confinement began in the United States in the 1790s as states constructed their first prisons and sought to move away from corporal punishment rooted in English colonialism and aspired toward ideals emerging during Enlightenment. Many early proponents of solitary confinement were Quakers, clinicians, and reformers, such as Dr. Benjamin Rush and The Philadelphia Society for Alleviating the Miseries of Public Prisons; they theorized that placing people in silence and solitude would stimulate an introspective process of moral repentance and social transformation (Guenther, 2013; Rubin & Reiter, 2018).

At first, states began authorizing the construction of prisons with spaces designed for isolating people convicted of violent crimes and deemed too dangerous to intermingle with others in free society or institutional setting. In the 1820s, Pennsylvania authorized the construction of the Western State Penitentiary and New York opened the Auburn State Prison to keep a select group of people in longer-term isolation (Guenther, 2013). The architectural designs of these prisons were poorly conceived and endangered the health and safety of people involuntarily caged within them. Early observers quickly found that confining people into small and poorly ventilated cells for uninterrupted and indeterminate periods of time was immediately harmful to an individual's physical and mental health (Dendy, 1843; Gray, 1848; Guenther, 2011). Muscular atrophy, psychological decompensation, self-injury and

suicide, and death were reported at these newly established prisons (D. H. Cloud et al., 2015; Guenther, 2013; Rubin & Reiter, 2018; P. S. Smith, 2006).

In response, however, penologists and politicians continued to advance theories that enforced isolation could achieve moral redemption and behavioral change (Guenther, 2013; Rubin & Reiter, 2018). Theories of spiritual rehabilitation through isolation provided a basis for the establishment of "silent prisons". The Eastern State Penitentiary in Pennsylvania, which opened in 1829, closed in 1971, and is currently a museum, was the nation's first silent prison. In this institution, and the others it inspired, prison administrators went to great lengths to preserve silence and prevent social interaction. When taken out of their cells, incarcerated people were draped with hooded garments to prevent non-verbal communication and eye contact (Guenther, 2013; Rubin & Reiter, 2018). Silent prisons' lofty ambitions sparked the interest of political theorist, Alexis de Tocqueville, and literary author, Charles Dickens, who traveled to the U.S. to observe what was being touted as a visionary system for rehabilitating people in world eager to distance itself from corporal punishment. However, after witnessing living conditions in silent prisons, Dickens and de Tocqueville issued scathing condemnations of these institutions, declaring them ineffective for rehabilitation and tortuously inhumane (D. H. Cloud et al., 2015; Guenther, 2013; Rubin & Reiter, 2018). Following his visit to Eastern Penitentiary, Charles Dickens lamented:

> I believe that very few men are capable of estimating the immense amount of torture and agony which this dreadful punishment, prolonged for years, inflicts upon the sufferers… from what I have seen written upon their faces, and what to my certain knowledge they feel within, I am only the more convinced that there is a depth of terrible endurance in which none but the sufferers themselves can

> fathom, and which no man has a right to inflict upon his fellow creature. I hold this slow and daily tampering with the mysteries of the brain to be immeasurably worse than any torture of the body; and because its ghastly signs and tokens are not so palpable to the eye and sense of touch as scars upon the flesh; because its wounds are not upon the surface, and it extorts few cries that human ears can hear; therefore the more I denounce it, as a secret punishment which slumbering humanity is not roused up to stay (Dickens, 1842).

In the mid-19th century, medical professionals in U.S. and Europe also began condemning solitary confinement. For example, The Lancet published reports of "prison psychosis" or "solitary confinement psychosis" attributed to isolation in a cell with little to no natural light, poor ventilation, and no meaningful human contact (Dendy, 1843). Francis Gray (1846) studied more than 4,000 people held in America's silent prisons, concluded in his book, Prison Discipline in America, "The system of constant separation [silent prisons'…even when administered with the utmost humanity, produces so many cases of insanity and of death as to indicate most clearly, that its general tendency is to enfeeble the body and the mind". Grassian and Friedman (1986) identified thirty-seven publications from 1854 to 1909 that reported the development of psychosis among prisoners subjected to solitary confinement in German prisons(Grassian & Friedman, 1986). Racial disparities were also documented in medical literature as early as the 1840s. One study in Philadelphia reported that black men were disproportionately placed in solitary confinement and endured twice the relative mortality rate as their white counterparts (BH., 1843).

In 1890, the U.S. Supreme Court addressed solitary confinement in prisons for the first time, holding that a Colorado statute that allowed subjecting people on death

row to solitary confinement violated the ex post facto clause of the United States Constitution. The ruling set a man convicted of murder free, because of the appalling effects of solitary confinement (" In re Medley, ," 1890). Justice Samuel F. Miller, who was also a physician, remarked:

> The peculiarities of this system were the complete isolation of the prisoner from all human society, and his confinement in a cell of considerable size, so arranged that he had no direct intercourse with or sight of any human being, and no employment or instruction.... A considerable number of the prisoners fell, after even a short confinement, into a semi-fatuous condition, from which it was next to impossible to arouse them, and others became violently insane; others still, committed suicide; while those who stood the ordeal better were not generally reformed, and in most cases did not recover sufficient mental activity to be of any subsequent service to the community (" In re Medley, ," 1890).

Reemergence of solitary at dawn of a prison boom

By the early twentieth century, solitary confinement had been mostly abandoned in US prisons. However, it reemerged on a smaller scale, when the federal government opened Alcatraz in San Francisco Bay in 1934 where it was used more sparingly (Guenther, 2011; Rubin & Reiter, 2018). When Alcatraz closed in the 1960s, the federal prison built to replace it in Marion, Illinois included a “long term control unit” for people categorized as the most violent or politically disruptive. The bare design and punitive policies governing this unit set the stage for wider adoption of solitary confinement as prison populations swelled, the demographics of residents shifted from black minority to black majority, and the penal philosophy of correctional systems took a sharp, punitive turn (Reiter, 2018; Rubin & Reiter, 2018; Shalev, 2008, 2011).

Solitary confinement reemerged at the dawn of the prison boom in the mid-1960s. However, in stark contrast to the ideals of Quakers and early proponents, its new propagators viewed it as an instrument for controlling growing prison populations that were becoming increasingly comprised of younger black men (Reiter, 2018; Rubin & Reiter, 2018; Shalev, 2008, 2011). Guenther (2013) describes how during the Cold War, solitary confinement was used by KGB and Chinese officials in detention camps as a "thought reform" mechanism for spies or people who were anti-Communists (Guenther, 2013). In the 1960s, some psychologists in the US adapted these methods, which later informed the adoption of "behavior modification programs" that are still prevalent in the U.S prison system. Guided by behavioral scientists at prominent universities, solitary confinement was extended into prisons as tool for dissolving personal identity and political alliances by stripping away social relationships. Prison officials borrowed from these "brainwashing" techniques as a tool for controlling people deemed as "anti-social" in the U.S. correctional systems, and they enforced aggressively against incarcerated people who were a part of the Black Power movement (Guenther, 2013).

Solitary confinement reemerged amidst a sea-change in the values and goals of the American justice system. In the mid-1970s, politicians denounced the legitimacy of rehabilitation as a goal of corrections, in favor of deterrence and retribution, achieved through harsher laws and prison conditions (Clear & Frost, 2015; Travis et al., 2014). Law enforcement institutions, lawmakers, and courts increasingly attributed crime to the moral failings of individuals, while discounting poverty, education, and access to healthcare as primary contributors (Travis et al., 2014). State legislatures rushed to pass laws that criminalized a wider range of activities and sent people to prison for longer

durations (Clear & Frost, 2015). Richard Nixon declared a national war on drugs and the federal government legislated large financial incentives for states to pass draconian laws that triggered, long mandatory prison sentences for a wide range of crimes, build more and bigger prisons, and abolish mechanisms of release, such as parole (Travis et al., 2014). Enforcement of these laws were targeted mostly against Black residents of impoverished city neighborhoods (Alexander, 2011; Clear, 2009; Clear & Frost, 2015; Hinton, 2016; Western & Wildeman, 2009). From 1973 to 1993, the nation's prison population swelled by 346 percent and jails and prisons became increasingly overcrowded, unsafe, and unhealthy environments (Travis et al., 2014). As prison systems became increasingly crowded and guided by punitive principles, living conditions worsened and violence became more prevalent. Uprisings at Attica prison in New York was a significant event that put political leaders nationwide on notice about the potential for organized uprisings of protest, as prison populations surged and living conditions deteriorated (H. A. Thompson, 2017). During this span, federal and state policymakers orchestrated an unprecedented, large-scale expansion in the construction of prisons nationwide (Travis et al., 2014). Many newly constructed prisons were architecturally designed to punish with spaces designated for holding people in prolonged solitary confinement (Eisenman, 2009).

Supermax era

In the 1980s, incarcerated men at USP Marion organized hunger strikes to protest obstruction to religious freedom, violence inflicted by prison guards, and substandard medical care (Richards, 2015; Rubin & Reiter, 2018). Unfortunately, the protests turned violent and two correctional officers were killed. In retaliation, the

entire facility was put in solitary confinement for the next 23 years. The lockdown at USP Marion is cited for setting the stage for the proliferation of "supermax" prisons across the country—high tech facilities architecturally designed for long-term solitary confinement (Eisenman, 2009). Rapid construction of supermax prisons ensued during the 1980s and 1990s as jails and prisons became increasingly overcrowded, chaotic and violent environments they shifted institutional priorities toward punishment, management and control at the expense of educational, treatment, or vocational programs(Reiter, 2016; Keramet A Reiter, 2012). In 1999, there were at least 57 supermax prisons, spread across 34 states. By 2004, 40 states had built or repurposed prisons as "supermax" facilities housing 25,000 people and hundreds of others established segregation units inside existing facilities (Garcia et al., 2016). Supermax prisons were being built at such a rapid pace in the 1990s, that soon there were more cells than people that prison officials had originally anticipated for these spaces. In Virginia, officials responded to this surplus by expanding eligibility criteria in order to fill their brand new, technologically advanced supermax facilities— Red Onion and Wallens Ridge. In effect, solitary confinement was no longer a destination reserved for the few so-called 'worst-of-the-worst" prisoners as it had been in Alcatraz (Guenther, 2013). In the era of mass incarceration, it became a mainstay tactic to punish, warehouse, and control the masses (Reiter, 2015).

Estimated Prevalence of solitary confinement today

In the U.S, state and local governments lack systems for tracking and reporting on solitary confinement practices in correctional settings (Fathi, 2010). As a result, reliable estimates of its prevalence are lacking (D. H. Cloud et al., 2015; Resnik et al.,

2018). Yet, the best available data shows that the number of people in solitary confinement within U.S. prisons has increased substantially in the era of mass incarceration (Resnik et al., 2018). For example, in 2006, one study suggested that from 1995 to 2005, the number of people held in solitary confinement on any given day increased from 57,591 to 81,622 people or by about 40 percent (Gibbons & Katzenbach, 2006). In 2016, the Liman Center for Public Interest Law at Yale Law School (Liman) conducted the first national survey of solitary confinement practices in state prisons (Resnik et al., 2018), and estimated that between 80,000 to 100,000 people were in solitary confinement (Resnik et al., 2018). These researchers have conducted follow-up surveys and found decreases compared to their baseline measurement, estimating that there were between 60,000 and 80,000 people--- or about 4.5 percent of people incarcerated in state prisons in solitary confinement on any given day (Resnik et al., 2018). An updated Liman survey suggests a reduction to about 45, 000 to 60,000 people in solitary confinement on a given day(Rubin & Reiter, 2018). However, these estimates are derived from self-reported, static snapshots, and do not account for the fact that people routinely cycle in and out of solitary confinement units. Others shave quantified solitary confinement exposures based on the percentage of an incarcerated population that experienced it over a defined period of time. Thus, while less than 5 percent of the prison population is isolated at any given moment, a significantly greater number of people experience it each year. For example, one study found that, about 20 percent of people in prison spent time in solitary confinement in a given year (Beck, 2015).

The health consequences of solitary confinement

There is broad consensus in public health and medicine is that solitary confinement is a profoundly harmful practice, often leading to severe psychological distress, self-injury, suicide, impaired vision, and increased health-related costs, among other harms(Haney, 2018a; Haney et al., 2020). Health researchers have consistently reported a distinct pattern psychiatric symptoms—emotional distress, cognitive deficits, social withdrawal, anxiety, paranoia, irrational anger, which often manifest in decompensating, aggressive, and erratic behaviors, including self-harm and suicide ; smearing or throwing bodily excrements; and flooding cells, starting small fires, and other displays of behavior categorized as psychosis (Grassian, 2006; Haney, 2017, 2018a; J. L. Jahn, N. Bardele, J. T. Simes, & B. Western, 2022; Kupers, 1996; P. S. Smith, 2006). For some individuals, these behaviors are the result of severe psychosis that is exacerbated by isolation, deprivation, and dehumanization (Andersen, Sestoft, & Lillebæk, 2001; Grassian, 2006; Haney, 2018a; Kupers, 1996; Reiter & Blair, 2015; L. A. Rhodes, 2002; Rhodes, 2005).

Social isolation is a defining feature of solitary confinement. Decades of research has proven that forming and nurturing meaningful social interactions and social connectedness are vital to the physical and mental health for individuals, families, and communities (Cacioppo & Hawkley, 2003). Conversely, it also has shown that loneliness, social exclusion and isolation, in a variety of contexts, harms the psychological status of people who endure it (Ahmadpanah et al., 2017; Berman, 2018; Cacioppo & Hawkley, 2003; Calati et al., 2018; Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015; Leigh-Hunt et al., 2017; Shankar, McMunn, Banks, & Steptoe, 2011; Steptoe, Shankar, Demakakos, & Wardle, 2013; Tomaka, Thompson, & Palacios, 2006).

For example, Hans Toch (1977) conducted in-depth interviews with people in isolation within New York's prison system. He labeled the cluster of psychological symptoms and self-injurious behaviors that he observed as "isolation panic" (Toch, 1977). Harvard psychiatrist, Stuart Grassian (1983) evaluated sample of men held in isolation at Walpole Prison in Washington. He similarly described a cluster of symptoms in a large percentage of the study sample including hypersensitivity to external stimuli, perceptual distortions, hallucinations, difficulty concentrating and with memory, aggressive fantasies of revenge against guards, paranoia, self-mutilation outbursts, panic attacks, and problems with impulse control. Grassian described what he observed as an "acute organic brain syndrome" that he later termed "Secured Housing Unit (SHU) Syndrome" after the prisons (Grassian & Friedman, 1986).

Another landmark study that brought attention to the adverse effects of solitary was the Pelican Bay Study, led by lawyer and psychologist, Craig Haney. In this study, 100 people in solitary in California prisons were randomly selected and interviewed to determine whether they experienced specific (1) indices of psychiatric trauma; (2) psychological effects of isolation. Haney found than half of the sample experienced 11 of the 12 indices of trauma (e.g. anxiety, lethargy, trouble sleeping). Additionally, over 60% experienced symptoms resembling the "SHU Syndrome" as defined by Grassian (1983), including oversensitivity to stimuli, hallucinations, violent fantasies, and irrational anger. Over 70% reported emotional difficulties, such as chronic depression, emotional flatness, and mood swings. While this study has been criticized for lacking standardized measures, it provides one of the most contextually-dense depictions and widely cited

pieces of evidence for how solitary confinement damages the human psyche (Haney, 2003).

Qualitative and ethnographic studies of people in solitary confinement have vividly documented the lived experiences of people confined to these hidden worlds, and helped shed light on how carceral contexts perpetuate emotional turmoil and frequently manifest in self-injury. Indeed, some of the most important studies documenting harm of solitary confinement on mental health have relied on qualitative methods (Guenther, 2013; Haney, 2003; Kupers, 1996; Rhodes, 2004). In her seminal work, Lorna Rhodes studied the lives of men at a Washington supermax prison, and described how social isolation and material deprivation endured was expressed in pathologies of acute and long-term forms of psychological decompensation and abnormal behaviors (L. A. Rhodes, 2002; Rhodes, 2004, 2005). Haney (2003), was among the first to conduct in-depth interviews with men housed in solitary confinement units (Haney, 2003, 2017, 2018a, 2018b). Policymakers, litigators, activists and clinicians have leveraged this lineage of scholarship to advance reforms seeking to restrict the use of solitary confinement in the form of legal settlements, legislation, and regulations (Keramet Ann Reiter, 2012).

Physical idleness is another defining feature of solitary confinement settings, and while under studied, legal scholarship and qualitative studies report that people who endure prolonged periods of solitary experienced diminished physical health, which include weight gain, loss of vision, and muscle atrophy.(Campbell, 2016; D. H. Cloud et al., 2015; Grassian & Friedman, 1986; Hagan et al., 2018; Reiter & Koenig, 2015; P. S. Smith, 2006; Suedfeld, Ramirez, Deaton, & Baker-Brown, 1982; B. A. Williams, 2016). A

smaller, but emerging body of research has documented how exposure to solitary confinement may contribute to chronic disease morbidity among older adults (J. N. Morgan, 2017; B. A. Williams, 2016). It is well documented that built environments that reinforce sedentary lifestyles characterized by a lack of cardiovascular exercise and physical idleness, which primary contributor to the onset and exacerbation of chronic illnesses. Research shows the importance of physical exercise in reducing anxiety and psychological stress in both community and correctional settings. (Battaglia et al., 2015; Berke, Koepsell, Moudon, Hoskins, & Larson, 2007; Cashin, Potter, & Butler, 2008; D. Woods, Breslin, & Hassan, 2017). Moreover, studies show that imprisoned people subjected to environments where they are deprived an opportunity to engage in rigorous physical exercise is associated with increased disruptive behaviors and sense of hopelessness (Cashin et al., 2008). In sum, the interactive effects of social isolation, sensory deprivation, and physical idleness compromise the health of people subjected to solitary confinement in significant and lasting ways.

Only a few studies have demonstrated the lingering harms of solitary confinement on people after they are released from prison. For instance, one cross-sectional study of people released from New York prisons seeking care in a primary care setting, found that solitary confinement was significantly associated with symptoms of post-traumatic stress disorder (PTSD) following release from prison (Hagan et al., 2018). A retrospective study of people released from North Carolina prisons over a 15-year period, found significant associations between exposure to solitary confinement and post-release mortality due to suicide, homicide, and overdose (Brinkley-Rubinstein et al., 2019).

The grey literature has also turned to interviews, letters from people in solitary confinement, and surveys to convey the harms of solitary on health. Human Rights Watch, the American Civil Liberties Union, Disability Rights International, the American Friends Service Committee, and the Vera Institute of Justice have produced a reports describing solitary confinement practices in different state prison systems (Abramsky, 2003; D. Cloud, Jessi LaChance, Lionel Smith, and Lauren Galarza. , 2019; D. H. Cloud, Kang-Brown, Jacob, and Vanko, Elena, 2016). Autobiographical testimonies from survivors of solitary confinement have also powerfully corroborated these observations, while also providing insights into behavioral routines, meditative rituals, emotional escapism, and acts of resistance that survivors of prolonged periods of solitary confinement have adopted for resilience. For example, Robert King, Herman Wallace, and Albert Woodfox, who each spent more than four decades in solitary confinement in Louisiana, describe daily monotony, idleness, slow passage of time, as well as frequent violence through self-education, physical exercise, and active resistance against wanton oppression(R. King, Canales, Morris, & Sosa, 2019; Woodfox, 2019).

Solitary Confinement, Self-injury, and Suicidality

Self-harm and suicide are significant public health problems that contributes to excess morbidity and premature mortality worldwide (Favazza, 1998; Klonsky, Oltmanns, & Turkheimer, 2003; Muehlenkamp, 2005; Rodham & Hawton, 2009; Skegg, 2005). Self-harm is a complex behavior that refers to “direct bodily harm or disfigurement that is deliberately inflicted on oneself” (Power & Brown, 2010). It most commonly includes behaviors such as cutting, scratching, or burning of the skin; hitting oneself; pulling hair; facial mutilation; and less frequently amputation (Favazza, 1998;

Power & Brown, 2010; Skegg, 2005). Many clinicians and researchers conceptually distinguish self-harm from suicidal behaviors contingent on the presence or absence of lethal intent (Muehlenkamp, 2005; Selby, Bender, Gordon, Nock, & Joiner Jr, 2012). Yet, others warn against this distinction, because self-harm and suicidal behavior can be difficult to differentiate clinically, both share common risk factors, and either commonly results in morbidity and mortality (Favazza & Rosenthal, 1993; Wilkinson, 2011). Additionally, those who disfavor differentiating these behaviors note that history of deliberate self-harm, regardless of lethal intent, is the strongest predictor of fatal suicide, especially for people with major depression, personality disorders, and/or a psychotic disorder (Klonsky et al., 2003; Plener, Schumacher, Munz, & Groschwitz, 2015; Skegg, 2005; Wilkinson, 2011).

Self-harm is widespread in prisons (Lohner & Konrad, 2006; Rodham & Hawton, 2009; Vinokur & Levine, 2019), and suicide is a leading cause of death among currently and formerly incarcerated people in the U.S. and globally (Noonan, Rohloff, & Ginder, 2015). While public health surveillance in correctional settings is lacking, this problem has been well-documented in academic research. In the United States, while prevalence estimates vary, a recent survey of state prison systems estimated that between 5-18% of men and 5-24% of women in engage in self-harm during incarceration in U.S prisons (H. P. Smith & Kaminski, 2011). Another survey found that less than 2 percent of the prison population engaged in self-harm during 2008 while in custody; but, 85% of state prison systems reported a self-harm event occurring at least once a week, with frequencies ranging from several times per week (50%), once per day (6%), and more than once per day (15%). Another study found that nearly 98 percent of prisons report

housing at least one person who engages in self-harm regularly (Appelbaum, Savageau, Trestman, Metzner, & Baillargeon, 2011). Suicide is the leading cause of mortality in local jails, accounting for more than one-third of deaths in jails in 2013. While less frequent in prisons, suicides accounted for approximately 6 percent of the deaths among people in state prisons in 2013 (Noonan et al., 2015). Over the past two decades, suicide mortality behind prison walls has grown by 85 percent (A. Carson, 2021).

Research on community samples show that people with psychiatric illnesses—such as major depression, borderline personality disorder, bipolar disorder, and schizophrenia are more prone to engage in self-injurious behaviors and suicide (Guertin, Lloyd-Richardson, Spirito, Donaldson, & Boergers, 2001; Harned, Najavits, & Weiss, 2006; Skegg, 2005; Suominen, Isometsä, Haukka, & Lönnqvist, 2004) Other individual-level risk factors reported in the literature include: histories of violence, addiction, and institutionalization during youth and adulthood prior to incarceration (Gunter, Chibnall, Antoniak, Philibert, & Black, 2013; Rodham & Hawton, 2009; Suominen et al., 2004; Welfare & Hollin, 2012).

Epidemiologic inquiry into social-ecological determinants of self-harm and suicide in carceral settings is relatively scarce (Hawton, Harriss, Hodder, Simkin, & Gunnell, 2001). However, knowledge derived observational and qualitative studies in criminology, psychiatry, and correctional health attribute higher rates of these behaviors correctional environments to a range of psychosocial, environmental, and clinical factors (Clements-Nolle, Wolden, & Bargmann-Losche, 2009; Fulwiler, Forbes, Santangelo, & Folstein, 1997; Godet-Mardirossian, Jehel, & Falissard, 2011; Gunter et al., 2013; Howard, Karatzias, Power, & Mahoney, 2017; Mandelli, Carli, Roy, Serretti, &

Sarchiapone, 2011; Milligan & Andrews, 2005; Noonan et al., 2015; Rivlin, Hawton, Marzano, & Fazel, 2013; Sarchiapone, Carli, Giannantonio, & Roy, 2009; Welfare & Hollin, 2012).

One line of research examines social exposures and clinical factors occurring prior to incarceration that increase an individual's vulnerabilities to self-injurious behaviors while imprisoned, and has focused on developmental, clinical, and demographic contributors (Clements-Nolle et al., 2009; Gunter et al., 2013; Howard et al., 2017; Mandelli et al., 2011; Rivlin et al., 2013; Sarchiapone et al., 2009). This literature consistently cites histories of childhood trauma, sexual abuse, and impoverishment are as primary contributors of self-harm among incarcerated people (Clements-Nolle et al., 2009; Gunter et al., 2013; Howard et al., 2017; Mandelli et al., 2011; Milligan & Andrews, 2005; Rivlin et al., 2013; Sarchiapone et al., 2009; Welfare & Hollin, 2012). Studies show that people who enter prison with a pre-existing mental illness and histories of physical, emotional, and sexual trauma are among the most likely self-harm while in custody (Clements-Nolle et al., 2009; Gunter et al., 2013; Howard et al., 2017; Mandelli et al., 2011; Milligan & Andrews, 2005; Rivlin et al., 2013; Sarchiapone et al., 2009; Welfare & Hollin, 2012). For instance, one study found that one-third of imprisoned people have a lifetime history of self-harm. Young et al. (2006) found that 15% of people receiving psychiatric treatment in a California prison engaged in self-harm (Young, Justice, & Erdberg, 2006).

The emotional, cognitive, and neurological harms attributed to solitary confinement are also associated with self-harm and suicidal behaviors. Difficulty with impulse control is one of the most common symptoms experienced among people in

solitary confinement. Haney (2003) and others have theorized that people adapt to rely on tightly controlled routines and structures of prison environments to direct and limit their behavior. When those routines are disrupted, such as upon release, people may be less able to control impulsive behaviors in the community or general population of the prison(Haney, 2003). Haney also posits that because a large part of human identities are socially constructed, people exposed to solitary confinement begin to lose grasp of who they are in relations to family, friends, and society (Haney, 2003, 2017). Impulse control has been cited as a reason that may lead to self-injurious behaviors in prison and community settings (Fagan, Cox, Helfand, & Aufderheide, 2010; Favazza & Rosenthal, 1993; Glenn & Klonsky, 2010; Herpertz, Sass, & Favazza, 1997).

Apathy, lethargy, and social withdrawal are also frequently observed symptoms among people in solitary (Grassian, 2006; Shalev, 2017; P. S. Smith, 2006). Clinicians posit that long-term isolation may engender fear and anxiety in the face of social interactions; this reaction, in turn may result in reclusiveness, social withdrawal while in solitary; and leave people unable to initiate social interactions and contribute to engagement in withdrawal (Haney, 2003). Hallucinations, illusions, & paranoid ideas have also been widely reported among people in solitary confinement. Haney (2003), for example, indicated that 41% of his sample reported hallucinations and 44% perceptual distortions, while Grassian (1983) found over a third of the subjects also had perceptual distortions or hallucinations. Similar symptoms are also associated with increasing vulnerability to self-harm and suicide(Glenn & Klonsky, 2010; Hawton et al., 2001; Herpertz et al., 1997; Lohner & Konrad, 2006; Rodham & Hawton, 2009; Tartaro, 2019; J. Thomas, Leaf, Kazmierczak, & Stone, 2006; Zetterqvist, 2015).

A smaller, but emerging body of research has focused on the ecological features of prison environments as contributors to self-harm and suicide. Studies have found that rates of suicide in prison systems are not associated with rates of suicide in the general population, which indicates that environmental properties within carceral systems themselves independently contribute to disparate rates of suicide observed among incarcerated people (Fazel, Grann, Kling, & Hawton, 2011; Fazel, Ramesh, & Hawton, 2017). In other words, higher rates of prison suicide "appear to be the product both of the number of risk factors to which prisoners were exposed before their incarceration and the harshness of the particular prison conditions that they experience during confinement"(Haney, 2012). For instance, several studies have found positive associations between levels of overcrowding in prisons and occurrence of suicide (Huey & McNulty, 2005). Qualitative studies also provide evidence for how lived-experiences of overcrowding engenders vulnerabilities to suicide and other forms of violence (Sharkey, 2010). Other studies have observed associations between deprivation of autonomy(Huey & McNulty, 2005), higher-security level, deficits in educational and rehabilitative programming, capacities for psychiatric services, and suicide trends. For example, Smith et al. (2011) found that the ratio of mental health workers and correctional officers to residents were both associated with prevalence of self-injurious behaviors across state prison systems (H. P. Smith & Kaminski, 2011). Contrarily, one recent international study of potential ecological contributors to prison suicides across multiple nations found no significant associations between overcrowding, per-capita expenditures on programming, staff-resident ratios, and management of healthcare (Fazel et al., 2017).

Descriptive and observational studies have consistently reported that self-harm and suicide occur most frequently in housing areas within prisons where people are socially and physically isolated and in higher-security facilities that impose more restrictive and punitive living conditions on residents (E. Lanes, 2009; E. C. Lanes, 2011; Reeves & Tamburello, 2014), An older study found that 75 percent of SH events occurred in punitive isolation units (Appelbaum et al., 2011). Reeves (2014) similarly observed that people where 400 times more likely to commit suicide when in a single-celled "segregation unit" than when sharing a cell with another person; as nearly every suicide occurred in these isolated settings over a seven year period.(Reeves & Tamburello, 2014)

Prior to this dissertation, only a few studies have sought to quantify relationships between exposures to solitary confinement and self-harm behaviors in a correctional setting (Kaba et al., 2014; E. Lanes, 2009). In a study of people incarcerated in the New York City jail system on Rikers Island, Kaba et al. (2014) found that those punished with solitary confinement were about 6.9 times more likely to engage in self-harm after controlling for the length of stay in jail, diagnoses of SMI, age, and race/ethnicity. Results also showed that while having an SMI and being 18 years or younger were also significant predictors self-harm, odds of self-harm remained significantly higher, independent of mental health status and age. Moreover, they found that nearly one quarter of people who engaged in self-harm did so more than once; and that younger adults diagnosed with an SMI in solitary confinement accounted for the majority of recorded self-harm acts.(Kaba et al., 2014). Lanes (2009) conducted a survival analysis to examine relationships between placement in solitary confinement and odds of self-

harm, and found that relative youth, having a mood disorder, history of suicide attempt, number of prior violent infractions, offenses, number of housing assignment changes within the past two years, and current placement in solitary confinement significantly increased risk of self-harm (E. Lanes, 2009). A subsequent study cited a lack of appropriate institutional responses to self-injury, high staff turnover, and poor staff training on suicide prevention as facility-level contributors (E. C. Lanes, 2011).

Connecting solitary confinement and overdose

Scholars who study solitary confinement have mostly focused on its effects on currently incarcerated people (Haney, 2003; Reiter et al., 2020). Relatively few studies have examined the effects of solitary confinement among formerly incarcerated people(Hagan et al., 2018), which has prompted calls for more research on this issue (Kupers, 2008; Luigi, Dellazizzo, Giguère, Goulet, & Dumais, 2020; K. E. McLeod & Martin, 2020). More specifically, inquiries into how solitary confinement may shape vulnerabilities to overdose (and other drug-related harms) is largely absent in health research and disjointed in discourses of stakeholders seeking to minimize or abolish it and others pushing for anti-carceral approaches to the overdose crisis. Only one study has examined the relationship between solitary confinement and overdose in the United States, finding a strong, positive association between exposures to solitary confinement and premature death due to overdose, homicide, and suicide among formerly incarcerated people(Brinkley-Rubinstein et al., 2019). Thus, Aim 2 of this dissertation aims to provide a rationale for conceptualizing solitary confinement as a socio-structural producer and accelerant of overdose vulnerability among formerly incarcerated people who use drugs.

Overdose is a leading cause of death among currently and formerly incarcerated people in the United States, (E. A. Carson, 2021). Though difficult to measure, the federal government reports that 58% of people in prison and 65% of those in jails are diagnosed with a substance use disorder(Bronson, Stroop, Zimmer, & Berzofsky, 2020). Another study estimates that one-third of people who use heroin enter a correctional facility each year (Boutwell, Nijhawan, Zaller, & Rich, 2007). There is also evidence to suggest that many people continue or begin using drugs during incarceration for similar reasons as they would in community settings(Rowell-Cunsolo, Szeto, McDonald, & El-Bassel, 2018). From 2001 to 2018, deaths due to "drug or alcohol intoxication" swelled by more than 600% and 200%, respectively, in state prisons and county jails (E. A. Carson, 2021). Contamination of the drug-supply with fentanyl and other synthetic adulterants has increased susceptibilities to overdose not only in communities, but also in jails and prisons (Kaplowitz et al., 2021). The correlates of overdose behind bars are poorly studied, though one report found that 80 percent of non-fatal overdoses occurring in North Carolina prisons occurred in solitary confinement units(J. B. Williams, Zarzar, & Sheitman, 2022).

Despite recent improvements, jails and prisons typically do not provide access to effective medications, harm reduction interventions, or mental health services aligned with the needs of people in their care and custody(Sugarman, Bachhuber, Wennerstrom, Bruno, & Springgate, 2020). Rather, responses to drug-related behaviors behind bars more typically entail intensifications of drug war- style retribution with little oversight and diminished due process. People suspected, accused, or convicted of using drugs in jails or prisons are routinely subjected to invasive searches, random urinalysis, forced

detoxification with minimal medical oversight, and a wide range of sanctions, including solitary confinement(D'Hotman, Pugh, & Douglas, 2019). In many jurisdictions, correctional policies dictate that those found guilty of possessing, using, or distributing drugs while incarcerated are commonly sanctioned with placement in solitary confinement. Still, there are other ways that people with use disorder (PWUD) can end up in solitary confinement.

The vast majority of people who enter a correctional facility are eventually released. Studies consistently find that people released from jail or prison face an elevated risk of overdose, especially during the first weeks of returning to the community (Binswanger, Blatchford, Mueller, & Stern, 2013). Most of this research is attuned to the possible moderating effects of sociodemographic (e.g. race, gender) and clinical factors (e.g. trauma, suicidality, chronic pain), mediating effects of the intermediate social and economic conditions that people frequently encounter when released from jail or prison (e.g. disrupted social networks, economic instability, stigma), and proximal circumstances (e.g. using alone, mixing drugs) and biological determinants (e.g. reduced tolerance) that result in overdose morbidity and mortality (Joudrey et al., 2019).

Scholarship linking incarceration and overdose has overlooked the influence of policies and practices that produce trauma and hazardous conditions within carceral spaces as contributors to overdose morbidity and mortality(K. E. McLeod & Martin, 2020). Though some people may receive treatment or healthcare services behind bars that were inaccessible to them in their communities, a problematic reality in itself, they also often endure exposures to noxious conditions and traumas within these settings--

overcrowding, inadequate healthcare services, unsanitary living conditions, poor nutrition, exploitive labor practices, minimal opportunities for programming, violence, and solitary confinement--- that compromise their well-being and contribute to healthy inequities in their communities(Freudenberg, 2001; Wildeman, Fitzpatrick, et al., 2018).

Solitary confinement is commonly experienced among people who cycle between jails, prisons and communities, of which a disproportionate percentage have substance use disorders. However, solitary confinement is rarely conceptualized as an apparatus of the drug war or the criminal legal system's broader impacts on vulnerabilities to overdose, during or subsequent to incarceration. Studying whether and how solitary confinement may influence vulnerabilities to overdose is needed for developing more nuanced understandings of how incarceration shapes overdose within and outside the walls of jails and prisons. Such research also has the potential for forging alliances between seemingly disjointed coalitions of community advocates committed to mobilizing anti-carceral solutions to the overdose crisis and those fighting to abolish solitary confinement as a public health and human rights imperative. Aim 2 of this dissertation describes the lived experiences of solitary confinement among formerly incarcerated people who use drugs to explore the potential processes through which this carceral practice shapes overdose vulnerabilities, and is a step toward bridging these gaps.

Solitary confinement as state-sanctioned violence

Solitary confinement is a form of state-sanctioned violence. Civil rights litigation, advocacy campaigns, organized hunger strikes, and scrutiny from international human

rights authorities, and increased media attention are among the factors prompting some jurisdictions to address solitary confinement in their correctional systems (D. H. Cloud et al., 2015; Reiter, 2014; Sakoda & Simes, 2021). In 2015, the United Nations revised the Standard Minimum Rules on the Treatment of Prisoners to include the "Mandela Rules", which for the first time clearly defines restrictive housing and provides guidelines on its use. Specifically, they call for an end to prolonged restrictive housing, defined as a period of more than 14 days (Assembly, 2015; Méndez, 2019). Solitary confinement has been challenged in state and federal courts, on grounds that it violates the Eighth Amendment's prohibition against cruel and unusual punishment(Fathi, 2015; Keramet Ann Reiter, 2012). Multiple federal courts have acknowledged that exposing people to prolonged solitary confinement causing devastating, lasting, and irreparable harms to the psychological health of incarcerated people (Fathi, 2015; Hanna, 2018; Reiter, 2015; Umphres, 2017). The Eighth Amendment jurisprudence prohibiting cruel and unusual punishment has placed restrictions on the use of isolation. Yet, federal court rulings have led to relatively modest reforms and do not align with international norms.(Gottschalk, 2015; Keramet Ann Reiter, 2012).

Momentum for reform and calls for abolition

A movement to abolish solitary confinement in the U.S. is mounting. National advocacy and think-tank organizations have launched multi-year initiatives that combine grass roots activism, impact litigation, research, and technical assistance to address solitary confinement in state prisons and local jails. State legislatures have also started to act, passing bills that restrict the use of solitary confinement for pregnant women, children, and people with serious mental illness (Fathi, 2015; Paltrowitz, 2023;

Simms, 2016; Steinbuch, 2014). Other bills have required state corrections agencies to promulgate new regulations intended to curtail the use of solitary as punitive sanction, and prohibit placements in solitary confinement and/or develop alternative housing units for people with mental illness and other groups with medical vulnerabilities (D. H. Cloud, Kang-Brown, Jacob, Vanko, Elena, 2016). Studies documenting health-related harms of solitary confinement have been instrumental in advancing advocacy, litigation, and legislative action (Grassian, 2006; Haney et al., 2020; B. A. Williams, 2016). Additionally, a growing body of professional organizations in psychiatry, medicine, social work, public health, and correctional health has issued position statements denouncing solitary confinement as human rights issue that demands legislative and executive action, while providing some policy recommendations for addressing its harms (Ahalt, Haney, et al., 2017; Appelbaum, 2015; D. H. Cloud et al., 2015; Keramet Ann Reiter, 2012; Shalev, 2017). In response to litigation and evolving norms, department of corrections have also begun to adopt administrative policy changes that decrease reliance on solitary confinement as a punishment for minor rule violations, place time limits on stays, and establish new data and reporting standards to monitor the progress of reforms (D. H. Cloud et al., 2021b; Shames, 2015).

Extreme heat as a form of carceral violence

The mounting frequencies, durations and severity of extreme heat events pose dire hazards for incarcerated populations worldwide. Building upon an emerging literature, Aim 3 of this dissertation examines an issue at the intersection of the contemporary climate crisis and mass incarceration in the United States. It explores associations of extreme heat, solitary confinement, and an indicator of suicidality among

incarcerated adult men in a Deep South prison system. Heatwaves are one of the most lethal weather phenomena, — accounting for more deaths than hurricanes, tornadoes, earthquakes, and flooding combined. Due anthropogenic climate change, temperatures and atmospheric moisture content have increased on a global scale since 1950 and are projected to continue rising (Coffel, Horton, & De Sherbinin, 2017; Fischer, Sippel, & Knutti, 2021; Perkins-Kirkpatrick & Lewis, 2020). For centuries, researchers have observed that suicides tend to increase in hotter seasons of the year. In the wake of the modern climate crisis, researchers are revisiting linkages between extreme heat and suicidality in different geographies and socio-political contexts. These studies consistently find positive associations between higher-ambient temperatures and incidence of suicide (Burke et al., 2018; PG Dixon et al., 2007; P. G. Dixon & Kalkstein, 2018). Based on historical and projected trends, Burke et al. (2022) predicts that by 2050, rising temperatures will contribute to 21,000 additional suicides in the United States (1.4 percent rate increase) (Burke et al., 2018).

Researchers posit several pathways through which extreme heat worsens vulnerabilities to suicidality. At a biophysical level, heat stress may increase mental health symptoms by modifying the body's ability to thermoregulate and regulate emotions (Lõhmus, 2018). This may trigger or exacerbate feelings of lethargy, irritability, and sadness, especially for people with psychiatric diagnoses, such as bipolar disorder, generalized anxiety, and depression(Lõhmus, 2018; Noelke et al., 2016; R. Thompson, Hornigold, Page, & Waite, 2018). Self-injurious behaviors associated with suicide are forms of violence, and an extensive literature has linked extreme heat to elevated social volatility, aggression, and violence(C. A. Anderson, 1989; C. A. Anderson

& DeLisi, 2011; Mares & Moffett, 2016; Miles-Novelo & Anderson, 2019). At community levels, studies from across the globe have linked heat-waves to escalations in hospitalization rates for behavioral health symptoms, including substance use; mood disorders; schizophrenia, and delusional disorders; and non-suicidal self-harm (Almendra, Loureiro, Silva, Vasconcelos, & Santana, 2019; Carlsen, Oudin, Steingrimsson, & Oudin Åström, 2019; Florido Ngu, Kelman, Chambers, & Ayeb-Karlsson, 2021; S. Lee, Lee, Myung, Kim, & Kim, 2018; Nori-Sarma et al., 2022; Pan et al., 2019; Trang, Rocklöv, Giang, Kullgren, & Nilsson, 2016; Vida, Durocher, Ouarda, & Gosselin, 2012).

Extreme heat poses distinct detriments to the health and safety of the 2.1 millions incarcerated people in the US, who have disparately higher rates of underlying mental health conditions compared to the rest of the U.S. population (Colucci et al., 2021; Motanya & Valera, 2016; Skarha et al., 2022). Common features of the built environments of jails and prisons can create and exacerbate heat-related vulnerabilities to health. Many jails and prisons have infrastructures that are not constructed to endure or adapt to the climatological shifts in the environment linked to rising temperatures. Carceral structures are mostly built with stone, metal, concrete and other materials that retain heat, and have small or closed windows that obstruct air circulation, which create conditions for indoor temperatures that surpass those outdoors (Colucci et al., 2021; Skarha et al., 2020). Overcrowding is widespread in the U.S. carceral system, with hundreds or thousands of people crunched into poorly-ventilated dormitories or small cells (single or double-bunked), which can intensify the physiological and psychological stress of heat exposures.(Colucci et al., 2021; Skarha et al., 2020) Solitary confinement

can intensify heat-related harms(Holt, 2015; Skarha et al., 2020). As substantiated in litigation and recent commentaries, people in solitary confinement are especially susceptible the hazards of extreme heat, because in these enclosed spaces, they are less able to escape or mitigate heat-related stress than those in the general population units of prisons or in community settings. In spaces without air-conditioning, people in solitary confinement are physically contained in compact, poorly ventilated tiers of cells, with restricted access to areas of an institution where they might find shade, air conditioning, ice, cold showers, and reprieve from heat. Litigation and journalistic accounts of heat exposures among people in solitary confinement depict people enduring tormenting heat, and resorting to stripping naked, using toilet water, and sleeping on concrete to cool off during summer months (Skarha et al., 2020).

Policies on temperature regulation inside prisons vary widely by state and facility (Holt, 2015). Especially across the Deep South, carceral institutions sit on landscapes with minimal shade from trees and other natural features to mitigate heat exposures. The spaces where people sleep and work often lack air conditioning, and require incarcerated people to rely on fans, ice, and cold showers to cool down in the summer months(Colucci et al., 2021; Holt, 2015; Skarha et al., 2020). About 95% of households in the South have air-conditioning, but most of the region's prisons, aside from those in Arkansas, do not. In Texas, Louisiana, Florida, and other Southern states, extreme-heat in prisons is an active area of civil rights litigation and advocacy (Holt, 2015). Prisons in these states implement common mitigation strategies, such as flagging people who are vulnerable due to their age, medical condition, or medication regimen and providing access to fans, ice, and cold showers on days when the heat-index reaches a particular

threshold (Holt, 2015). However, these policies are typically intended to avert heat exhaustion or heat stroke, and dehydration, and have been less attuned to the psychological and behavioral effects of extreme heat in carceral spaces.

Only two studies have explored associations between extreme heat and the health of incarcerated populations. A study of the Texas prison system found that an extreme heat day was associated with a 15.1% increased all-cause mortality risk. Comparing prisons with and without air-conditioning, they found that air-conditioning reduced mortality risk; and conversely, a 1-degree Fahrenheit increase above 85°F was associated with a 0.7% increase in the risk of death. They also estimated that about 13% of deaths in Texas prisons may be attributable to extreme heat in prisons without air conditioning(Skarha et al., 2022). Another study found that "intensely hot days", those exceeding the 90th percentile of maximum heat index relative to previous years, increased the probability of severe violent incidents by about 20 percent; and that "unmitigated exposure to heat generates an additional 44 cases of intense violence per year" in the Mississippi prison system (A. Mukherjee & Sanders, 2021) .

Policymakers have paid less attention to the behavioral health implications of heat-related stress in carceral spaces, and its potential influence on suicidality. Self-harm and suicide are among the leading contributors of morbidity and mortality among incarcerated populations. People with serious mental illnesses, such as schizophrenia, bipolar disorder, and major depression, are at increased risk of self-harm and suicide and are overrepresented in correctional settings (Fazel, Cartwright, Norman-Nott, & Hawton, 2008; Fazel et al., 2017; Huey & McNulty, 2005; Sarah Larney & Michael Farrell, 2017). We build on this emerging domain of research by conducting the first

study empirically exploring linkages between extreme heat and behavioral health—specifically, the occurrence of suicide-watch placements as an indicator of suicidality--in a sample of incarcerated people in a Deep South prison system.

Rising temperatures related to climate change contribute to a wide range of public health problems. While empirical research is lacking, scholars, litigators, and activists are bringing attention to connections of climate change, mass incarceration, and oppressive conditions of confinement in prison settings. Pellow (2019) notes "water contamination, hazardous industrial wastes, airborne toxins, and excessive heat are environmental risks that are rampant inside US prisons, thus revealing how more-than-human ecological agents impact the health of incarcerated populations as well as communities outside of prisons" (Pellow, 2019). Exposure to extreme heat can lead to a wide range of health problems and premature death, especially for medically vulnerable groups, such as the elderly, people with disabilities, and those on psychotropic medications (Oudin Åström, Bertil, & Joacim, 2011). Scientific inquiry into the implications of climate change of violence is an emerging and important body of literature. Research outside the carceral context, show significant relationships between heat index, psychological distress, aggression, and different forms of violence, including suicide (C. A. Anderson, 2001). Additionally, this research shows that heat-related risks may be exacerbated in institutional settings with poor ventilation where depression, cardiovascular and cerebrovascular conditions, and diabetes are prevalent among residents. Studies of heat waves in cities consistently elucidate the interactive dangers of extreme heat and social isolation. Specifically, a few studies suggest relationships between rising temperatures and incidence of suicide.(P Dixon et al., 2014; Y. Kim, Kim,

& Kim, 2011; Peng, Wang, Kan, Chen, & Wang, 2017). Many prisons across the United States, especially those in Southern States, lack air-conditioning and are poorly ventilated. Excessive heat in prison settings is also being litigated in federal court on the grounds of violating 8th Amendment prohibitions against cruel and unusual punishment. These cases have centered on the deleterious harms of excessive heat on the health of medically vulnerable groups (Holt, 2015).

Theoretical framework

This dissertation seeks to understand how exposure to carceral violence, in the forms of solitary confinement and extreme heat, become embodied in the health and behavior of incarcerated people. As Haney (2018) observed, "solitary confinement is only ever embodied in actual places, ones that exist in any given amalgam of different conditions that vary along dimensions of harshness and resulting risk of harm (Haney, 2018a). In other words, this theorization holds that the effects of solitary confinement on people's behavior cannot be detached from its spatial, temporal, sensory, and social forms; and must be considered in relation to individual and collective vulnerabilities and resilience to its harms. This insight underscores the importance of meticulously describing the social and material contexts of the carceral spaces where people are isolated and knowing more about lived experiences directly from the people who inhabit these spaces. Analysis is grounded in the constructs and propositions of ecosocial theory of disease distribution (ecosocial theory) (N Krieger, 2011), and bolstered by those from those in carceral geography (Moran, 2016; Moran & Jewkes, 2015; Moran, Turner, & Schliehe, 2018), theories of dehumanization (Bandura, 2017; Bustamante et al., 2019;

Haslam, 2006), and the risk environment framework (Collins, Boyd, Cooper, & McNeil, 2019; T. Rhodes, 2002).

Ecosocial Theory of Disease Distribution

Ecosocial theory is apt for explaining how structural forces shape distributions of death, disease, and disability across ecological levels and along lines of race, class, and geography over time. It is concerned with answering who and what drive social inequalities in health, as a theory for assessing how societal health is shaped by living conditions afforded by past, present, and changing arrangements of "power, property, and the production and reproduction of social and biological life." It rejects biological reductionism and cautions against biomedicalization of public health issues without discounting genetic predispositions and biophysical processes as probabilistic or determinant forces (Nancy Krieger, 2001a, 2001b, 2005, 2008, 2009, 2010; N Krieger, 2011; Nancy Krieger, 2011, 2012; N Krieger, Dorling, & McCartney, 2012). Ecosocial theory has been used to explain how historical, legal, and societal forces that underpin racism, sexism, and economic inequalities explain inequitable burdens of disease burdens (Nancy Krieger, 2016).

Embodiment

Embodiment is ecosocial theory's bedrock construct: it considers how people "literally embody, biologically" [their] lived experiences in societal and ecological context, the material and social world in which [one] lives in" (Nancy Krieger, 2005; N Krieger, 2011). And, in turn how these culminate to create population patterns in health and disease. It posits that determinants of health are mostly shaped by exogenous forces beyond innate traits and volition of individuals. Instead, it acknowledges that

distributions of health and disease are primarily caused by historical and ongoing societal conditions and group-relations that foster imbalances in the accumulation of power, property, and privileges over time (Nancy Krieger, 2005). Embodiment is a "contextual-construct" that is active and reciprocal: because it considers reciprocal and determinant relationships between structurally imposed environmental conditions, biophysical properties, human agency, behavior and health outcomes(Nancy Krieger, 2005; N Krieger, 2011). Thus, embodiment is a construct for contextualizing complex behaviors that occur and vary in form and function in different settings (Nancy Krieger, 2005; N Krieger, 2011).

Multiple pathways of embodiment

Ecosocial theory also posits that there are "multiple pathways of embodiment" at different ecologic levels that manifest at "different spatiotemporal scales,"(Nancy Krieger, 2005, 2011) which include: social and economic deprivation; exposure to toxic substances, pathogens, and hazardous conditions; discrimination and other forms of socially-inflicted violence; targeted marketing of harmful products; inadequate or degrading healthcare; and degradation of ecosystems, which is related to systemic alienation or oppression of indigenous people"(Nancy Krieger, 2005, 2011). As Krieger has noted, it would be unreasonable to expect any researcher to test all pathways of embodiment in a single study. Thus, this dissertation contemplates solitary confinement and extreme heat as a pathways of social deprivation, hazardous conditions, and discrimination or socially inflicted trauma (N Krieger, 2011).

<u>Economic and social deprivation</u>

solitary confinement is disparately experienced by people who have endured economic and social deprivation prior to incarceration. Deprivation of social contact is a defining feature of incarceration that is exacerbated by placement in solitary confinement (Haney, 2018a). Through this pathway, solitary confinement is posited to deepen social deprivation by physically isolating people and diminishing their ability to communicate with family, friends, and counselors that work in the prison. As described in earlier sections, social isolation contributes to emotional and psychological harms that are associated with increased susceptibility to self-injury. solitary confinement can also exacerbate economic deprivation. Most people in solitary confinement are not permitted to hold prison jobs or receive a nominal wage. These restrictions limit one's ability to purchase food items, toiletries, reading materials, and other basic necessities from a prison commissary. Without agency to obtain such essential items, people in solitary confinement become beholden to correctional officers to request things such as soap, toilet paper, newspapers. This can breed tension between guards and incarcerated people, which sometimes results in verbal or physical violence. Additionally, people unable to earn a prison wage in solitary confinement lose a source of income that may be used to pay outstanding debts to other incarcerated people, which carries a risk of retaliation. Together, social and economic deprivation incurred while in solitary confinement may increase vulnerabilities to self-injurious behaviors.

Toxic substances, pathogens, and hazardous conditions

The proposed study conceptualizes solitary confinement and extreme heat as a potential ways by which a hazardous condition within a prison setting becomes embodied in self-injury.

Solitary confinement itself could be viewed as a hazardous condition given what is known about its effects on human health. Yet, environmental conditions of prison facilities and those within units designed to hold people in isolation warrant attention as potential contributors to morbidity and mortality. One way that solitary confinement may become embodied is through exposures to physical properties of these micro-environments. There are significant variations in the architectural design, age and quality of building infrastructure, types of lighting or lack of natural sunlight, use of technologies (e.g. manual vs. automatically locking doors), acoustics and noise levels, sanitary conditions, poor nutrition, inadequate temperature regulation or ventilation, direct or indirect exposure to tear gas or mace, and other potentially contributing factors to physical and mental health.

Discrimination and socially inflicted traumas

Ecosocial theory posits that discrimination and other forms of socially inflicted traumas are a pathway through which an exposure becomes embodied. Most people in prison experience socially-inflicted traumas throughout their life-course that shape their experiences before, during, and post incarceration (Nancy Krieger, 2011). Third, as described throughout this proposal, solitary confinement is an experience that inflicts profound emotional, physical, and psychological trauma on many of those who are exposed. Solitary confinement is itself a form of trauma, or more bluntly state-sanctioned torture under international human rights law.

Solitary confinement also operates as a form of institutionalized discrimination, which bears relevance to its potential influence on the occurrence and meanings of self-injurious behaviors. Solitary confinement units can be conceived as micro-

environments, or “prisons-within-prisons”, where people who are among the most stigmatized and vulnerable to violence, such as those with serious mental illness are commonly placed. Thus, physical removal and isolation of people from general population into a segregated setting where they are more likely to decompensate and engage in self-injurious behaviors exacerbates underlying traumas that lead to solitary in the first place.

Second, as noted earlier, solitary confinement is an extreme form of punishment that is often discriminatorily imposed on racial and ethnic minorities (Allen-Bell, 2011; Chavez, 2019; J. N. Morgan, 2017; Reiter & Blair, 2015; Shaylor, 1998; Wachtler & Bagala, 2013). Prison officers have broad authority to subject people to placement in solitary confinement for violating a wide range of institutional rules (Shames, 2015), and to exact additional punishments upon people sanctioned to this punishment.

Interplay of exposure, susceptibility, and resistance

Ecosocial theory’s third proposition underscores the importance of exploring the “interplay of exposure, susceptibility, and resistance” at multiple ecological levels and across the life-course in relation to historical generation”(N Krieger, 2011; Nancy Krieger, 2011). This proposition accounts for differences in health profiles within and between different social groups of people nested in structures shaped by geographic, economic, and social divisions. It recognizes that common exposures differentially afflict different groups of people based on their susceptibility and resistance to the risk an exposure carries. Different groups of people are statistically more likely to be exposed to solitary confinement while incarcerated than others; and more susceptible to

experiencing the cognitive, emotional, and psychological turmoil associated with prolonged isolation, idleness, and sensory deprivation.

Resistance to the harms of solitary confinement can take many forms that exemplify human resilience amidst severe and oppressive living conditions. Anthropological studies and testimonies of individuals captivated in solitary confinement for years and decades provide narrative accounts of the introspective, imaginative, and ritualistic thinking and behaviors that people adopt to stave off psychological deterioration. Resistance to harms of solitary confinement have also manifested in the forms of organized protests and acts of collective resistance, such as hunger strikes, that bring attention to levels of human suffering taking place in hidden environments (R. H. King, 2012; McGuire, 2017; Rubin, 2017a, 2017b).

Accountability and Agency

Ecosocial theory's fourth proposition focuses on how political and economic systems shape inequities in distributions of health, disease, and death in a society, and brings focus to critical the capacities of individuals, institutions, and systems to act (agency) and their legal, ethical, and moral obligations to take or avoid action on particular issues in contextually-defined situations (accountability) (N Krieger, 2011; Nancy Krieger, 2011). This proposition holds that macro-level forces are more likely to influence phenomena at meso and micro levels, while fully recognizing the possibility for micro-level actions to have powerful effects at a macro-level. In fact, to illustrate this concept, Krieger points to the success of individuals who catalyzed collective organizing and social movements that fought against odds to dismantle oppressive economic and

political regimes, institutions, and systems and usher in newly defined constitutional rights and equality for historically subjugated groups of people.

Here, a focus on agency and accountability imputes a duty upon social scientists to question, challenge, and reckon with the social origins and pedigrees of theories used to explore and explain public health problems in a society. Shedding epidemiological light onto health inequities manifesting in hidden places that evade public scrutiny, such as solitary confinement units in prisons, is critical for increasing accountability of government systems whose policies and practices result in state-sanctioned violence and bringing agency to voiceless groups of people via legal interventions. By increasing transparency and providing empirical insights into an overlooked public health problem, the proposed study may provide evidence to guide ongoing efforts to reform correctional practices and transform prison environments to alleviate psychological suffering that manifests in self-injury.

Carceral Geography

Carceral geography is a sub-discipline of critical human geography that focuses on the interplay between Foucauldian ideas of how space, place and geography influence human psychology and the scholarship of Loic Wacquant who has described the rise of punitive political ideologies underlying hyper-incarceration of oppressed and marginalized groups in the U.S. and other Western societies(Collins et al., 2019; Moran, 2016; Moran & Jewkes, 2015; Moran et al., 2018). Carceral geographers explore how properties of space, place, time, and geography influence human psychology, in the context of the rise of retributive ideologies that have fueled hyper-incarcerations of

historically oppressed and marginalized groups in the U.S. and other Western societies (R. W. Gilmore, 2007).

The work of prison abolitionist, Ruth Wilson-Gilmore, provides much of the intellectual underpinnings and inspiration for this emerging literature (R. W. Gilmore, 2007). Carceral geography challenges the Foucauldian notion of "prison as a constantly surveilled space in which prisoners internalize the regime to become 'disciplined and docile bodies.' Its central criticism rests on the notion that such a view minimizes complexities of human agency within carceral spaces, by overlooking and how people express resilience and resistance to oppressive sovereign power (Moran, 2016). Thus, it calls on researchers to critically contemplate the meaning of complex behaviors that occur in carceral spaces by capturing the perceptions, emotions, beliefs and interpretations of directly-impacted parties (Moran, 2012a). A researcher's analytical process for interpreting meaning from personal narratives of others should be interpreted in light of theory and extant literature, while routinely reflecting upon the influence of one's disciplinary training, personal values, and life experiences in interpretation (Crewe, 2011; Crewe, Warr, Bennett, & Smith, 2014). In part, carceral geography views incarceration and its physical structures as tangible and visible displays of sovereign power. At a systems level, prisons are considered institutions for dividing and excluding people, in processes of distributing social, economic, and political power, mostly along lines of race and class (R. W. Gilmore, 2007; Moran et al., 2018).

Given its focus on the interplays between space, place, and power in prisons, carceral geography provides an intellectually deep set of constructs and ideas for exploring how different forms of carceral violence, such as environmental injustices and

solitary confinement shape vulnerabilities to self-injury, and the meaning of these acts from the perspective of those directly impacted(Guenther, 2011, 2013, 2016, 2017).

Similar to ecosocial theory, the construct of embodiment in carceral geography considers how features of carceral environments are expressed in the emotion, cognition, behavior, and ultimately the bodies of humans. For example, Wahidin (2002) used embodiment to explore "how prison time is inscribed upon the confined body", while considering multi-level interplays between the biological and the social, the individual and collective, and structure and agency (Wahidin, 2002). Embodiment is a central construct within carceral geography that considers "the experience of carceral space at an intensely personal level, tracing the ways in which the individual spaces of the prison elicit and facilitate different emotional expression, the ways in which the experience of incarceration is inscribed corporeally upon the imprisoned body, and the embodied strategies deployed by occupants of carceral space (Moran, 2016). For example, Moran (2011) conducted interviews with more than 200 women who were currently or formerly imprisoned in the Russian Federation to examine how prison time was inscribed on the emotions and bodies of women. This study used embodiment to convey how prison time was inscribed on the body of women after their release from prison in the form of emotional anxieties before release and societal stigma of loss of teeth as a marker of imprisonment (Moran, 2012b). As another example, Chamberlen (2016) operationalized embodiment to explore relationships between "pains of imprisonment" and self-injurious behaviors among incarcerated women through in-depth interviewing (Chamberlen, 2016).

Ecosocial theory and carceral geography also underscore the importance of historical context in the formulation and interpretation of empirical research (Moran, 2016). Carceral geographers examine questions related to the embodiment of carceral spaces, in the historical context of the rise of retributive ideologies fueling the hyper-incarceration of historically oppressed and marginalized groups in the U.S. and other Western societies.(R. W. Gilmore, 2007; Moran, 2016; Morin & Moran, 2015)

Theories of dehumanization

Especially for Aim 3, this dissertation integrates ideas from theories of dehumanization to consider the structural, institutional, and psychological mechanisms that breed mistreatment, oppression, and denial of autonomy, dignity, and entitlements to other groups of people, frequently in contexts of extreme events, such as genocide, war crimes, and torture (Bandura, 1999; Bustamante et al., 2019; Haslam & Loughnan, 2014; Viki, Osgood, & Phillips, 2013). Analogous to ecosocial theorists and carceral geographers, scholars of dehumanization have defined embodiment, as the "condition of becoming", examining how "dehumanization travels not only vertically between individual mind and body but also horizontally across similarly positioned bodies" (Bustamante et al., 2019). Multiple state and federal courts have held solitary confinement practices to violate the 8th Amendment's prohibition of "cruel and unusual punishment" especially for people with underlying SMI. As noted, based on interpretations of the United Nations' Mandela Rules, advocates, some legal scholars, and human rights entities consider long-term solitary confinement ("the confinement of prisoners for 22 hours or more a day without meaningful human contact"), when lasting more than 15 consecutive days, as a form of "ill-treatment" and in in some situations as

a form of torture (Fuller, 2018; Haney et al., 2020; Méndez, 2019). While such standards have amplified calls for reform, solitary confinement, both as a short and long-term practice, remains a commonly used tactic by correctional systems in jails and prisons in the United States (and elsewhere). Accordingly, theories of dehumanization can aid in understanding the power structures perpetuating its persistence in the U.S. penal system, despite its well-known harms, and dismantling them in pursuit of health equity, social justice and state accountability.

Cumulative dehumanization is a construct for understanding how events perceived as ordinary or routine for some accumulate to cause psychological distress and harms to marginalized groups, and emerged in studies of how exposures to police stops, searches, and arrests become embodied among residents of predominantly Black communities (Bustamante et al., 2019). Rather than police, Aim 3 applies cumulative dehumanization to examine the influence of correctional officers' exerted power to punish people in solitary confinement through deprivation of material sustenance ("food loaf", shutting off water and electricity, taking away mattress) and subjection to violent force (chemical spray and tasers), in shaping vulnerabilities to self-injury among incarcerated people.

The Risk Environment Framework (REF)

The Risk Environment Framework (REF) is a schematic tool for uncovering the social, political, and economic forces within different places and contexts that produce or reduce vulnerabilities to overdose and other drug related harms (Rhodes, 2002; Strathdee et al., 2010). Epidemiologists and drug policy scholars have applied REF to document the myriad mechanisms through which criminalization and law enforcement

practices (e.g. policing and incarceration) give rise to overdose vulnerabilities in diverse geographies and social contexts. However, few studies have focused on features of risk environments within the walls of jails and prisons as shaping overdose vulnerabilities for currently or formerly incarcerated people. In Aim 2, REF is applied for contextualizing the social and physical features within the micro-environments of spaces used for solitary confinement that become embodied and influence psychological states and behavioral responses that lead to overdose. Aim 2 situates solitary confinement as socio-structural manifestation of the drug war, by drawing attention to the potential processes through which it may be accountable for contributing to overdose vulnerabilities.

Recap of Study Aims

Aim 1 (Chapter 2) explores possibility that power structures of dehumanization within spaces used for solitary confinement operate as a pathway of embodiment that increases vulnerability to self-injury among people with SMI, and calls attention to punishments, beyond social isolation, that prison staff inflict upon people in solitary confinement as mediating vulnerabilities to self-injury among people diagnosed with serious mental illnesses.

Aim 2 (Chapter 3) brings to bear an issue at the intersection of distinct yet intertwined public health and human rights crises confronting the United States: the escalating scourge of overdose fatalities and the pervasive use of solitary confinement in jails and prisons. It documents the lived-experiences of solitary confinement among people who use drugs, and investigates the potential mechanisms through which this

widely adopted carceral practice may create and shape post-release drug-related overdose.

Aim 3 (Chapter 4) used fixed-effects negative binomial regression models to assess associations between daily exposures to extreme heat and daily incident rate of suicide watch incidents across six Louisiana prison facilities. This analysis was conducted on a longitudinal panel dataset that merged daily climatological data with administrative data from the Louisiana Department of Corrections and Rehabilitation

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Chapter 2. Self-injury and the embodiment of solitary confinement among adult men in Louisiana prisons

Abstract

Solitary confinement is a harrowing human rights and public health problem that is currently inflicted as a routine punishment for a litany of prison rule violations, a reactionary tactic to quell resistance to prison conditions, and as a destination of last resort for people serious mental illnesses (SMI) who are especially vulnerable to its harms. An extensive body of research has documented clusters of psychiatric symptoms—emotional distress, cognitive deficits, social withdrawal, anxiety, paranoia, sleeplessness, and hallucinations—linked to solitary confinement that often manifest in decompensating behaviors, which include self-injury and suicide. It summarizes the historical evolution of solitary confinement, recaps its linkages to self-injury and suicidality, and offers a theoretical framework grounded in ecosocial theory, and supplemented with concepts from theories of dehumanization and carceral geography. This study bolsters this body of evidence by focusing on whether and how exertions of power by prison staff to deploy mechanisms of dehumanization—as a pathway between SMI and self-injury among a cross section of adult men (n=517) exposed to solitary confinement in Louisiana prisons in 2017. Findings reinforce the need for interventions

that diffuse forms of carceral power and practices that continue to subject people to isolation, dehumanization, and violence.

Chapter 2: Self-injury and the Embodiment of Solitary Confinement among Adult Men in Louisiana Prisons

Introduction

Solitary confinement is a harrowing human rights and public health problem that epitomizes the dehumanizing conditions of carceral environments in the mass incarceration era (D. H. Cloud et al., 2015). An estimated 55,000 to 62,500 (4.5%) people in state prisons are locked in isolation inside steel and concrete cages for upwards of 22 hours each day (Bertsch et al., 2020). Solitary confinement encompasses a broad bureaucratic nomenclature (e.g. “restrictive housing”, “administrative segregation”) and is informally called “the hole” (Browne et al., 2011; D. H. Cloud et al., 2015; Foster, 2016; Haney, 2018b). Regardless of terminology and acknowledging heterogeneity in conditions between and within carceral systems, people confined in these spaces are typically exposed to similarly severe conditions: caged in a small cell with a bed, toilet, sink, and perhaps a window. Access to programming and visits with loved ones is often restricted or non-existent. Physical exercise is typically offered 3-5 times weekly for 30-60 minutes, alone in caged enclosures. These spaces can be monotonously predictable; but at other times, erratically noxious with aversive sights, jarring sounds, and odious smells that people are powerless to avoid (Browne et al., 2011; D. H. Cloud et al., 2015; Haney, 2018b). The amount of time people spend in

solitary confinement varies widely and may extend from days to decades. (Bertsch et al. 2020; Resnik et al., 2018).

People with serious mental illnesses (SMI), such as schizophrenia, bipolar disorder, and major depression, are overrepresented in solitary confinement and especially vulnerable to its harms (Bertsch et al., 2020; CLA-Liman, 2020; Reiter & Blair, 2015; Reiter et al., 2020). In many states, Black, Indigenous, and People of Color (BIPOC) are disproportionately subjected to solitary confinement relative to their percentage of the overall prison population, while their white counterparts are underrepresented (Henry, 2022; Kaba et al., 2015; Pullen-Blasnik et al., 2021; Resnik et al., 2018).

The hyper-criminalization of Blackness in U.S. society is compounded by intersecting socio-structural forces that marginalize people with SMI (Muhammad, 2019; Walker, Spohn, & DeLone, 2016; Ware, Ruzsa, & Dias, 2014). In moments of mental health emergencies, BIPOC with SMI, are more likely to be restrained, detained, and physically harmed or killed by law enforcement entities (M. N. McLeod, Heller, Manze, & Echeverria, 2020; Saleh, Appelbaum, Liu, Stroup, & Wall, 2018), while their white counterparts are more likely to receive more treatment-based responses (Heitzeg, 2015; Kaba et al., 2015; M. D. Thomas, Jewell, & Allen, 2021). Several studies have reported racial disparities in exposures to solitary confinement. Some scholars attribute these disparities to implicit and explicit racial biases in correctional officers' enforcement of disciplinary rules (Allen-Bell, 2011; Olson, 2016). Correctional officers may be more likely to perceive behaviors related to mental illness as willful acts of

"deviance" or "disobedience" and respond punitively, when the person involved is BIPOC versus White (Duxbury, Frizzell, & Lindsay, 2018; Ewing, 2016; Henry, 2022).

Despite disputes among a group of non-clinical criminologists (Gendreau & Labrecque, 2018; R. D. Morgan et al., 2016), there is consensus among health and human rights authorities that solitary confinement diminishes the health people who endure it (D. H. Cloud et al., 2015; Haney et al., 2020), which is grounded in an extensive literature that has mostly linked the practice to deleterious mental health outcomes (Appelbaum, 2015; Haney, 2018a; J. Jahn, N. Bardele, J. Simes, & B. Western, 2022; P. S. Smith, 2006), though increasingly to mortality and physical health outcomes (Brinkley-Rubinstein et al., 2019; Strong et al., 2020; B. A. Williams, 2016). This study aims to bolster this body of evidence by examining relationships between solitary confinement and self-injury in a Deep South prison system. The analysis looks beyond social isolation—the hallmark feature of solitary confinement-- to bring focus to structures of power that permit dehumanization by depriving people of sustenance and inflicting physical violence upon them—as a pathway between SMI and self-injury among incarcerated people.

First, as background, we provide a non-exhaustive summary of the historical evolution of solitary confinement, recap its linkages to self-injury and suicidality, and establish a theoretical framework for the current study, grounded in ecosocial theory, and supplemented with concepts from theories of dehumanization and carceral geography.

A Brief History of Solitary Confinement

Solitary confinement began in the 1790s in the U.S. as states constructed prisons as alternatives to corporal punishments of English colonialism and to replace dilapidated jails that had erupted into chaos, violence, and uprisings after the Revolutionary War (Rubin, 2015). Early proponents were evangelicals and reformists who theorized that enforced silence and isolation would prompt an introspective process of moral repentance, spiritual reckoning, and social transformation and penologists who viewed silence and physical separation as necessary to address the problems plaguing the jails or "proto-prisons" that preceded the penitentiaries (Meskell, 1998; Rubin & Reiter, 2018; P. S. Smith, 2019). Into the 1800s, the practice of solitary confinement evolved as states "experimented" with and debated the purported merits of two competing penological models of confinement. In 1818, Pennsylvania lawmakers paved the way for the production of two state prisons, Western State Penitentiary and Eastern State Penitentiary to operate on "the principle of solitary confinement"(Rubin, 2015). Under the Pennsylvania model, people were kept separated in cells for the entirety of each day. All activities, such as reading, praying, working, and exercising occurred alone in their cells, except for occasional interactions with prison officials and silent walks to a small yard adjacent to their cell. In 1821, New York opened Auburn State Prison that was initially intended to operate a hybrid model of incarceration that relatively speaking, more closely resembles the design and operation of modern prisons. Some residents were placed in larger, open congregate living areas, while others were kept in narrow and poorly ventilated solitary confinement cells with nothing more than a Bible. However, solitary confinement practices in the first Auburn prisons produced dire results, and its propagators adapted this model to what is known as the "Silent System" -- keeping people in solitary cells at night while forcing them to work in silence in

factory-like conditions, under the threat of physical brutality, during the day. The ways through which tensions between the Auburn and Pennsylvania systems of confinement shaped the evolution of carceral systems and heterogeneities in solitary confinement practices into the mass incarceration era is more thoroughly discussed elsewhere(Guenther, 2013; Rubin, 2015).

By the mid-19th century, physicians, jurists among others had condemned solitary confinement as a profoundly harmful (Gray, 1848; Nitsche, Willmanns, Barnes, & Glueck, 1912). Reports of "solitary confinement psychosis" surfaced in the medical literature in the 1840s and prison reform organizations published series of harrowing reports of people experiencing muscular atrophy, psychosis, self-harm and suicide in solitary confinement cells, which played a role in many states moving away from the practice (Rubin, 2015). For example, in 1840, the North American Review summarized evidence of its harms based on prison mortality records, physician notes, and recorded cases on "insanity" across multiple state institutions:

> It [solitary confinement] is inhuman[e] and unjust, enormously expensive, and pernicious to society, inasmuch as it creates each year a fearful amount of insanity [sic], the effects of which, owing to the tendency of this disease to hereditary transmission, cannot fail to be felt and deplored for many generations. We are almost afraid to estimate the amount of the evil [sic] it has already caused.

By the early twentieth century, solitary confinement had been largely abandoned in U.S. prisons. Yet, it resurfaced in the 1960s, at a time when retribution began to supersede rehabilitation as a chief penological principle; educational, vocational, and rehabilitative programs in prisons were diminished and the demographics of prison

reversed from majority white to majority Black, marking the start of a multi-decade prison boom (Guenther, 2013; Sakoda & Simes, 2021; P. S. Smith, 2019). In the 1980 and 1990s, federal and state governments built or reconfigured thousands of prisons with spaces designed for prolonged isolation (Reiter, 2016; Richards, 2015).

Solitary confinement's rise is interwoven into the structural racism and violence underpinning the evolution of mass incarceration in the aftermaths of enslavement and Jim-Crow era oppression (Adamson, 1983; Armstrong, 2011; Guenther, 2013; Sakoda & Simes, 2021; Loïc Wacquant, 2002b). As early as the mid-1840s, public health leaders called attention to racialized harms of solitary confinement (BH., 1843). For example, one author observed:

> Now among the blacks in prison at Philadelphia … the chance that imprisonment on this plan [solitary confinement] will kill the black convict [sic] within one year is two and a half times as great as the chance of his dying within that year if he should remain at liberty.

Recent studies have also found racial disparities in solitary confinement(Pullen-Blasnik et al., 2021; Sakoda & Simes, 2021; Schlanger, 2012). In part, the resurgence of solitary confinement into the mass incarceration era was retaliatory to political organizing and uprisings within prisons to protest worsening conditions (Gottschalk, 2010; Guenther, 2013; Woodfox, 2019). Beginning in the mid-1960s, in contrast to the original proponents of solitary confinement, some contemporary propagators viewed it as a tactic for repressing the organizing power of a rapidly growing prison population, mostly comprised of younger black men(Rubin & Reiter, 2018). Indeed, some scholars view the reemergence of solitary confinement through a historical lens, as form of

racialized oppression in the lineage of convict leasing, chain gangs, and other criminal legal practices used to sustain racial capitalism and suppress political resistance to abusive prison conditions that disproportionately harm people along intersections of race, class, and disability (Armstrong, 2011; Davis, 2011; Ewing, 2016; R. W. Gilmore, 2007; Hattery & Smith, 2022; McKittrick, 2011).

Changes in Mental Health Policy

In the 1840s, advocates led a crusade to create a network of state psychiatric hospitals in part, by calling attention to "the present state of insane persons [sic] confined in cages, closets, cellars, stalls, pens! Chained, naked, beaten with rods, and lashed into obedience. . ." in jails and prisons (Dix, 1904). Civil commitment to state asylums was a primary response to mental illness for the next century. However, much like the jails and prisons, conditions in state asylums were horrid. Exposes of inhumane conditions, the advent of psychotropic drugs, rise of community-based psychiatry, stronger civil protections against involuntary commitment, and creation of funding streams for community-based care via Medicaid were driving forces that led to closures of psychiatric hospitals, beginning the mid-1950s—known as deinstitutionalization (Frank & Glied, 2006).

The deinstitutionalization movement's vision to replace asylums with community mental health centers was hampered by neoliberal economic policies that deregulated, defunded, and privatized vital components of the social safety net, the biomedicalization of public health, the criminalization of poverty and mental illness and the war on drugs (Harcourt, 2011; D.-Y. Kim, 2016; Prins, 2014); which culminated to abdicate core functions of public health and social service systems to an expanding and increasingly

retributive criminal legal system (Lamb & Weinberger, 2005; Rotter & Compton, 2022). Some scholars refer to “trans-institutionalization” to convey the structural changes leading to the overrepresentation of people with SMI in jails, prisons, and long-term solitary confinement, specifically in the wake of the shortcomings of deinstitutionalization and the rise of “tough on crime” policies and mass incarceration; though, empirical support for this theory is contested(Prins, 2011).

Regardless, today, jails and prisons are the largest providers of publicly-funded mental health services for millions of marginalized people (Rothman, 2017; Rotter & Compton, 2022). While even higher in jails, the prevalence of serious mental illnesses (SMI) is at least 2-4 times higher in prisons than community settings (Prins, 2014). Yet, prisons are mostly ill-equipped to provide levels of care and support that many of these individuals would benefit from receiving. There are shortages of counselors, nurses, psychologists, and psychiatrists to identify, prevent, and treat the complex mental health needs of incarcerated people. Instead, correctional officers who typically lack the knowledge to identify and skills to respond to people experiencing emotional distress and psychosis but are trained to enforce a rules that govern nearly every aspect of survival in prison, and carry the weight of responsibilities for meeting their daily needs (Reiter & Blair, 2015). Together, the scarcity of mental health services amidst an abundance of punishment results in people with SMI being disparately disregarded in solitary confinement, either as a sanction, or because the severity of their disabilities make them vulnerable within general population settings (Metzner & Fellner, 2013; Reiter & Blair, 2015).

In summary, the origins of solitary confinement at the dawn of the first penitentiaries and its reemergence and proliferation in the mass incarceration era have been shaped by a complex interplay of historical and structural forces. Today, solitary confinement is often inflicted as a punishment for prison rule violations, a reactionary tactic to quell unrest, resistance and uprisings in protest of prison conditions, and as and disproportionately as a destination for many marginalized people with severe psychiatric disabilities that has resulted in a public health and human rights crisis.

Self-injury and solitary confinement

An extensive body of research has documented clusters of psychiatric symptoms—emotional distress, cognitive deficits, social withdrawal, anxiety, paranoia, sleeplessness, and hallucinations—linked to solitary confinement that often manifest in decompensating behaviors, which include self-injury and suicide (D. H. Cloud et al., 2015; Haney et al., 2020; J. L. Jahn et al., 2022; P. S. Smith, 2006).

The prevalence of self-injury and suicide is substantially higher among incarcerated people compared to the rest of the U.S. population (A. Carson, 2021; Fazel et al., 2017; S. Larney & M. Farrell, 2017). Over the past two decades, suicide mortality behind prison walls has grown by 85 percent (A. Carson, 2021). Self-harm is a leading cause of morbidity and significant predictor of suicide among incarcerated people in the United States. The annual prevalence of self-harm in state prisons is harder to document, but is estimated at 5-6% among men and 20-24% among women, which surpasses the < 1% of adults in community settings(Favril, Yu, Hawton, & Fazel, 2020). Nearly 20% of incarcerated people diagnosed with a mental health condition engage in self-harm while in custody, compared to 4% in community settings (Favril et al., 2020).

Self-harm and suicides among incarcerated people frequently occur in areas of institutions where people are socially and physically isolated (Reeves & Tamburello, 2014). Having an SMI and being exposed to solitary confinement are potent predictors of self-injurious behavior among incarcerated people (Chamberlen, 2016; E. Lanes, 2009; S. Larney & M. Farrell, 2017). Kaba et al. (2014) found that people punished with solitary confinement in New York City's jail system were 6.9 times more likely to self-harm than those who were not, even after controlling for length of stay in jail, SMI diagnoses and demographics. Other have produced similar findings (Brinkley-Rubinstein et al., 2019; E. Lanes, 2009; S. Larney & M. Farrell, 2017; Way, Sawyer, Barboza, & Nash, 2007)

One limitation of prior studies, however, is a need for more contextual nuance for how power structures dictating the material and social worlds within spaces used for solitary confinement shape self-injury, suicidality, and other harms. Seminal anthropological studies have provided rich and contextualized accounts of the lived-experiences of solitary confinement across and within different prison systems(Rhodes, 2004). However, in public health literature, solitary confinement is most often conceptualized as dichotomous exposure or measured in metrics of time (i.e. frequency or duration of exposure (Brinkley-Rubinstein et al., 2019; Kaba et al., 2014). Understandably, social isolation, a hallmark feature of solitary confinement, and its pathologic consequence – loneliness - is posited as a primary mechanism producing health-related harms (Haney, 2018b). Sociologists and anthropologists have more thoroughly described the myriad, intersecting conditions that can influence psychological decompensation. On one hand, focusing on time makes sense, because

legislation seeks to align with the Mandela Rule, which sets a 15-day limit on solitary confinement. However, focusing on temporal properties and social isolation alone risks reinforcing incremental reforms limiting the number of days people can spend in solitary confinement and overlooks the influence of power structures that allow deprivations of other basic needs and subjections to violence to exist. Bolstering epidemiological evidence of solitary confinement's harms can be advanced with more nuanced constructs and measures of the varying social and material conditions within and between carceral contexts.

Institutional policies and organizational cultures give frontline prison staff broad power over the lives of incarcerated people, but little accountability for how their exertions of that power affect the well-being of people in their custody. While correctional staff must follow procedural rules governing admissions, reviews, and releases from solitary confinement, several reports issued by the Vera Institute of Justice found problems in many states due process mechanisms, and inconsistencies in how staff apply them(D. Cloud, Jessi LaChance, Lionel Smith, and Lauren Galarza. , 2019; D. H. Cloud, Kang-Brown, Jacob, Vanko, Elena, 2016; Hastings, 2016). Correctional staff, whether they are on the frontlines in the unit or higher ranking officials, make decisions that influence whether a person is placed in solitary confinement, how long they stay, and what material conditions they experience. Many officers, however have little education, preparation, training, or oversight for how they use such immense power (Armstrong, 2014; Fathi, 2010). Shedding light on how prison staff's exertions of power shape self-injury in the deepest ends of carceral systems, may

help advance legal interventions focused on uprooting policies that permit dehumanization, in addition to those focused on setting time restrictions.

This study seeks to address this knowledge gap by calling attention to punishments, beyond social isolation, that prison staff inflict upon people in solitary confinement as mediating vulnerabilities to self-injury among people diagnosed with serious mental illnesses. It aims to explore possibility that power structures of dehumanization within spaces used for solitary confinement operate as a pathway of embodiment that increases vulnerability to self-injury among people with SMI.

Theoretical framework

This study is guided by the ecosocial theory of disease distribution (ecosocial theory) and supplemented by concepts of embodiment within carceral geography and theories of dehumanization (Bustamante et al., 2019; Haslam & Loughnan, 2014; Nancy Krieger, 2021). Ecosocial theory is apt for studying how structural forces shape distributions of death, disease, and disability across social-ecological levels and along gradients of race/ethnicity, gender, class, and place, over time (Nancy Krieger, 2001b; N Krieger, 2011). Few studies have turned to eco-social theory to study self-injury or suicide (Cohen, Lindsey, & Lochman, 2021).

Studies have demonstrated the potent influence social exclusion, disintegration, and isolation in shaping vulnerabilities to self-injury and suicide at the individual, familial, community, and societal levels (S. Larney & M. Farrell, 2017). Conversely, strong social bonds, social cohesion and social support are protective against morbidity and mortality due to SIB (Hawton et al., 2001). From this lens, incarceration is a form of structurally-imposed social disintegration because it physically, socially, and

emotionally removes or disrupts a person's connections to family and other sources of support that lessen vulnerabilities to self-injury and suicide. This aligns with literature revealing how mass incarceration is interwoven into a broader web of social disintegration (Brinkley-Rubinstein, 2013; Massoglia & Pridemore, 2015; B. Pettit & Western, 2004; Wildeman & Wang, 2017).

By design, solitary confinement is an extreme form of social disintegration, because it often intensifies the harms of incarceration and deprives people of their autonomy to build and nurture meaningful social interactions – a fundamental human instinct, while subjecting them to violent and dehumanizing conditions. In the following subsections, two core constructs in ecosocial theory, accountability and embodiment, are defined and tailored to the current study by integrating analogous concepts from carceral geography and dehumanization literature.

Accountabilities for self-injury

Accountability is broadly concerned with answering who and what account for inequalities in health as shaped by historical and current arrangements of "power, property, and the production and reproduction of social and biological life." (Nancy Krieger, 2001b). This study posits that carceral systems, and actors within them, are accountable for producing vulnerabilities to self-injury and suicidality among incarcerated people with SMI. From this view, societal-level forces such racism, ableism, and economic inequities have intersected over time to result in an overrepresentation of people with SMI in solitary confinement nationwide, as shaped by the contemporary carceral system's evolution from enslavement, racialized violence, and criminalization of mental illness.

Through law, policy, and cultural norms, carceral systems allot immense power to correctional staff to deprive people of sustenance (food, water, electricity), freedom of movement (exercise, use of restraints) and social bonds (restricted communication and visits from loved ones) as punishments for a wide array of behaviors (e.g. disobeying an order, refusing work) with little oversight (Deitch, 2020; Fathi, 2010). In many prison systems, behavioral health issues are hyper-criminalized in institutional policies and practices that promote viewing self-injury as "manipulation" or "malingering" subject to punishment, rather than a symptom of trauma or a behavioral response to harsh conditions of confinement (Kenning et al., 2010; H. P. Smith, Power, Usher, Sitren, & Slade, 2019). In recent years, an increasing number of correctional agencies have adopted policies to de-escalate situations involving a person experiencing a mental health crisis. However, in many systems there are still institutional policies and structural factors that give correctional officers power and training to react to mental health crises with escalations of violence and retribution, via cell-extractions, chemical spray, tasers, restraints, and punishments that compound the harms and extend durations of isolation and the harms it causes (Abramsky & Fellner, 2003). Moreover, if with policies intended to de-escalate such situations, there is little oversight and correctional officers may arbitrarily resort to using force against people with serious mental illness, which has been the subject of litigation and focus of human rights organizations (Fellner, 2015)

Embodiment of carceral contexts

Embodiment is ecosocial theory's bedrock construct and refers to how people "literally embody, biologically… [their] lived experiences in societal and ecological

context. ", while considering reciprocal interplays between structure and agency across and within multiple ecological levels (Nancy Krieger, 2001b, 2021). This study explores how exertions of power that deprive sustenance for and inflict of violence on people in solitary confinement produce place-based vulnerabilities to self-injury among people with SMI.

As Professor Craig Haney has observed, "solitary confinement is only ever embodied in actual places, ones that exist in any given amalgam of different conditions that vary along dimensions of harshness and resulting risk of harm" (Haney, 2018b). This study's conception of embodiment draws on carceral geography: an abolitionist subdiscipline of human geography that explores how properties of space, place, and time influence emotion, cognition, and behavior in the contexts shaped by retributive ideologies and hyper-incarceration of marginalized groups in Western societies (R. W. Gilmore, 2007; Moran, 2016). Whereas ecosocial theory has mostly been applied to examine embodiment at community and population levels, carceral geographers look at the "experience of carceral space at an intensely personal level, tracing the ways in which the individual spaces of the prison elicit and facilitate different emotional expression, the ways in which the experience of incarceration is inscribed corporeally upon the imprisoned body, and the embodied strategies deployed by occupants of carceral space" (Moran, 2016).

According to ecosocial theory, there are multiple pathways of embodiment (economic and social deprivation, toxic substances, pathogens, hazardous conditions, discrimination and other forms of socially inflicted trauma, targeted marketing of harmful commodities, inadequate or degrading healthcare, and degradation of

ecosystems) (N Krieger, 2011). Though most are germane, we focus on discrimination and socially inflicted trauma as potential pathways of embodiment leading to self-injury among people with SMI exposed to solitary confinement.

Theories of dehumanization consider the structural, institutional, and psychological mechanisms that breed mistreatment, oppression, and denial of autonomy, dignity, and entitlements to other groups of people, frequently in contexts of extreme events, such as genocide, war crimes, and torture (Bandura, 1999; Bustamante et al., 2019; Haslam & Loughnan, 2014; Viki et al., 2013). Analogous to ecosocial theorists and carceral geographers, scholars of dehumanization have defined embodiment, as the "condition of becoming", examining how "dehumanization travels not only vertically between individual mind and body but also horizontally across similarly positioned bodies" (Bustamante et al., 2019). Multiple state and federal courts have held solitary confinement practices to violate the 8th Amendment's prohibition of "cruel and unusual punishment" especially for people with underlying SMI. As noted, based on interpretations of the United Nations' Mandela Rules, advocates, some legal scholars, and human rights entities consider long-term solitary confinement ("the confinement of prisoners for 22 hours or more a day without meaningful human contact"), when lasting more than 15 consecutive days, as a form of "ill-treatment" and in in some situations as a form of torture (Fuller, 2018; Haney et al., 2020; Méndez, 2019). While such standards have amplified calls for reform, solitary confinement, both as a short and long-term practice, remains a commonly used tactic by correctional systems in jails and prisons in the United States (and elsewhere). Accordingly, theories of dehumanization can aid in understanding the power structures perpetuating its

persistence in the U.S. penal system, despite its well-known harms, and dismantling them in pursuit of health equity, social justice and state accountability.

Cumulative dehumanization is a construct for understanding how events perceived as ordinary or routine for some accumulate to cause psychological distress and harms to marginalized groups, and emerged in studies of how exposures to police stops, searches, and arrests become embodied among residents of predominantly Black communities (Bustamante et al., 2019). Rather than police, this study explores the influence of correctional officers' exerted power to punish people in solitary confinement through deprivation of material sustenance ("food loaf", shutting off water and electricity, taking away mattress) and subjection to violent force (chemical spray and tasers), in shaping vulnerabilities to self-injury among incarcerated people.

Methods

Study setting

Louisiana's prison system, an epicenter of mass incarceration and solitary confinement, is the setting for this study. In 2018, Louisiana prisons held the greatest percentage of people in some form of solitary confinement—17.6 percent, which was four times the estimated national average (D. Cloud, Jessi LaChance, Lionel Smith, and Lauren Galarza. , 2019; Resnik et al., 2018). Several of Louisiana's prisons are located on the landscapes of former cotton plantations that enslaved thousands of people of African descent until these properties were sold to the state to create prisons and a convict-leasing system after the Civil War. The "Angola 3", Albert Woodfox, Herman Wallace, Robert King, were held in solitary confinement for decades in Louisiana prisons, in part based on their affiliation with the Black Panther Party (Woodfox, 2019).

Approximately half of people sentenced to prison in Louisiana are in a state-operated prison, and the remainder are housed in parish jails.

This study only includes people who were incarcerated in Louisiana's state-operated prisons. As stated in the Louisiana Department of Corrections and Rehabilitation's administrative rules and described in previous literature, imprisoned people in Louisiana may be subjected to various forms of solitary confinement based on a range of factors and circumstances. For example, they may be temporarily placed in solitary confinement pending an investigation or disposition of administrative or newly filed charges or while awaiting transfer to another location ("administrative segregation); sanctioned indeterminately to solitary confinement after being found guilty of violating one or more prison rules ("extended lockdown"); based on sentencing ("death row"); after requesting or being deemed to require protection from others in the general population ("protective custody" or "closed-cell restriction"); on a long-term basis for people who prison officials deem "unable to live in general population at any institution" based on factors such as the nature of their conviction, prior employment history (e.g. law enforcement), or other significant protection concern; and in "treatment" units designated for people with complex and chronic psychiatric disabilities who have difficulty residing in the general population and require more intensive monitoring by health and correctional staff. The conditions (e.g. visitation, double versus single-celling, and access to programing) in these units vary within and across institutions, based on factors precipitating a person's placement in solitary confinement and the policies governing the type of unit to which they are assigned. However, a report by the Vera Institute of Justice observed that despite such

differences, “living conditions in these units [solitary confinement] are characterized by social isolation, idleness, boredom, and sensory deprivation, often for prolonged and indeterminate periods of time.”

Study sample and procedures

The study sample was obtained secondarily from a cross-sectional survey of adult men who were exposed to solitary in Louisiana prisons in 2017 (Solitary Watch, June 2019). Prisons are opaque institutions that are difficult to access for purposes of public health surveillance, external oversight, and empirical research. Thus, in 2017, The American Civil Liberties Union (ACLU), MacArthur Justice Center, Solitary Watch, and Loyola University filed a request via Open Records Act. (La. R.S. 44:1 et seq) to obtain a census of all people who were currently in solitary confinement in Louisiana’s prisons. Paper surveys were sent via legal mail to 2,092 people on this roster. Participants were provided written assurance of confidentiality and instructions and stamped and addressed envelopes to send responses via “Legal Mail” back to the ACLU offices. Completed surveys were received from 709 people across nine prisons, a response rate of 34% that varied considerably by prison. Previous studies have used similar approaches (B. A. Williams et al., 2006).

Researchers obtained scanned versions of the original completed surveys for each respondent, after redacting identifiable information. Only surveys from respondents who gave permission on their original survey to have their responses used for future research were shared, which reduced the final sample to 517 respondents. Survey responses were entered manually and recoded as necessary for analysis. Consistency

and accuracy of data entry were checked through double-coding. Open-ended responses were recorded verbatim and used to contextualize responses to other items.

Measures

The focal outcomes were whether a person engaged in self-injurious behavior while in solitary confinement.

Self-injurious behavior (SIB) was coded as a binary variable based on combining affirmative responses to questions that asked: " Have you attempted to harm yourself since you have been in this segregation unit?" and/or "Which, if any, of the following symptoms have you experienced as a result of being in segregation? (self-harm)"?

Serious mental illness: The focal independent variable was serious mental illness (SMI) defined as a binary measure that included participants who reported being diagnosed with one or more psychotic disorders, bipolar disorder, major depression, and post-traumatic stress disorder (PTSD) before placement in solitary confinement.

Mediating variable

Cumulative dehumanization was operationalized as a continuous variable, a count of incidents where prison staff exercised their discretion to subject people to punishments that resulted in deprivations of material needs and/or physical violence. We tallied the number of incidents when people were subjected to restrictions or denied access to food (e.g. punished with nutraloaf or not receiving meals); water and/or electricity (guards turned off the water or lights in cells), clothing (guards took away their clothing), mattress (guards took left them with only a concrete slab for sleeping or resting); recreation (guards took away their ability to go outdoors for exercise and

sunlight); chemical agents (guards sprayed them with pepper spray); tasered (guards tased them with a taser gun).

Cumulative dehumanization was further categorized in two dichotomous domains. Sustenance deprivation refers to whether or not a person reported being punished with restrictions on meals, having water or electricity turned off in their cell, and having their mattress taken away. Violent physical force refers to whether or not a person reported ever being sprayed with chemical agents or tased while in solitary confinement. Importantly, cumulative dehumanization is a structural construct, and does not measure the intentions of correctional officers or provide circumstances leading to each punishment. Rather, it captures exposures to conditions that were permitted by institutional policies and experienced as punishments by respondents.

Covariates

Several co-variates were included based on prior literature and theory.

Nominal Prospect for release: We recoded multiple closed and open-ended survey items to create an indicator of nominal prospect of being released from prison, based on whether respondents reported a scheduled release date that exceeded 100 years life expectancy, sentenced to life-in-prison, sentenced to death penalty reflect the absence or low probability of release.

Demographics : Race and/or ethnicity were obtained by a survey question asking participants to check whether they identified as “African American/Black”, “Caucasian/white”, “Latinx”, or “Other”. For analytical purposes, we recoded responses into a dichotomous indicator of whether a person identified as a member of a Black,

Indigenous, Person of Color (BIPOC=1) versus White; because most respondents identified as “African American/Black” (75%) and very few identified as “Latino” (n=4). Age was calculated in years from participants’ self-reported birthdate at the time of survey completion.

Time in Solitary confinement: Time spent in solitary confinement was estimated by totaling responses from survey items assessing frequency and duration of solitary confinement exposures. These were recoded into a variable that reflected the total number of 90-day stints that a person endured in solitary confinement, because Louisiana Department of Public Safety and Corrections policy required review of each person’s placement in solitary confinement every 90 days, and prior reports suggest this is a meaningful benchmark for how incarcerated persons in solitary confinement monitor the passage of time.

Basis for solitary confinement placement: A binary indicator was created to represent whether each person was subjected to solitary confinement for violating a prison rule based on the type of unit they were housed in at the time of survey completion (1=Solitary confinement as punishment, 0=classification or protective custody). Those who reported being in “Extended Lockdown” or “Working Cell-Block” as a punishment or pending disposition of a disciplinary hearing in “Administrative Segregation” were coded as 1. Those who reported being in closed-cell confinement, protective custody, or death row were coded as 0.

Statistical Analysis

A descriptive analysis was conducted to compare demographics, sentencing, SMI status, and measures of dehumanization among participants who engaged in self-injury

and those who did not (Table 1). Before testing hypotheses, data were assessed for missing variables (Little & Rubin, 2019). Results from Little's test showed that data were not missing completely at random ($x2=29.07$, $p < .01$). Accordingly, multiple imputation was adopted before re-running analysis with imputed values. For model building, unadjusted odds-ratios were calculated to assess bivariate association between self-injury, focal predictors, and co-variates.

Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) were calculated from logistic regression models. ORs represent the odds of engaging in self-injury while in solitary confinement based on SMI status, quantity of 90-day stints , basis for admission, degree of dehumanization, pre-existing SMI status, and demographic attributes and sentencing.

First a logistic regression analysis was conducted to assess associations between SMI, cumulative dehumanization, and self-injury while controlling for aforementioned covariates. We then used logistic regression with bootstrap replication (Shrout & Bolger, 2002) to test the hypothesis that exposure to greater degrees of cumulative dehumanization during solitary confinement mediated the observed pathway between SMI and self-injury, while controlling for demographics, time in solitary confinement, and sentencing factors. Subsequently two separate models were run that independently assessed the two categories of cumulative dehumanization (sustenance deprivation and violent physical force) as possible mediators. All analysis was conducted in STATA Version 16.

Results

Participant characteristics for the total sample are presented in Table 1. Sample demographics resembled those of the overall prison population, and other studies of solitary confinement in Louisiana. Most respondents (79.9%) identified as Black Indigenous Person of Color (BIPOC). More specifically, 75.4% identified as Black/African American; 21.1% as "Caucasian or White"; 1.2% as Latino ; and 0.8% as American Indian/ Native American; and 1.4% as "Other". More than a third, (36.4%) reported a medical diagnosis of one or more SMI before exposure to solitary confinement. An estimated 20.9% of respondents were imprisoned for life, sentenced to death, or had a nominal prospect of a release date based on the length of their sentence. The response rates from each prison were as follows: Louisiana State Penitentiary (43.1%); Rayburn Correctional Center (13.1%); David Wade Correctional Center (26.7%); Dixon Correctional Center (4.7%); Elayn Hunt Correctional Center (4.1%); Raymond Laborde Correctional Center (6.3%); Winn Correctional Center (1.9%).

Most participants reported being sent to solitary confinement as a disciplinary sanction (67.1%) as opposed to protective custody or other reasons. Though, 16.5% reported never being housed in the general population while incarcerated, which mostly included people on death row and those assigned to closed-cell-restriction (a type of long-term isolation). For the sample, the total time in solitary confinement varied widely from 0.44 to 35 years and averaged 5.11 years (SD±5.79).

Overall, participants were subjected to an average of 2.79 types of dehumanization, ranging from 0-9 types. Forty-one percent (n=212) reported at least one form of sustenance deprivation, which included guards replacing meals with a food loaf (a bland blend of bread, meats, and vegetables into a compact loaf), turning off their

water or electricity as punishment, or taking away their mattress for multiple days. More than one-third (34.62%, n=179) reported that correctional officers used physical violence against them (being sprayed with chemical agents and/or tasered) (Table 1). A total of 134 participants (25.97%) reported ever engaging in self-injury while in solitary confinement. More than half of this group, 73 people (54.48%), reported that at least one of their acts of self-harm was a suicide attempt.

Logistic regression results

Table 3 reports bivariate associations between predictors, covariates, and the outcome. As anticipated, in the bivariate model people with previously diagnosed SMI had 4.64 times greater odds of self-injury than people who were not diagnosed with an SMI, especially for those with major depressive disorder. A higher percentage of people who self-injured were sent to solitary confinement for violating prison rules, and on average endured a greater quantity of total 90-day stints in solitary confinement. People who self-injured were exposed to a greater quantity of punishments, and higher frequencies of the more severe types of dehumanization (sustenance deprivation and violent physical force). BIPOC was not significantly associated with increased odds of self-injury in this sample.

Table 4 reports adjusted odds-ratios (aORs) and coefficients for three logistic regression models and displays results of mediation models for cumulative dehumanization, sustenance deprivation and violent physical force. Results show minimal variation between OR and aORs for relationship between SMI and self-injury, between bivariate and multivariate models, which suggests the association was robust to confounders of age, race/ethnicity, nominal prospect for release, admission to solitary

as a punishment, and total 90-day stints in solitary confinement. Several covariates were also significantly associated with increased odds of self-injury. Each additional 90-day stint in solitary confinement was significantly associated with a 1.0% increase the odds of self-injury. People placed in solitary confinement as a punishment for breaking a prison rule, were 2.02 times more likely to engage in self-injury than those placed in solitary confinement for putatively non-punitive reasons (i.e. protective custody).

Dehumanization as a mediator

Results of mediation analyses suggest that the degree and type of dehumanization endured may mediate pathways between SMI status and self-injury in solitary confinement settings. The first model suggests that each additional punishment imposed (cumulative dehumanization) was associated with a 9.6 percent increase in odds of self-injury (Table 4a). The mediation effect of sustenance deprivation was 0.134 (SE=0.055, p=0.01) and the mediation effect for violent physical force was 0.126 (SE=0.056, p=0.01), suggesting both types of dehumanization plausibly mediate pathways between SMI status and self-injury to varying degrees.

Discussion

From its inception in the earliest penitentiaries through its vast expansion in the mass incarceration era, solitary confinement has been shown to produce dire degrees of psychological despair, psychosis and premature death (Haney et al., 2020). Findings substantiate earlier evidence of strong associations between solitary confinement, serious mental illness, and self-injury (Kaba et al., 2014; E. Lanes, 2009). People who disclosed having a serious mental illness (SMI) were nearly 5 times more likely to

engage in self-injury while in solitary confinement than those without SMI, after accounting for relevant confounders.

Social isolation and suboptimal healthcare are domains of solitary confinement that health researchers have highlighted to explain vulnerabilities to self-injury and suicide (Appelbaum, 2015; Kaba et al., 2014). This analysis expanded inquiry into domains of carceral power: and found that punitive exertions of power and dehumanization, as permitted by institutional policies and likely shaped by structural forces, may mediate associations between SMI and self-injury. (Liebling, Durie, Stiles, & Tait, 2013; Marzano, Ciclitira, & Adler, 2012). Cumulatively, each additional type of dehumanization that prison staff inflicted was associated with nearly a 14% increase in odds of self-injury after controlling for confounders. We found a stronger association between of sustenance deprivation (e.g. food loaf, mattress taken away, water or lights turned off) and self-injury, compared to violent physical force (e.g. tasered or sprayed with mace), though both exerted a significant effect. This result aligns with an extant literature linking self-injury to dehumanization and trauma (Marzano et al., 2012; H. P. Smith, 2015). Such findings signal a need to scrutinize the policies that permit correctional staff to inflict these types of punishments and underscore the importance of finding more humane strategies for responding to disruptions and other problems that arise in carceral contexts.

In Louisiana prisons and other correctional systems, solitary confinement is rationalized through a variety of carceral logics, though most frequently as a punishment, purportedly to deter violations of prison rules. Indeed, participants sent to solitary confinement as a punishment were about twice as prone to self-injury as those

segregated for other reasons (e.g. “protective custody”). This may be due to the fact that solitary confinement as a sanction is inherently punitive and involuntary, while people separated under “protective custody” may request physical separation due to fear of victimization or other harms in the general population units where between 96-100 adults are in an open-roomed dormitory.

These findings corroborate recent reports on solitary confinement practices in Louisiana that underscore the stark reality that thousands of people with SMI are warehoused and traumatized in the state’s prisons(D. Cloud, Jessi LaChance, Lionel Smith, and Lauren Galarza. , 2019; Solitary Watch, June 2019). A coalition introduced a bill in Louisiana in 2020 to restrict the use of solitary confinement for people with SMI that failed to gain sufficient support. At the very least, we hope findings can bolster ongoing efforts in Louisiana to advance legislation and community support for abolishing the use of solitary confinement.

This approach infused conceptualizations of embodiment from ecosocial theory, carceral geography and dehumanization literature with the hope that more researchers will consider applying social epidemiology’s tools to address human rights issues in prisons. Given its focus on interplays between space, time, and power in prisons, carceral geography provides a critical and complementary dialectic to ecosocial theory for exploring how physical and social components of solitary confinement units shape vulnerabilities to self-harm, while considering the meanings of these acts for directly impacted people. Scholars should also extend theories of dehumanization to better understand the psychology and behavior of frontline correctional officers who are involved in enforcing solitary confinement, which is likely important for addressing the

structural and institutional level forces where their power to punish lies. Integrating these theoretical concepts can advance calls for structural solutions that go beyond incremental remediations.

Limitations and Future Directions

There were several limitations to address in future research. First, because this survey was cross-sectional, it is not possible to draw causal inferences about associations or make conclusions about directionality for mediation effects reported. Retrospective cohort and longitudinal studies with quasi-experimental design components are important direction for continuing to document relationships between incarceration, prison conditions, self-harm and suicide. Second, since this was a secondary analysis of self-reported experiences with solitary confinement, there are concerns about construct validity and biases to acknowledge. On one hand, based on such data, there are potential problems with aggregating individualized responses to derive a measure of cumulative dehumanization as a mediator. Extending theories of dehumanization to solitary confinement research will require development of more reliable measures to assess the various ways through dehumanization manifests among incarcerated people and correctional staff who work in these spaces. Insights into the experiences of correctional staff working in solitary confinement units may shed light onto how carceral policies governing their profession may result in harms and behaviors that do not align with their intentions as individuals(Mears, Cochran, Aranda-Hughes, & Brown, 2022). Our study was also unable to account for the possibility that people in the sample had endured solitary confinement in other carceral settings outside of Louisiana or in parish jails, which plausibly could bias our findings. Furthermore, was

not possible to reliably determine lethal intentions of participants who reported self-injury or verify self-reported diagnoses from this self-reported data. Future studies that draw on correctional health records for obtaining such clinical information can help reduce biases that are inherent in self-reported measures.

It is important to acknowledge that women were excluded from this study because the Louisiana Correctional Institute for Women flooded and was evacuated in August of 2016, which resulted in displacement of incarcerated women across the state. As a result, there were too few women in the data we obtained for statistical analysis. More research is needed that is focused on the experiences of women in solitary confinement, generally, and specifically in relation to self-injurious behavior.

Another limitation of our analysis is that we did not account for potential clustering at the prison level. While conditions in solitary confinement units are similar, subsequent inquiries should examine more closely the potential influence of prison-specific variations in exposures and outcomes. Additionally, clinical, anthropological, and phenomenological inquiries can bring depth and nuance to understanding the social meanings of self-injury as an embodiment of carceral conditions. Such studies should contend with the idea that embodiment of dehumanization is a dynamic, "active condition of becoming" that is not only "moving under the skin," but also "resisted, negotiated or contested". For some, self-injury in solitary confinement may represent a "corporeal resistance to dehumanization" rooted in historically determined power structures of oppression and marginalization. Documenting the individualized and collective meanings of different manifestations of self-injury (hunger-strikes and non-suicidal self-injury) from a non-medicalized lens is important for interventions that go

beyond the status quo of clinical treatment and target societal-level power structures of the prison industrial complex.

The response rate to the original survey (33%) was relatively low and may not be representative of the population in solitary confinement in Louisiana's state operated prisons. However, lower response rates are more common in prison research due to a variety of factors (e.g. fear of retaliation by prison staff, higher prevalence of low literacy, or obstruction by correctional staff). The original study was administered through legal mail by organizations involved in active litigation (over solitary confinement); and therefore it is likely that such factors were at play. Though, we are encouraged by the higher response rates at two prisons with the greatest capacities for solitary confinement, the lower response rate at Elayn Hunt Correctional Center in particular is of concern, because this institution is designated for people experiencing acute and more disabling mental health issues and likely introduced bias that underestimated degrees of self-injury among people in solitary confinement.

Conclusion

Ending solitary confinement in carceral systems is a critical and complex imperative for public health scholars, practitioners, and activists to pursue. Together, our findings further substantiate what is known about the harms of this practice through the lens of ecosocial theory and suggest that exposures to greater degrees of cumulative dehumanization significantly increased odds of self-injury among people in solitary confinement and may mediate pathways between SMI status and self-injury. Combining ideas and principles from ecosocial theory, carceral geography, and theories of dehumanization may help advance and reinforce the need for structural interventions to

diffuse forms of carceral power and practices that continue to cage thousands of people under conditions of isolation, dehumanization, and violence.

Chapter 1.
Table 1. Descriptive Statistics for Total Sample (n=517)

	Totals (%) or means (std. deviations [SD])
Reported Self-Injury	134 (25.9%)
Serious Mental Illness (1 or more)	188 (36.4%)
Age	mean=38.4 (SD=11.49)
BIPOC	413 (79.9%)
Nominal prospect of release	108 (20.9%)
Solitary as punishment	347 (67.1%)
90-day stints in solitary confinement	mean=20.74 (SD=23.49)
Sustenance deprivation (at least 1 type)	212 (41.0%)
Food loaf	86 (16.7%)
Mattress taken	168 (32.6%)
Water/Electricity shut off	36 (6.9%)
Physical violent force (at least 1 type))	179 (34.6%)
Tasered	22 (4.3%)
Mace (chemical spray)	178 (34.5%)
Cumulative dehumanization	mean = 2.8 (SD=0.92)

Table 2 reports means and standard deviations (SD) for continuous variables (age, 90-day Stints in Solitary Confinement, and cumulative dehumanization) and frequencies and percentages for categorial variables for the total sample.

Table 2. Percentages and Mean Demographics, SMI status, Solitary Confinement, Cumulative Dehumanization, and Self-Injury for Total Sample (n=517)

	Respondents who reported Self Injury (n=134)	Respondents who did not report Self-injury (n=383)
Age	mean= 36.1 (SD= 0.84)	mean=39.3 (SD=0.64)
BIPOC	108 (80.6%)	305 (79.6%)
Nominal prospect of release	33 (24.6%)	75 (19.6%)
Serious Mental Illness (1 or more)	85 (63.4%)	103 (26.9%)
Solitary as punishment	103 (76.9%)	244 (63.7%)
90-day stints in solitary confinement	mean=24.50 (SD=22.81)	mean=19.4 (SD=23.64)
Sustenance deprivation	77 (57.5%)	135 (35.3%)
Food loaf	29 (21.6%)	57 (14.9%)
Mattress taken	60 (44.8%)	108 (28.2%)
Water/Electricity shut off	16 (11.9%)	20 (5.2%)
Physical violent force	70 (52.2%)	109 (28.5%)
Tasered	8 (5.9%)	14 (3.7%)
Mace (chemical spray)	70 (52.2%)	108 (28.2%)
Cumulative dehumanization	mean=3.4 (SD=2.04)	mean=2.6 (SD=2.12)

Table 2 reports means and standard deviations (SD) for continuous variables (age and cumulative dehumanization) and frequencies and percentages for categorial variables. The first column includes the variables used in the analysis. The second column reports descriptive statistics for survey respondents who reported self-injury while in solitary confinement (n=134).

Table 3. Bivariate and Multivariable Logistic Regression Results:
Focal Dependent Variable =Self-Injurious Behavior

			Bivariate			MULTIPLE VARIATE				
	Odds Ratio	SE	95% CI		p-value	Odds Ratio	SE	95% CI		p-value
Age	0.97	0.01	0.95	0.99	0.001	0.97	0.01	0.95	0.99	0.05
BIPOC	1.06	0.26	0.65	1.74	0.81	1.17	0.35	0.66	2.11	0.58
Nominal prospect for release	1.33	0.32	0.84	2.13	0.22	2.51	0.76	1.38	4.55	0.00*
SMI	4.71	1.01	3.10	7.16	0.00*	4.57	1.10	2.86	7.31	0.00*
Solitary as punishment	1.89	0.44	1.20	2.97	0.01*	1.97	0.54	1.15	3.53	0.01*
90-day stints in solitary confinement	1.01	0.01	1.00	1.02	0.04*	1.03	0.01	1.00	1.02	0.02*
Cumulative dehumanization	1.25	0.06	1.14	1.37	0.00	1.13	0.06	1.01	1.26	0.03*
Sustenance deprivation	2.48	0.51	1.66	3.70	0.00*	1.96	0.46	1.24	3.10	0.00*
Physical violent force	2.74	0.57	1.83	4.12	0.00*	2.26	0.53	1.43	3.59	0.00*

Table 3 Reports Bi-variate associations from logistic regressions of each predictor and self-reported self-injury in solitary confinement. Age is a continuous variable. BIPOC refers to Black Indigenous Person of Color. Nominal Prospect for release refers to respondents who reported having a life-sentence, a death sentence, or having a remaining sentence length in years greater than a life-expectancy of 100 years (i.e. an effective life sentence). SMI refers to self-reported diagnosis of a serious mental illness (e.g. schizophrenia, bipolar disorder, major depression) before placement in solitary confinement. 90-day stints is the number of 90-day stints that a person spent in solitary confinement, which is based on procedural rules that require correctional officials to review placements in solitary confinement every 90 days. Cumulative dehumanization is the number of additional punishments that person reported enduring while in solitary confinement. Sustenance deprivation refers to self-reported punishments as to whether a person was ever subjected to food loaf, mattress taken, and or water/electricity shut off. Physical violent force refers to whether a person was ever sprayed with a chemical agent or tased (i.e. use of force) while in solitary confinement.

Table 4. Results of Mediation Models with Odds of Self-Injury as Focal Dependent Variable

	Cumulative dehumanization			Sustenance deprivation			Violent physical force		
	OR	[95% CI]		OR	[95% CI]		OR	[95% CI]	
SMI	4.67	2.95	7.40	4.42	2.75	7.09	4.50	2.81	7.22
Cumulative dehumanization	1.14	1.02	1.27	2.27	1.43	3.58	1.96	1.24	3.10
Age	0.98	0.95	1.00	0.97	0.95	0.99	0.97	0.95	0.99
BIPOC	1.18	0.66	2.09	1.20	0.67	2.16	1.11	0.63	1.99
Life in prison	2.30	1.28	4.15	2.67	1.46	4.89	2.37	1.11	4.32
Solitary as punishment	2.04	1.20	3.47	2.08	1.21	3.57	1.90	1.11	3.25
90-day stints in solitary confinement	1.01	1.00	1.02	1.02	1.01	1.03	1.02	1.01	1.03
Mediator	Coef.	[95% CI]		Coef.	[95% CI]		Coef.	[95% CI]	
Cumulative dehumanization	0.096*	0.011	0.234						
Sustenance deprivation				0.134*	0.019	0.248			
Violent physical force							0.126*	0.023	0.229

Table 4. Reports results from mediation analysis assessing whether cumulative dehumanization, sustenance deprivation, and violent physical force may lie on the causal pathway between SMI and self-injurious behavior in solitary confinement. It reports co-efficients for each construct as a mediator and 95% Confidence Intervals [CI]. Cumulative dehumanization is the number of additional punishments that person reported enduring while in solitary confinement. Sustenance deprivation refers to self-reported punishments as to whether a person was ever subjected to food loaf, mattress taken, and or water/electricity shut off. Physical violent force refers to whether a person was ever sprayed with a chemical agent or tased (i.e. use of force) while in solitary confinement.

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Chapter 3. Deep End of the Drug War: Solitary Confinement and Overdose Among Formerly Incarcerated People

Abstract: The overdose crisis is among the most pressing public health challenges of the 21st century. Since 2001, more than a million lives have been lost to drug-related overdoses in the United States. Incarceration is a potent producer of overdose morbidity and mortality. Yet, scholarship linking incarceration and overdose has overlooked the influence of policies and practices that produce trauma and hazardous conditions within carceral spaces as contributors to overdose morbidity and mortality. Solitary confinement is a public health and human rights issue that exemplifies the degrading living conditions within jails and prisons in United States. An extensive literature links solitary confinement to clusters of mental, physical, and behavioral harms, but inquiries into how solitary confinement may shape vulnerabilities to overdose (and other drug-related harms) is largely absent in health research. This qualitative study describes the lived experiences of solitary confinement among formerly incarcerated people who use drugs and constructivist grounded theory to posit potential processes through which this carceral practice shapes overdose vulnerabilities.

Chapter 3. Deep End of the Drug War: Solitary Confinement and Overdose Among Formerly Incarcerated People

This paper brings to bear an issue at the intersection of distinct yet intertwined public health and human rights crises confronting the United States: the escalating scourge of overdose fatalities and the pervasive use of solitary confinement in jails and prisons. It documents the lived-experiences of solitary confinement among people who use drugs, and investigates the potential mechanisms through which this widely adopted carceral practice may create and shape post-release drug-related overdose.

The overdose crisis is among the most pressing public health challenges of the 21st century. Since 2001, more than a million lives have been lost to drug-related overdoses in the United States. Alongside COVID-19, overdoses contributed to reduction in US life expectancy by about 1.5 years in 2021(Friedman & Hansen, 2022), taking the most lives on record yet in single year, at least 107,000 people (Control & Prevention, 2022). Prescription opioids and heroin have accounted for the largest share of these deaths, however overdose rates involving cocaine, methamphetamine, and benzodiazepines have also increased (Control & Prevention, 2022). Overdose deaths have disproportionately impacted people and places throughout different waves of the crisis, with recent evidence showing a widening of racial inequalities in overdose mortality (Friedman & Hansen, 2022). Police arrest, prosecution, and incarceration are common lived-experiences among many people who use drugs, and known to increase vulnerabilities to overdose, a leading cause of death among currently and formerly incarcerated people (Flam-Ross et al., 2022; Zhang et al., 2022).

Solitary confinement is a public health and human rights issue that exemplifies the degrading living conditions within jails and prisons in United States. It is broadly defined as a continuous exposure to extreme social isolation, idleness, and material and sensory deprivation for upwards of 22 to 23 hours per day. Access to treatment, visitation, exercise, and healthcare services is generally minimal or non-existent(D. H. Cloud et al., 2015; Haney et al., 2020). Solitary confinement is mostly enforced as a punishment for violating a wide variety of institutional rules, ranging from minor infractions, such as cell phone possession and tattooing to serious acts of violence (D. H. Cloud et al., 2015; Haney, 2018b). Though, correctional systems also resort to it as a destination of last resort for people with severe psychiatric illnesses and others with disabilities who fear for their safety or struggle to adapt to stressors within general population units (Reiter & Blair, 2015).

During the prison boom in the 1980s and 1990s, the use of solitary confinement increased vastly, as states, localities, and the federal government constructed thousands of jails and prisons with spaces designed or conducive to keeping people in isolation(Reiter, 2018; Sakoda & Simes, 2021). However, there is a lack of reliable data or oversight mechanisms for monitoring the prevalence of solitary confinement in carceral institutions(Deitch, 2020; Fathi, 2010). In 2012, the Liman Center at Yale University began surveying correctional administrators to estimate the prevalence of solitary confinement in state prisons, and track legal reforms intended to reduce or end this practice (School, 2020). Acknowledging limitations in their methodology (e.g. self-report, cross-sectional survey design, non-responsive states), the Liman Center's most recent report conservatively estimates that in 2021, about 41,000-48,000 people in state

prisons were solitary confinement (i.e. " isolation in a cell for an average of twenty-two or more hours per day for fifteen or more consecutive days on any given day") on any given day, with wide variation between states.(Resnik, Albertson, Li, & Taylor, 2022) Based on the Liman Center's analysis, the use of solitary confinement in state prisons has decreased substantially as the result of court mandates, legislation, and administrative reforms in the wake of decades of advocacy.(Shalev, 2022) Still, the prevalence of solitary confinement in jails (as opposed to prisons) is more opaque and legal interventions to address it less developed.

An extensive literature links solitary confinement to clusters of mental, physical, and behavioral harms, many of which are comorbidities among people who overdose, such as depression, anxiety, psychosis, self-injury, and suicide, as summarized elsewhere (Haney et al., 2020; Kaba et al., 2014; P. S. Smith, 2019). Such research is instrumental for bolstering advocacy and legal interventions to reduce or abolish solitary confinement (Haney, 2018b; Haney et al., 2020; Shalev, 2022). Between 2018 and 2020, twenty-five states introduced legislation to limit exposures to solitary confinement. Citing the extant literature, a primary provision of such legislation prioritizes limiting or prohibiting exposures to solitary confinement for groups especially vulnerable to its harms due to an underlying health status, including pregnancy, serious mental illness, intellectual disabilities, among others(Dillon, 2018; Paltrowitz, 2023; Shalev, 2022).

Scholars who study solitary confinement have mostly focused on its effects on currently incarcerated people (Haney, 2003; Reiter et al., 2020). Relatively few studies have investigated the enduring effects of solitary confinement among formerly

incarcerated people (Hagan et al., 2018), despite calls for more research on this topic (Kupers, 2008; Luigi et al., 2020; K. E. McLeod & Martin, 2020). More specifically, inquiries into how solitary confinement may shape vulnerabilities to overdose (and other drug-related harms) is largely absent in health research and disjointed in discourses of stakeholders seeking to minimize or abolish it and others pushing for anti-carceral approaches to the overdose crisis. Only one study has examined the relationship between solitary confinement and overdose in the United States, finding a strong, positive association between exposures to solitary confinement and premature death due to overdose, homicide, and suicide among formerly incarcerated people(Brinkley-Rubinstein et al., 2019). The following section provides a rationale for diving deeper into this observation, and conceptualizing solitary confinement as a socio-structural producer and accelerant of overdose vulnerability among formerly incarcerated people who use drugs.

Connecting the drug war, solitary confinement and overdose crises

The war on drugs--broadly defined as socio-political system of laws criminalizing drugs and bestowing immense power and resources to carceral institutions to arrest, incarcerate, and surveil people who use drugs, disproportionately targeting those in historically oppressed and economically disadvantaged communities, often at the expense of public investments on education, healthcare, and other social determinants of health—has worsened the overdose crisis in a variety of ways(Gottschalk, 2023). For example, aggressive, drug-war policing tactics often deter people who use drugs from seeking support and increase susceptibilities to risky drug use behaviors that can result

in fatal overdose, such as using in secluded spaces, refraining from calling 911 when witnessing an overdose, or underutilizing overdose prevention services.

At the other end of the criminal legal continuum, studies also show that incarceration is a potent producer of overdose morbidity and mortality (Binswanger et al., 2013). At a societal level, the steep growth of incarceration rates since the 1980s has contributed to higher county-level rates of overdose deaths, interactively, yet apart from influences of economic decline, opioid-prescribing trends, and other confounders (Nosrati et al., 2019).

In the United States, overdose is a leading cause of death among currently and formerly incarcerated people (E. A. Carson, 2021). Though difficult to measure, the federal government reports that 58% of people in prison and 65% of those in jails are diagnosed with a substance use disorder (Bronson et al., 2020). Another study estimates that one-third of people who use heroin enter a correctional facility each year(Boutwell et al., 2007). There is also evidence to suggest that many people continue or begin using drugs during incarceration for similar reasons as they would in community settings(Rowell-Cunsolo et al., 2018). From 2001 to 2018, deaths due to “drug or alcohol intoxication” increased by more than 600% and 200%, in state prisons and county jails, respectively (E. A. Carson, 2021). Contamination of the drug-supply with fentanyl and other synthetic adulterants has increased vulnerabilities to overdose not only in communities, but also in jails and prisons (Kaplowitz et al., 2021). The correlates of overdose behind bars are poorly studied, though one report found that 80 percent of non-fatal overdoses occurring in North Carolina prisons occurred in solitary confinement units(J. B. Williams et al., 2022)

Despite recent improvements, jails and prisons typically do not provide access to effective medications, harm reduction tools, or mental health services tailored to the needs of people in their custody(Sugarman et al., 2020). Rather, responses to drug-related behaviors behind bars more typically entail amplifications of drug war- style retribution with little transparency or less due process. People suspected, accused, or convicted of using drugs in jails or prisons are routinely subjected to invasive searches, random urinalysis, forced detoxification with minimal medical oversight, and a wide range of sanctions, including solitary confinement(D'Hotman et al., 2019). In many jurisdictions, correctional policies dictate that those found guilty of possessing, using, or distributing drugs while incarcerated are commonly sanctioned with placement in solitary confinement. Still, there are other ways that people with use disorder (PWUD) can end up in solitary confinement.

Due to structural inadequacies in the clinical capacities of jails and prisons, incarcerated people with drug dependency may be forced to undergo withdrawal and detoxification fail to meet community standards of care, sometimes under conditions that resemble solitary confinement(Bunting, Nowotny, Farabee, McNeely, & Beckwith, 2023; Maradiaga, Nahvi, Cunningham, Sanchez, & Fox, 2016; Wakeman & Rich, 2015). Many incarcerated people with substance use disorders have comorbid psychiatric conditions, such as acute psychosis, self-injury, and suicidality(Baranyi, Fazel, Langerfeldt, & Mundt, 2022), which can increase their chances of experiencing solitary confinement in mental health units, or being subjected to isolation under suicide watch protocols, though the extent of such incidents is poorly monitored(Haney et al., 2020; J. L. Jahn et al., 2022; Kaba et al., 2014).

The vast majority of people who enter a correctional facility are eventually released. Studies consistently find that people released from jail or prison face an elevated risk of overdose, especially during the first weeks of returning to the community (Binswanger et al., 2013). Most of this research has concentrated on potential moderating effects of sociodemographic (e.g. race, gender) and clinical factors (e.g. trauma, suicidality, chronic pain), mediating effects of the intermediate social and economic conditions that people frequently encounter when released from jail or prison (e.g. disrupted social networks, economic instability, stigma), and proximal circumstances (e.g. using alone, mixing drugs) and biological determinants (e.g. reduced tolerance) that result in overdose morbidity and mortality (Joudrey et al., 2019). This body of evidence has enhanced efforts to expand access to medications for opioid-use disorders, overdose education and naloxone distribution programs, and other social services in correctional settings and upon reentry (Malta et al., 2019).

Yet, conceptually and empirically, scholarship linking incarceration and overdose has overlooked the influence of policies and practices that produce trauma and hazardous conditions within carceral spaces as contributors to overdose morbidity and mortality(K. E. McLeod & Martin, 2020). Though some people may receive treatment or healthcare services behind bars that were inaccessible to them in their communities, a problematic reality in itself, they also often endure exposures to noxious conditions and traumas within these settings-- overcrowding, inadequate healthcare services, unsanitary living conditions, poor nutrition, exploitive labor practices, minimal opportunities for programming, violence, and solitary confinement--- that compromise

their well-being and contribute to healthy inequities in their communities(Freudenberg, 2001; Wildeman, Fitzpatrick, et al., 2018).

Solitary confinement is commonly experienced among people who cycle between jails, prisons and communities, of which a disproportionate percentage have substance use disorders. However, solitary confinement is rarely conceptualized as an apparatus of the drug war or the criminal legal system's broader impacts on vulnerabilities to overdose, during or subsequent to incarceration. Studying whether and how solitary confinement may influence vulnerabilities to overdose is needed for developing more nuanced understandings of how incarceration shapes overdose within and outside the walls of jails and prisons. Such research also has the potential for forging alliances between seemingly disjointed coalitions of community advocates committed to mobilizing anti-carceral solutions to the overdose crisis and those fighting to abolish solitary confinement as a public health and human rights imperative. The current study is a first step toward bridging these gaps. It describes the lived experiences of solitary confinement among formerly incarcerated people who use drugs to explore the potential processes through which this carceral practice shapes overdose vulnerabilities.

Theoretical framework

Our analytical approach integrates concepts of embodiment from ecosocial theory of disease distribution and carceral geography while drawing on intersectional adaptations of the Risk Environment Framework (REF), a widely used tool for identifying and addressing multi-level determinants of drug-related harms(Collins et al., 2019; R. W. Gilmore, 2007; W. R. Gilmore, 2021; Nancy Krieger, 2001b; Moran, 2016; T. Rhodes, 2002). Each of these theoretical frameworks examine how interplays

between carceral structures shape inequitable distributions of death, disease, and disability across ecological levels(Nancy Krieger, 2011; T. Rhodes, 2002).

As ecosocial theory's core construct, embodiment posits pathways through which people "literally embody, biologically" [their] lived experiences in societal and ecological context, the material and social world in which [one] lives in"(Nancy Krieger, 2005, 2011). We draw on carceral geographers' applications of embodiment to supplement this definition. Social-epidemiologists typically measure pathways of embodiment and associated outcomes quantitatively, at community and population levels(Nancy Krieger, 2005, 2008, 2012). Carceral geographers, by contrast, more often turn to qualitative inquiry, phenomenological interpretations, and archival research to measure embodiment of "carceral space at an intensely personal level, tracing the ways in which the individual spaces of the prison elicit and facilitate different emotional expression, the ways in which the experience of incarceration is inscribed corporeally upon the imprisoned body, and the embodied strategies deployed by occupants of carceral space." (Moran, 2016; Turner & Knight, 2020) According to ESD, there are multiple pathways of embodiment (economic and social deprivation, toxic substances, pathogens, hazardous conditions, discrimination and other forms of socially inflicted trauma, targeted marketing of harmful commodities, inadequate or degrading healthcare, and degradation of ecosystems) (Krieger, 2011). Again, drawing the insights of carceral geographers, we aim to develop a grounded-theory for how conditions within spaces used for solitary confinement as a pathway of discrimination and socially inflicted trauma that is embodied in ways that create and accelerate overdose-vulnerabilities among formerly incarcerated people who use drugs.

The Risk Environment Framework (REF) is a schematic tool for uncovering the social, political, and economic forces within different places and contexts that produce or reduce vulnerabilities to overdose and other drug related harms (Rhodes, 2002; Strathdee et al., 2010). Epidemiologists and drug policy scholars have applied REF to document the myriad mechanisms through which criminalization and law enforcement practices (e.g. policing and incarceration) give rise to overdose vulnerabilities in diverse geographies and social contexts (cite). However, few studies have focused on features of risk environments within the walls of jails and prisons as shaping overdose vulnerabilities for currently or formerly incarcerated people. We turn to the REF for contextualizing the social and physical features within the micro-environments of spaces used for solitary confinement that become embodied and influence psychological states and behavioral responses that lead to overdose. This study aims to situate solitary confinement as socio-structural manifestation of the drug war, by drawing attention to the potential processes through which it may be accountable for contributing to overdose vulnerabilities.

Methods

A theory-driven, convenience sample of formerly incarcerated people (FIP) in Georgia who currently or recently used drugs (n=22) was recruited via community-based outreach methods (e.g. electronically flyers, on-foot recruitment) and peer referral between January 2021 and March 2022. People responded to phone calls, emails, or in-person (often after receiving a flyer or based on peer referral). Brief phone or in-person screenings were administered to identify eligible participants. Eligibility criteria included a) being aged 18-65 years old, b) active drug use or history within the

last year of a substance use disorder involving one or more of illicit substances (heroin and/or prescription opioids, cocaine (crack or powder), benzodiazepines, or methamphetamines, c) prior exposure to solitary confinement in a Georgia jail and/or prison within the past 5 years. Purposive sampling was adopted for comparing lived experiences of solitary confinement between those who had overdosed and those who had not; as well as heterogeneity in demographic attributes, experiences with different types of incarceration (e.g. jail vs. prison), and drug use behaviors. During recruitment, we sought to recruit equal numbers of participants who had overdosed post-release from incarceration and those who had not. Eligible individuals were verbally consented and invited to take part in a semi-structured, one-on-one interview with the PI (DC). Interviews lasted between 30 to 90 minutes.

An interview guide was developed through an iterative coding process drawing on studies linking incarceration to overdose and others linking solitary confinement to health-related harms(Flam-Ross et al., 2022). The guide was intended to elicit narratives about participants' lived experiences before, during, and after incarceration. For instance, some questions asked about childhood, family circumstances, and adulthood to gather information related to social positionality. Other questions focused on contexts surrounding drug use, access and utilization of treatment and social support services, and nature and extent of exposures to incarceration. Another series of questions asked participants to describe the contextual circumstances that resulted in subjection to solitary confinement, the social and material conditions they endured while in solitary confinement, and how such experiences affected drug use behaviors and overdose vulnerabilities. Participants who disclosed using drugs during

incarceration were asked whether they were ever sanctioned with solitary confinement as a result, and if so, how that experience affected them. The interviewer adopted an empathetic listening approach to foster rapport. Due to COVID-19 precautions, most interviews were conducted outdoors in a public setting that afforded privacy (n=17, 77.3%) or via video web-conferencing (zoom) (n=5, 22.7%). Interview participants received $100 gift card. Audio-files were transcribed verbatim.

Analysis

We adopted a constructivist grounded theory (CGT) approach for analyzing qualitative interview data. This guided, but flexible approach allowed for generating theoretical notions about the influence of solitary confinement, as a socio-structural form of state-violence, on vulnerabilities to overdose, through an inductive but systematic analysis of lived-experiences of directly-impacted PWUD. In alignment with Charmaz, CGT is a set of inter-related sensitizing concepts in this analysis, which provides " ways of seeing, organizing, and understanding experience"… that are "embedded in our disciplinary emphases and perspectival proclivities"(Charmaz, 2014, 2017).

The first author led an iterative coding process which involved generating, refining, and consolidating codes that described participant's lived experiences with solitary confinement and potential processes through which these exposures shaped vulnerabilities to overdose during periods of incarceration and transitions between carceral and community settings. Only one coder was used for the analysis because of the sensitive nature of the data and due to logistical disruptions related to the COVID-19 pandemic. Demographic attributes of participants were extracted from eligibility

screenings and merged with qualitative data to create descriptive memos for each participant that summarized early life experiences, drug use trajectories (e.g. age of onset, drugs of choice), histories and geographies of incarceration and solitary confinement, and overdose-related experiences). Annotations, axial coding, and memoing was also used to formulate and refine codes related to the social, physical, and experiential domains of solitary confinement and develop ideas for how those domains may intersect with intersectional forces and properties of risk environments within and between carceral and community settings. To explore potential processes through which solitary confinement becomes embodied to influence overdose vulnerability, we dichotomized the sample into two groups, those who reported overdosing at least once following an exposure to solitary confinement and those who had not. This approach allowed for describing variations in the risk environments within solitary confinement settings as well as for contemplating the factors that counteracted vulnerabilities to overdose between the groups.

Ethics Statement

This study was approved by the Emory University Institutional Review Board and data was protected by a federal Certificate of Confidentiality.

Results

First, we summarize demographics, drug use, solitary confinement exposures and overdose of the study sample. We then posit a grounded theory developed to conceptualize potential mechanisms of embodiment through which solitary confinement shapes overdose vulnerability, and forms of resistance to counteract them.

Demographics, drug use, solitary confinement, and overdose

The mean age of the 14 participants who overdosed following release from incarceration was 47.2 years (SD=2.17 years) compared to 32.9 years (SD=1.52) among those 8 who did not overdose (Table 1). The percentage of women and men in the sample who overdosed was similar: 67.7 % of women and 61.5% of men. Most participants identified as either Black/African-American (59.1%) or White/Caucasian (36.4%), and one participant as Latino. Most participants had extensive histories of incarceration relative to their age and years using drugs. Most had incurred multiple jail and prison terms in Georgia, though several had also been incarcerated in facilities in other states. Only two participants had never been sentenced to prison but each reported having had multiple jail admissions. Among the total sample, self-reported frequencies of solitary confinement varied: a total of 5 (22.7%) participants had 1-2 exposures; 7 participants (31.8%) had 3-5 exposures; 5 participants (22.7%) had 6-10 exposures; and 5 participants (22.7%) reported more than 10 exposures. A total of 14 participants (63.6%) had experienced one or more overdoses subsequent to an exposure to solitary confinement. Among this group, 6 participants had experienced 1-2 overdoses, 5 participants between 3-5 overdoses, and 3 participants had overdosed more than 6 times (n=14). Most participants who had overdosed reported that heroin and other opioids as primary drug(s) of choice, often mixing heroin with stimulants (i.e. cocaine and methamphetamine) or benzodiazepines.

Overview of grounded theory

Figure 1 displays a conceptual diagram of the grounded theory of mechanisms through which solitary confinement becomes embodied and produces overdose

vulnerability. Table 2 defines each category in the diagram. First, it posits that people experienced different types of risk environments in solitary confinement, with variations in degrees of social isolation, sustenance deprivation, dehumanization, denial of care, and physical violence. It suggests that people subjected to greater degrees of social isolation, deprivation of sustenance, denial of care, physical violence and dehumanization, tended to embody these risk environments in various ways—i.e. via inflictions of trauma, dissolution of social relationships, physical deterioration, withdrawals, drug cravings, and suicidality—that subsequently created vulnerability to overdose post-release. If further theorizes that exposures to and embodiments of solitary confinement interact with other features within post-release risk environments (diminished social support, stigma/criminalization, housing/economic instabilities, poor access to harm reduction and healthcare) to compound susceptibilities to drug use behaviors (immediate drug use, reduced tolerance, using alone, mixing drugs, intentional overdose) that often precipitate overdose among formerly incarcerated people. Lastly, it illuminates potential ways through which people in solitary confinement engaged in acts of coping and resistance to counteract exposures to and harms of solitary confinement, which may protect against overdose.

Risk Environments in Solitary Confinement

Participants experienced solitary confinement to varying degrees and in diverse locations (e.g. jails, prison, and probation detention centers) across Georgia. While many of the core features of solitary confinement (social isolation, dehumanization) were consistently reported, regardless of setting, other features of these environments, as shaped by their institutional contexts and legal jurisdiction, may have influenced the

risk environment within solitary confinement, the pathways in and out of solitary confinement, and in turn shaped vulnerabilities to overdose in distinct ways. Below, we define, compare and contrast variations in risk environments and opportunities for resistance between participants who had overdosed following release from incarceration (n=14) and those who had not (n=8).

Social isolation emerged as a category in the risk environment of solitary confinement (Figure 1) that refers to the extent to which people were deprived of their ability to communicate with family and loved ones via phone, visitation, email, and letters, as well as opportunities to communicate with other incarcerated people. All participants cited the importance of social connectivity and maintaining relationships outside of jail or prison as a vital for coping with the psychological toll of social isolation, and endured restrictions on their ability to do so while in solitary confinement. Yet, participants who overdosed post-release from incarceration tended to describe more extensive impediments to positive, human interaction compared to those who had not overdosed.

Participants who had not overdosed recounted fewer barriers to communicating with family via phone, email, and visitation than whose who overdosed, which helped counteract the harms of social isolation. As consistent with Intersectional Risk Environment Framework (IREM), participants' ability to overcome physical and economic barriers to communication and harms of social isolation while in solitary confinement settings were influenced by their social positionality. For example, participants who had not overdosed tended to have family members that provided emotional support and financial resources for making phone calls, corresponding via

email, traveling distances for visitation, and funding commissary accounts to purchase items not provided by the state that helped mitigate social isolation.

For example, Mark, a white man in his 30s, emphasized that his family's economic status was the only way he could have routine communication with his brother, parents, and minister during a year-long stretch in solitary confinement, which he said provided a sense of hope and critical emotional comfort to diminish the disparaging conditions he was experiencing. As he explained, "My people could put money on the phone. Knowing that my family's going to be there, knowing that they're healthy, that was a big thing that I was always keeping it in the back of my mind." During calls his family told him that he would have a stable environment when he left prison, which helped him "look past the little things" to know "Okay, at least I am prepared for when I get out. I know I have a job and a place to stay. So, if I just stayed strong during while in lockdown [solitary confinement], things will get better. I've just got to look at the long road ahead."

By contrast, people who overdosed post-release tended to report longer periods of social isolation characterized by an inability or more restrictions on phone calls, visits, or interactions with counselors or other sources of support within their prison environments. Several participants said the only way to communicate with other incarcerated people while in solitary confinement was through faceless means devoid of human contact, which included "kites" (i.e. sliding a piece of paper on a string underneath the cracks in a door) or "talk[ing] through the crack or the vents." For example, Jason[1], a white man in his fifties who had overdosed several times following

[1] We use pseudonyms throughout the paper.

release from prison, said he lost all ability to communicate with people other than prison guards for a six-month period after being punished with solitary confinement for defending himself against an assault:

> "There's a certain sound that that door makes when it closes behind you that you will never, ever forget. It's like, no matter how many people love you out in the free world, it's like the whole world just went away. It's like you have no more contact. You have contact with one guard, and that's it."

Other participants who overdosed more frequently described how guards disregarded written policies supposed to grant people in solitary confinement regular phone calls and mail, in retaliation to people who protested their mistreatment. Amy, a white woman in her thirties, was placed in solitary confinement in local jails while undergoing heroin withdrawals, recalled that jail administrators deprived people communication to avoid accountability: "They really didn't want us to use the phones. I noticed that if you ever started talking about what they were doing to you … the phone would just go off completely. No dial tone or nothing, just off. That happened a lot. They would say they was having trouble with the phone… But we know better than that."

Deprivation of sustenance was another category of the solitary confinement risk environment (Figure 1) that refers to the extent to which people were deprived of nutrition, hygiene products, sunlight, running water, and other essential needs. All participants experienced deprivation of sustenance in solitary confinement, though to varying degrees.

People who had not overdosed typically had more resources for counteracting the harms of exposures to such deprivations by supplementing meal portions and obtaining hygiene items via prison commissaries, which again, appeared to hinge on their social

positionality or connections to community-based organizations. For example, Mark recalled, “The food was terrible. You're starving, but I was fortunate enough to be able to get honey buns, sausages, soups, and packs of tuna through the store [commissary]. A lot of people in solitary don’t get that.” Shantel, a Black transwoman in her early 30s, had been enrolled in a harm reduction program before, during, and after a recent incarceration at a county jail, where she was in solitary confinement for several months on a “psych ward floor with mentally ill folks that literally don't supposed to be in jail.” She recalled witnessing other women in that unit physically deteriorate and get into altercations with staff and other women over food and not having sanitary products for their essential needs. “Yeah, I done seen a lot of other people in there crying for food and stuff, and they [guards] do nothing, because you locked down.” She said because her case manager “went out of her way to make sure I got everything that I needed”, referring to food, soap, and toothpaste from the jail commissary, she was less susceptible to the harms of such neglectful conditions.

By contrast, participants who had overdosed post-release recounted experiencing greater degrees of sustenance deprivation, often inflicted as additional punishments, and tended to lack resources for counteracting harms. Prison staff punished several participants with “food loaf” (a meal replacement that blends and presses vegetables and protein into a bland loaf). Jason said he was put on food loaf for several months disobeying orders.

> They give you this shit called Nutraloaf… the whole time you were in the hole. That's all you get. And I don't know what sick son of a bitch came up with that idea, because you don't get nearly what you're supposed to. After about five days you're not going to have the energy to walk through the fucking door. And if you

> do something to piss them [prison guards] off, they're coming in there, and you're just laying on stainless steel or the concrete floor"

Deprivation of sustenance also entailed correctional staff turning off the lights or water in a person's cell, denying them access to prison yards for exercise, or ignoring requests for toilet paper, sanitary napkins, and other items for personal hygiene. Lamont, a Black man in his forties, lamented, "all the silly games they [guards] play just because they can. Don't run yard call, feed you late, your food's cold." Amy said that in one jail, while she was in solitary confinement, "They'd antagonize you. They would tap at the glass and do random stuff like keep the water from me or turn my toilet off in my cell and get me to the point where I was belligerent, and where I was resisting and then they're fighting me back with excessive force, but nobody believes you when you're in that state of mind."

Most participants, regardless of whether they had overdosed post-release, were subjected to uncomfortable heat, humidity, or cold temperatures in solitary confinement units with little ability to avoid the deleterious effects. However, people who did not overdose reported exposures to solitary confinement in settings without temperature control less frequently. For example, Loraine, a Black woman in her sixties, was placed in isolation for several months after getting into a fight. As did others, she said that violence was more frequent in crowded housing units, especially during the summer months because they lacked air conditioning and people became more agitated when exposed to heat-related stress. Moreover, she recalled that a solitary confinement unit, as the only setting in one prison that had air conditioning and said she would sometimes get into small fights to escape the heat, humidity, and violence during the summer. When asked about the psychological effects of being in solitary confinement, she said,

“Well, I would hear voices and I be so depressed. But, it really didn't mess with my mind too bad, because I could get away from motherfuckers that try to fuck with you [in general population units], and they got air conditioning in there [solitary confinement unit].”

People who overdosed more frequently described being subjected to extreme temperatures while in solitary confinement without air conditioning or other means to mitigate excessive heat or cold conditions. Breonna recalled the harms of being in solitary confinement during the summer at women’s prison. “You got 25 people on the tiers trying to catch air from a fan that's moving side to side. The only spot to get cooler is just to lay on the floor or wet your t-shirt on and put it on. It was horrible.” Lamont said the air conditioners in one prison were frequently broken, and “with the sweltering heat, it was like a box. And I just kept screaming and hollering for air.” As did others, Marcus experienced a fear of dying in solitary confinement during summer months.

> In the summertime, there wasn’t no air conditioning or ventilation in there. You just had to bear it out. It was really bad. You're just breathing in the air that come from a fan. I couldn't hardly sleep. I just rolled over in bed, forced myself to go to sleep. And then when I woke up, I felt miserable all over again. I thought I was going to die.

Dehumanization was a category of the risk environment (Figure 1) conceptualized as the social and physical conditions within solitary confinement that devalued participants’ humanity and personal identities and resulted in diminished self-worth and for some people, losing the will to live.

All participants endured dehumanizing conditions while in solitary confinement. However, those who did not overdose post-release appeared to encounter lesser degrees of dehumanization, which again, seemed to vary based on social positionality. Mark, a younger white man, was kept into solitary confinement for nearly three years while waiting for trial, and then on multiple occasions while in prison. He reported fewer antagonistic interactions with guards and said he felt respected most of the time: "I tried to be respectful. And for the most part, they [guards] reciprocated that same level of respect." When asked about interactions with staff, Lacey, a white woman in her twenties, could not recall being verbally denigrated by staff members who worked on a solitary confinement unit for people with medical conditions, and similarly perceived most officers as "respectful" and "just doing their jobs, for the most part."

People who overdosed post-release, by contrast, endured more overt and severe dehumanization, often after being placed in solitary confinement for using drugs or for suicide watch. For example, Dennis, a white man in his 50s, who had been using heroin for more than 20 years analogized his experience to a neglected, abused animal:

> "The hole is the worst thing that you could do to anybody. It's like putting a dog on a chain, on a tree, and not feeding him, cold, no blanket, nobody loves it. And every now and then, they kick you. That's what it felt like. And 30 days is like 30 years."

Other participants said that prison staff used racially-coded terms to denigrate them. Lamont said that while staff never used explicit terms, the "racism was palpable in that environment" and felt dehumanized by staff constantly calling them "convict" or "inmate" instead of their given name.

> I didn't have mostly white officers until I went down to a prison down South. And, they were real racist down there. Especially the ones working in solitary confinement, the racism was very high. Nobody never called me the N word, but you know, you can feel it. All of them are just kind of like, "You're a convict, a piece of shit, and we're officers" I remember, one officer said “You got to start ironing your clothes”… I didn't care about no prison clothes. I called them slave clothes. So, I wasn't interested in ironing them.”

Denial of care is a category of the risk environment of solitary confinement (Figure 1) that refers to the extent to which people were denied adequate medical care or drug treatment. Denial of care was reported among all participants; though, the circumstances surrounding their experiences and types of clinical conditions that went unmet varied between those who had overdosed post-release versus those who had not. For instance, those who had not overdosed more frequently shared being denied medical attention for physical ailments, such as fevers and skin rashes. By contrast, those who overdosed more consistently reported inadequate medical treatment for withdrawals and detoxification, often during acute psychiatric episodes. Jason, a white man who had used heroin during imprisonment and was placed in solitary confinement, said:

> I was so worried about being dope sick that I didn’t give a shit and was just hoping that they have something in there [solitary confinement] they can give me. But they didn't. They didn't have anything. So, I was just throwing up. I knew at that point in my life that heroin withdrawals don't kill you, but just wanted to die.

On at least two occasions, Jermale was placed in solitary confinement for about 6 months for possessing heroin and for having “dirty urine”. He recalled, “I went cold

turkey. That was the worst thing for like two weeks. All you want to do is die. What trips me out, they don't really check on you or ask you how you are doing, they just walk past and see if you still alive." He recalled resuming using heroin each time he exited solitary confinement but feared asking for any clinical care [from prison staff], because "they would have thrown me right back in the hole."

Others were subjected to solitary confinement in response to a mental health crisis, which often involved suicidal ideations and psychosis while detoxing from crack cocaine or methamphetamine. When asked how guards at an Atlanta jail responded to people experiencing mental health crises during withdrawals, Gina said: "With solitary [confinement]. They lock you in a cell, let you have your episode. They wouldn't call the nurse. They wouldn't call for a counselor or therapist or any other resource. I would flip out sometimes and bang on the door to let them know, 'Hey, I'm back here. Let me out of here."

Physical violence refers to the extent to which correctional staff used force against people in solitary confinement that caused pain and/or injury (e.g. cell extractions, spray with chemical agents, use of tasers, and forcible medication). Nearly all participants reported directly experiencing or witnessing physical violence at the hands of correctional staff while in solitary confinement.

Yet, those who had not overdosed appeared to encounter fewer antagonistic interactions with correctional officers that escalated into physical violence that resulted in bodily injuries. Again, for some participants social positionality provided resources that helped avoid conflicts with staff and other incarcerated people in contexts where uses-of-force and assaults, respectively, were more probable. For example, Mark's

family had resources to hire an attorney who succeeded in advocating to have him transferred out of maximum-security prison where he witnessed others in solitary confinement get sprayed with chemical agents and tased during cell extractions, to a medium-security prison with more educational programming and closer to his family. He never experienced this type of violence personally and was able to get a transfer out of this unit: “I had an attorney. I'm just kind of assuming that she knew somebody, and put in a good word for me, to get me out of there [solitary].”

Other participants who had not overdosed felt compelled to request “protective custody” to escape threats of violence and conflict within the general population units, and said that in such situations, being physically separated provided them momentary safety from violence that outweighed harms of isolation. As Tanika explained,

> Me, being locked up for so long, I didn't care really. I didn't want to be on the compound [general population]. It was just way too much. Every drug you can think of was there. You would hear on the radio, "We just got a black bag threw over the gate," and you know exactly what that meant. They [prison gangs] just took over the prison. They was going to do what they want to do. It was just nothing the warden could do about it.

Gerard said that he opted into protective custody to escape exploitation and threats of violence from prison gangs over drug-related debts, noting that people without a stable source of income were forced to rely on correctional staff for protection: “If you can't afford nothing, you will get your head smashed about a debt. I saw two people get killed.

By contrast, people who had overdosed tended to report more physical violence at the hands of correctional staff while in solitary confinement that resulted in

significant injuries. Jermale recalled guards subjecting him and others to forceful cell extractions and chemical spray, often in retaliation to voicing grievances about living conditions.

> They (correctional officers) used to just spray it in my cell and, man, you'd be sitting up there choking and crying and hollering, because it was unbearable. When you get hit with that pepper spray, man, it feels like your skin is melting."

Several participants were subjected to body searches or cell extractions that had escalated into bodily harm for those who endured it, but no accountability for staff perpetuating it. Gina recalled,

> They [male guards] are literally allowed to just beat women in there. The searching was horrible. I've never seen so many guys who were able to abuse women and get by with it. He grabbed me, body slammed me and cuffed me from behind, shackled my legs. My wrist was broken. My leg still got the cuff mark on it. What did he get? A week of vacation. Nothing was done about it.

Resilience & Resistance to Solitary Confinement.

Participants resisted or counteracted exposures to and harms of solitary confinement in various ways, which may have subsequently influenced their overdose post-release. Engaging in acts of resistance and coping routines was viewed as vital for surviving the cumulative harms of oppressive risk environments for all participants, regardless of whether or not they had overdosed post-release. However, participants who had not overdosed tended to have more opportunities to counteract the harms of social isolation, sustenance deprivation, and denials of treatment, again shaped in part

by social positionality and contextual circumstances precipitating exposures to solitary confinement.

Physical exercise and reading were the most consistently reported coping strategies. Demarius, a 50-year-old Black man, counteracted the harms of social isolation and idleness through a routine of strenuous exercise, voracious reading, and regular rest. He said it was the only way to find "that inner peace" and protect himself from spiraling into deeper depression. Moreover, he emphasized that enhancing his physical strength and endurance was not only for his own health, but also for defending himself against violence from guards during cell searches and extractions.

> I ain't going to sit here and lie to you. A lot of them fights that I'm telling you about were with guards. They done beat me several times….they were eight to one on me, their whole fucking gang. So, I just basically worked out. That's what I had to do in the hole. You know what I'm talking about?

Others found hope and empowerment through acts of resistance in solidarity with and to benefit others in solitary confinement. Lamont devoted time to studying law and filing claims through the grievance system and courts to hold prison officials accountable for depriving people of their rights and basic needs and teaching resilience and self-advocacy to younger men coming into prison. When asked how he protected himself against the harms of solitary confinement, he said.

> Well, they [prison guards] gave me a war to fight, and that kind of averted my energy. I really had a heart for guys [peers]. I remember, they [guards] used to put us out on the yard for about almost two hours, with no water out there and no bathroom. So, I researched the law and told them they couldn't put us out on the yard without no water. And, I was happy when they finally built a water fountain

> and a bathroom out there. Then me just teaching other people. That is what gave me hope and ended up helping me in the long run.

Those who overdosed post-release tended to report having fewer outlets or resources to resist mistreatment or mitigate the harms of the risk environment of solitary confinement. They more frequently described situations in which small acts of resistance provided senses of hope, agency, and empowerment, but that correctional staff diminished by retaliating with additional punishments. Without means to communicate or strong social networks outside of prison, an absence of reading materials to counteract boredom, little access to law libraries or "jailhouse lawyers", and no financial support to purchase items on commissary, many participants turned to introspective coping mechanisms that were less effective in changing their material conditions and counteracting the psychological toll of isolation and deprivation. For example, Jermale struggled to hold onto hope, but found some solace "fantasizing or dreaming that I had a place and how I wanted a more perfect life. And I held onto that dream, because this is all I got. That's what you got to do. There is nothing positive there and when that negative spirit get on you in the hole, it hardened my heart."

Amy described how women in solitary confinement units banded together the best they could to help each other through the physical torments of withdrawal, but said it wasn't enough to counteract the neglectful and dehumanizing treatment they incurred.

> "We were all detoxing off stuff and there weren't enough nurses or people that we could talk to or ask for help. We were all just helping each other through the withdrawal symptoms. And if somebody had extra food and somebody needed it,

they would help out. It really was dynamic how we helped each other, but in such a weird, strange way. We were all in there just really sick and nobody cared.

EMBODIMENT OF SOLITARY CONFINEMENT AS OVERDOSE VULNERABILITY

As depicted in Figure 1, our constructive-grounded theory suggests that participants who overdosed embodied domains of solitary confinement described in the previous section in ways that shaped susceptibilities to overdose subsequent to their release from incarceration. In each subsection, we posit processes of embodiment by drawing on the lived experiences of participants who overdosed, and then summarize differences among participants who did not overdose.

Infliction of trauma

Solitary confinement was embodied as a distinctly harmful form of trauma that triggered memories of previous traumas and had lasting psychological harms that culminated in cravings for drugs, suicidality, and risky drug use behaviors (e.g. using alone or in secluded spaces, sharing needles), following release from incarceration.

Several women experienced sexual violence in solitary confinement, which inflamed psychological wounds from previous traumas. For example, while undergoing withdrawals and detoxing in solitary confinement, Beth was left alone in a cell without any clothes and visibly exposed to passing guards, which triggered traumatic memories from abuse experienced in survival sex work. “Anybody could look in on you at any time and that's pretty traumatizing when you have trauma already surrounding that [sexual

abuse].” As a result, since her release, she had developed a disabling fear of sleep, which she said led to her more frequently injecting methamphetamines after using heroin.

> “I had extreme paranoia for several years. I was scared that somebody would take me somewhere in my sleep…. That I’d be woken up by usually men saying, ‘Come on. Come with me and take off your clothes and get in this hole.’ I was trying to treat those things that I was scared to death of with meth. I used it to keep from sleeping.”

People who reported overdosing post-incarceration more frequently reported using drugs during their incarceration, which had often led to cycles of solitary confinement sanctions, an experience they said intensified cravings and susceptibilities to using drugs upon release. As did others, Gerard recalled feeling strong urges for drugs to relieve the anguish of “boredom, stress, and feeling of being oppressed” in solitary confinement.

> “An idle mind is the devil's playground. When I was in isolation, all I thought about was drugs and beer. If you're just sitting there doing nothing…all I thought about was I can't wait to do some heroin. I can't wait to do a rock.

While he did not use drugs in prison, he said that enduring solitary confinement intensified his desire to quickly return to using heroin, cocaine, and alcohol alone, soon after returning to the community.

> “For the first week, when I woke up, I was like, "Man, damn. I keep thinking I'm still in isolation." I beat myself down. I'll be like, "Man, you know what? Fuck this shit. I'm fixing to go hustle up some money and get some drugs and alcohol

> because it makes me feel good. Then I don't have to think about all the stuff that I've been through in prison."

The infliction of trauma diminished participants' sense of self-worth and accelerated a cascade of emotional agony, which for some led to intense cravings and riskier, heavier drug use and overdose.

> When you get out of solitary, you want to enjoy yourself, and people go to drugs to enjoy themselves if they do drugs. So yeah, it makes you want to enjoy yourself 10 times more. Because you got to compensate for everything you've been through. I can definitely attest to that. Because if you get out of solitary… even if you don't go home, you going to do drugs in the population [prison], and you might even go out there and OD on some shit, because you got a lot of shit on your mind.

Being forced to undergo withdrawals and detoxification in solitary confinement was a particularly traumatic experience that compounded its psychological toll and increased cravings for drugs. As did others, Amy likened the experience of going through withdrawals in solitary confinement to dying and said that she had overdosed "more times than I could recall" during the years she cycled between jail, solitary confinement and a community in metropolitan Atlanta.

Dissolution of social relationships

Solitary confinement was also embodied in dissolutions of social relationships that were sources of emotional and material support during and after incarceration, which led to social withdrawal, diminished motivation to rekindle relationships with families, and created instabilities following release from incarceration that were attributed to overdose vulnerability. Gina said that being unable to communicate with loved ones for extended periods of time, "really ruined relationships. You lose

friendships. You lose family members. Because, the way to show love is to answer the phone. And people don't think about that." Similarly, Henry said that he eventually "completely lost contact" with family and friends, which had persisted since he was released.

> It's an emotional roller coaster. After so many times, you've developed an emotional callousness. And I don't want to equate it to death, but that's the closest thing I could probably relate to. Although they're not dead and I am not dead, I don't have any contact with them. They're now no longer part of my life.

Jermale recalled losing touch with his ailing mother after he was disappeared for nearly a year of solitary confinement for using heroin in prison. As he explained, "I couldn't make phone calls. No visitation. It was crazy. And then… you lose contact, you don't even get no mail in the hole either. You lose all kinds of contact. Then they shipped me off to another prison. My mom didn't know where I was, and that's what you worry about." His mother passed away while he was in solitary confinement. After nearly a year, he left solitary confinement and was released from prison four days later in a state of grief, despair, and depression, and quickly returned to injecting heroin and cocaine, overdosing twice within three months of his release.

> "I got out of prison four days later [after a year in solitary], but I didn't come straight home. Went straight to drugs. Atlanta got the best drugs and cheaper drugs, so I knew where to go. You get more for your money's worth. I was in a hotel, and I overdosed."

Dissolutions of social relationships made it harder for people to secure supports upon release, which often led to houselessness and poverty for some participants. In

these contexts, participants resorted to riskier and heavier drug use practices that precipitated overdoses.

Dennis, a longtime heroin user, was houseless in downtown Atlanta when he exited prison and had overdosed 4 months and 6 months after his release from solitary confinement. When asked the effects of solitary confinement on this transition, he said it left him feeling more hopeless, suicidal, and sensitized to sights, sounds, and social encounters in the city, which made him distrustful of social workers and others offering services.

> "It was hard coming out. It took maybe two months to get normal again. Oh yeah, it was like colors were brighter because, you know, you don't get much sunlight in there. So it was a little freaky. I was scared of everybody and everything for a while. I couldn't trust nobody. I didn't think I was going to make it, I wanted to kill myself. It was that bad. Well, you got to also think, they put me on the streets, I had nowhere to go. No help from them assholes. And anyway, I wanted to use a lot. It's all I wanted to do."

Trey, an older Black man who had overdosed months after his release from prison, said that solitary confinement made him more socially anxious and withdrawn in ways that hampered his self-confidence to seek treatment, housing, or employment services, which in turn intensified his cravings for heroin. "I was nervous as hell. Everything looks different. God. I'd just up and start fucking with drugs some more. Went back over to Boulevard, where I did them. That's the truth, man."

Suicidality and losing the will to live

Social isolation and dehumanization were embodied in feelings of depression, hopelessness, self-degradation, and for some, suicidality that persisted upon release. As

Amy explained, “Everybody became suicidal when you put them in the back and hide them from everybody and they're going through their thing [heroin withdrawal]... I thought I was dying.” She also spoke about how she had internalized being repeatedly humiliated and dehumanized by guards in a jail’s solitary confinement unit in ways that made her feel less able to resist domestic abuse and sexual violence, traumas that underpinned tendencies to use heroin and methamphetamine more heavily and chaotically.

> I started to dehumanize myself with them [guards] treating me that way. I guess, got used to it. Even just being incarcerated, but especially in isolation, you just start to feel like an animal in a cage. And when you get out of that cage, you just don't really care if anybody treats you badly. When they take everything away from you and then throw you out to the street, any little morsel is a blessing. It's hard to articulate.

Beth explained how social isolation, denial of care, and dehumanization culminated into heavier heroin and methamphetamine use and multiple overdoses. When she was released to the community, Beth recalled feeling that “I was useless. I was worthless.” She felt socially withdrawn, distrustful of others, and suicidal. On multiple occasions, she was released directly from solitary confinement in jail to the community, and immediately purchased a bag of heroin with an intention to fatally overdose. She said, “my suicide attempts were astronomical when I got out. I would just be like; I don't care if I OD.”

> Well, when you go from high as a kite in the streets and then go to no human contact and no drugs and just stuck back there by yourself, and then they just throw you out in the road, I did whatever I had to do, to be honest. That almost

> always equaled getting high, but each time got a little harder. Each time was a little more difficult to come back from. I don't know how to really articulate that, but I would feel the effects of it for longer and the drugs didn't work as well. It was terrifying to say the least.

Physiological deterioration

Deprivation of sustenance and denial of care were embodied in deterioration of physical health, which made their bodies less resilient to stress associated with heavy drug use. Undesirable and meager portions of food had caused some people to experience weight loss, weakness, and nutritional deficiencies. When he was release from solitary confinement to a general population unit, Lamont recalled:

> I was very small. It was kind of like my body was disproportioned. I was real frail, because I remember, when I got back into the general population, I ain't going to never forget. This one dude knew, man. He says, "Man, you must have been in the hole a lot." Because you know, your skin be lighter, because you ain't taking no sun.

Meager meal portions were viewed by some as a tactic of control, intended to diminish their physical capacity to resist force and violence from guards. Gerard recalled, “They feed you less when you're in isolation than population, so if they have to come in and restrain you, you have no energy. You're either pacing back and forth or laying down.”

Lamont resumed using heroin and cocaine shortly after returning to the community and had overdosed twice. He said that denial of treatment, deprivation of sustenance, and dehumanization had broken his spirit and weakened his will to seek housing and healthcare. He recalled injecting heroin in secluded spaces in downtown Atlanta to avoid police and interacting with other people, when he experienced two

overdoses. "You get beat down so bad that the only thing you just know is just to submit. So, when you get out, you just lay down in the gutter and don't realize that there is a program out there."

Embodiment among participants who had not overdosed

As discussed earlier, participants who had not overdose appeared to endure cumulatively less severe and harsh risk environments in solitary confinement, were better situated for counteracting or resisting exposures to solitary confinement and its harms, often due to their social positionality, which together may have reduced the extent to which these risk environments became embodied and led to overdose.

They tended to have stronger social support networks inside and outside jail and prison , which helped lessen post-release vulnerabilities to overdose by helping them obtain housing, clinical treatment, employment, and other resources that provide stability and mitigated susceptibilities to risky drug use behaviors. For example, Janine, a white woman in her mid-thirties had overdosed on heroin multiple times before prison (her first and only incarceration) had secured housing, employment, and health insurance for outpatient drug treatment within the first months of her release through her family's social networks. As she put it, "I was going through all this [solitary confinement] and coming out of prison, and my mom and sister, were my ride or die and just there for anything."

Moreover, participants who were connected to community organizations before, during, and upon release from incarceration encountered fewer barriers to obtaining

housing, treatment, and other services protective against overdose vulnerability. Chantel, a Black transwoman in her early 30s, said that staying connected to a harm reduction provider during incarceration was pivotal in securing her release from a county jail's solitary confinement unit and promptly providing her with housing, transportation, and healthcare immediately upon returning to the community. Comparing her circumstances to friends who had fatally overdose after leaving jail, she reflected,

> That could have been me.. . . going off somewhere to shoot up and never come back. I'm not going to lie. It [jail and solitary confinement] almost broke me. But, she [case manager] pushed the issue [release bond]. And I don't know what she did, but she did it. It was such a relief to come up out of there [solitary confinement unit]. They put me in an apartment. They pay for my Ubers. They got me [health] insurance. They trying to get me a job. They help people find their way in the world."

Other participants who had overdosed multiple times soon after their release from prison but had since entered treatment emphasized the importance of social support and solidarity with other formerly incarcerated people using drugs. Despite his lack of trust for police and social workers, Henry said that his peers had helped him find shelter, buy a sleeping bag, and navigate sparse resources for providing medication for opioid-use disorder. He had experienced an overdose shortly after release from prison but had mostly refrained from using heroin since he got access to opioid-agonist treatment he found through a peer.

> But people like me, that love opiates, which is my drug of choice, Suboxone is the best thing that ever happened. But they [service providers] don't come around

> and tell nobody. I got lucky. [friend] told me about this place because somebody had told him. So if it wasn't for word of mouth, these people wouldn't get help. They're just going to sit here and bang and OD.

Discussion

The systematic cycling of millions of people between marginalized communities and degrading conditions within correctional institutions, has shaped disparities in the distribution of disease, despair, and death during the most consequential public health epidemics in modern history(T. I. Mukherjee & El-Bassel, 2020). While drug policy experts, epidemiologists, and activists have demonstrated the influence of mass incarceration on the overdose crisis, scholars and advocates alike have not conceptualized solitary confinement as instrument of the drug war or measured its impacts on the lives of people who use drugs as they transition from incarceration to the community.

Drawing on constructs of embodiment from ecosocial theory and carceral geography this study posits a grounded theory of possible pathways through which risk environments and lived-experiences of solitary confinement become embodied and can lead to overdose post-incarceration (Figure 1). All participants, regardless of whether they had overdosed post-release from incarceration were exposed to risk environments characterized by varying degrees of each category. Though, participants who had overdosed endured greater degrees of social isolation, dehumanization, physical violence, and denials of care, which were embodied through a variety of social and individual pathways, as contributing to overdose vulnerability.

Social positionality, along lines of economic privilege, race, and social class also appeared to influence the carceral basis given for placement in solitary confinement, the risk environments within these settings, and individuals' capacities and opportunities to mitigate or resist exposure to and harms of deprivation of sustenance, social isolation, and denials of care. In other words, people who did not overdose post-release tended to have social and economic advantages that helped mitigate their overall exposures to deprivations and degradations of solitary confinement in the most restrictive carceral institutions. By contrast, those with more significant histories of impoverishment, familial incarceration, and other forms of socioeconomic instability were typically subjected to more harsh environments, with fewer resources to mitigate or avoid the harms.

Study findings recast what is already known about the social and material conditions of solitary confinement and its profound harms, but also make important elaborations to this literature. Answering calls for more research on post-release harms(K. E. McLeod & Martin, 2020), it is the first study to shed light on the lived-experiences of solitary confinement among formerly incarcerated people who use drugs and face heightened vulnerability to overdose. Participants shared harrowing accounts of being subjected to solitary confinement not only as a punishment for using drugs during incarceration, but also in situations involving mental health crises fueled by agonizing experiences of forced withdrawal from heroin, cocaine, and/or methamphetamines, compounded for some by dehumanizing conditions while on suicide watch.

Social isolation is potent contributor to overdose in any setting, and solitary confinement, by definition is hyper-intensive mechanism for engendering loneliness and dissolving social support. The benefits of providing incarcerated people with access to medications and harm reduction interventions are robustly supported, and suggests that increasing access to medications for opioid-use disorder and of overdose education and naloxone distribution programs will reduce morbidity and save lives (Macmadu et al., 2020). Yet, it is possible that even in jails and prisons that embrace these services, their reach and effectiveness of these services may be undermined by continued reliance on excessively punitive enforcement tactics such as solitary confinement. Among participants who disclosed an opioid-use disorder, none reported receiving access to buprenorphine, methadone, or other effective medications while incarcerated. Rather, those who obtained buprenorphine did so through jail or prison drug markets to stave off dope sickness, which triggered punishment with solitary confinement and other sanctions. This finding corroborates troubling accounts in a mounting body of litigation challenging denials of access to medications for opioid-use disorders in jails and prisons as cruel and unusual punishments under the 8th Amendment, and in violation of the Americans with Disabilities Act. While more research is needed, our findings offer important context and nuance to an extensive epidemiological evidence linking incarceration to excess odds of overdose. Our grounded-theory may prove useful for litigators seeking to contextualize how denials of evidence-based treatments in carceral settings may manifest in placements in solitary confinement and other deprivations that increase susceptibilities to risky drug use and overdose.

Continuing to empirically connect forced withdrawals, solitary confinement, and overdose may help substantiate legal challenges to each of these practices. Our findings also bolster previous studies showing that overdose and suicidality are intricately connected causes of premature death. Indeed, many participants in our sample reported being placed in solitary confinement following a mental health crisis, which worsened their symptoms and enflamed psychological wounds from past traumas. Many participants attributed solitary confinement to increasing their propensities to engage in heavier and riskier drug use during and following incarceration. Other recent class action lawsuits assert that placing people with serious mental illness, developmental disabilities, and other health-related impairments in solitary confinement violates the Americans with Disabilities Act (Schlanger, 2016). While substance use disorder (SUD) is a disability protected by the ADA requirements, litigators are yet to formulate legal theories for how solitary confinement practices violate ADA as applied to people with SUD. Our grounded-theory also be valuable to litigators conceptualizing legal theories to challenge solitary confinement as violations of the ADA.

Limitations and future directions

This study has several limitations to address in future research. First, our findings are based on an analysis of formerly incarcerated people who were residing in the metropolitan Atlanta area and had experienced solitary confinement across many of the same, but also different jails and prisons in Georgia. It was therefore not possible to fully account for the influence of factors distinct to the institutions where they were exposed.

While many participants had been incarcerated in some of the same institutions, future studies might consider adopting more precise recruitment methods. Of course, causal inferences about the effects of solitary confinement on overdose cannot be drawn from this qualitative study. Future studies should strive to apply cohort and quasi-experimental designs to quantitatively test ideas in this study's grounded theory more rigorously. Mixed-methods studies are a promising avenue, because they can help quantify relationships between solitary confinement exposures and overdose with statistical power and causal inference, while also providing qualitative narratives to contextualize and interpret effects. Conducting such research may require requesting administrative records from departments of correction and merging them with mortality records held by public health agencies. Partnerships between lawyers, epidemiologists, and community stakeholders may be fruitful collaborations for conducting such research, and disseminating findings in ways that translate to holding carceral actors accountable.

Table 1. Study Sample Characteristics (N=22)	
Mean Age	42 years (range, 27-61 years)
Gender	
Men	13 (59.1%)
Women	9 (40.9%)
Race/Ethnicity	
Black/African American	13 (59.1)
White	8 (36.4%)
Latino	1 (4.6%)
Drugs Ever used	
Heroin	13 (59.1%)
Prescription opioids	14 (63.6%)
Cocaine (crack or powder)	16 (72.7%)
Benzodiazepines	13 (59.1%)
Methamphetamines	10 (45.5%)
Injecting drugs	10 (45.5%)
Mixing opioids + stimulants	15 (68.2%)
Mixing opioids + benzos	7 (31.8%)
Housing Status	
History of housing instability	18 (81.8%)
Unhoused at interview	5 (22.7%)
Solitary Confinement	
1-2 exposures	5 (22.7%)
Between 3-5 exposures	7 (31.8%)
Between 6-10 exposures	5 (22.7%)
>10 exposures	5 (22.7%)
Ever overdosed Post-release	14 (63.6%)
1-2 times	6 (42.9%)
Between 3-5 times	5 (35.7%)
6 or more times	3 (13.6%)

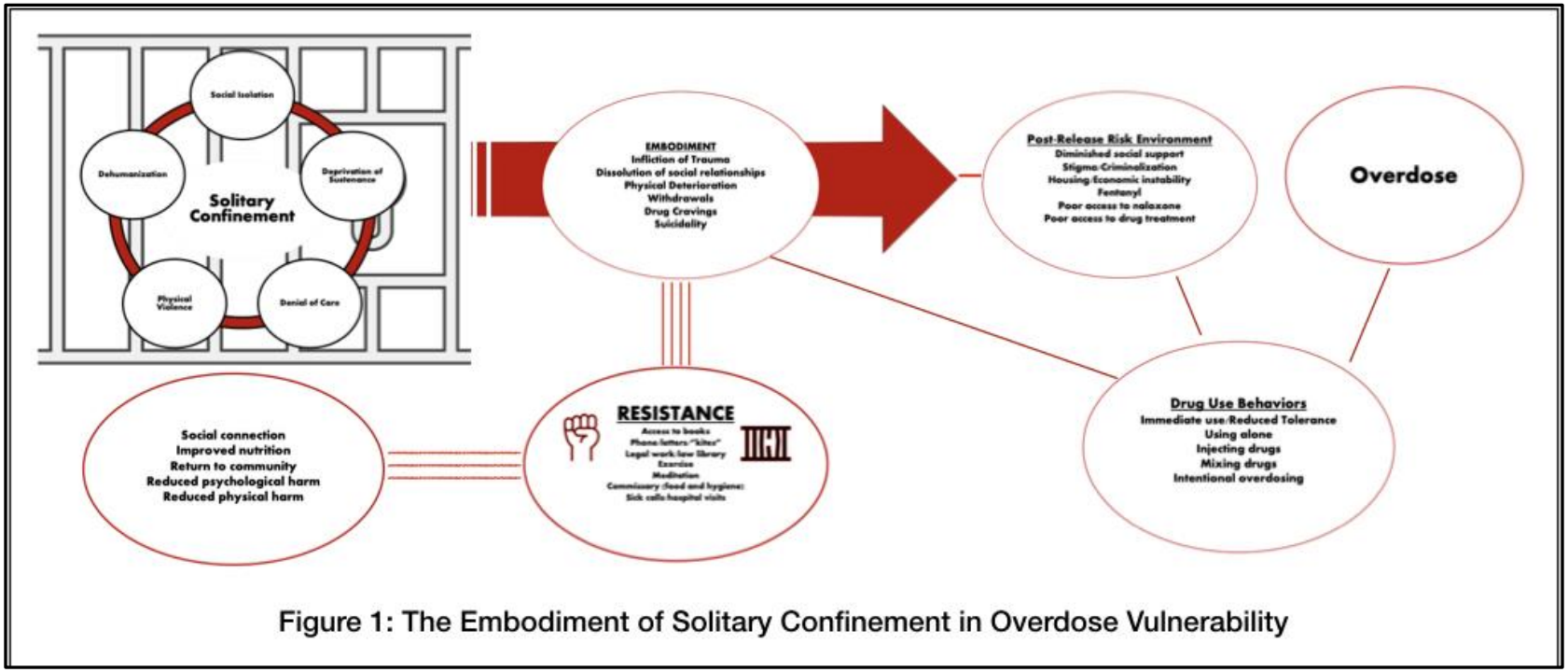

Figure 1: The Embodiment of Solitary Confinement in Overdose Vulnerability

Chapter 3 References

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Chapter 4. Extreme Heat and Suicide Watch Incidents in a Deep South Prison System

Abstract:

Heatwaves are one of the most lethal weather phenomena, — accounting for more deaths than hurricanes, tornadoes, earthquakes, and flooding combined. Extreme heat poses distinctly dire detriments to the health and safety of the 2.1 millions incarcerated people in the US, who have disparately higher rates of behavioral health conditions compared to the rest of the U.S. population. Activists, litigators, and journalists have led efforts to hold state actors accountable for health-related hazards attributable to unmitigated heat exposures in carceral settings. Building upon an emerging literature, this longitudinal panel study merged climatological data with measures of the daily maximum heat index with daily data from the Louisiana Department of Corrections and Rehabilitation (January 2015 to December 31, 2017) and used fixed-effects negative binomial regression models to assess associations between daily exposures to extreme heat and daily incident rate of suicide watch incidents across six Louisiana prison facilities. Compared to relatively milder days (i.e. those where the maximum daily heat-index was in the 60-69°F range), the incident rate of suicide watches was 29% greater for days when the maximum heat-index reached 80-89F and 36% greater on days climbing into the 90-103°F range, after controlling for relevant facility-level covariates and potential seasonality effects. The results bolster a budding body of scholarship elevating the perils of heat exposures for incarcerated populations into the purview of public health discourse.

Chapter 4. Extreme Heat and Suicide Watch Incidents in a Deep South Prison System

Introduction:

The escalating frequencies, durations and severity of extreme heat events pose dire hazards for incarcerated populations worldwide. Building upon an emerging literature, this study examines an issue at the intersection of this climate crisis and mass incarceration in the United States, by exploring associations of extreme heat, solitary confinement, and an indicator of suicidality among incarcerated adult men in a Deep South prison system.

Heatwaves are one of the most lethal weather phenomena, — accounting for more deaths than hurricanes, tornadoes, earthquakes, and flooding combined. Due anthropogenic climate change, temperatures and atmospheric moisture content have increased on a global scale since 1950 and are projected to continue rising (Coffel et al., 2017; Fischer et al., 2021; Perkins-Kirkpatrick & Lewis, 2020) Heatwaves— defined as temperatures that significantly exceed those on historical record in a region-- are becoming more frequent and lasting longer (Perkins-Kirkpatrick & Lewis, 2020; Rogers, Kornhuber, Perkins-Kirkpatrick, Loikith, & Singh, 2022). In the United States, heat-wave frequency has increased steadily over the past 70 years, from an average of two heat waves annually in the 1960s to 6 annually in the past two decades. Heat waves are comprised of days that meet the definition of extreme heat, which refers to days where the heat index is above 90 degrees or exceeds the 90th percentile for the average maximum daily heat index for a geographic area (Skarha et al., 2022). In 2021, across

all U.S. counties, there was a median of 15 extreme heat days compared to a median of 3 days of extreme heat in 1979 (Fischer et al., 2021).

While most research has looked at the consequences for physical health (Ebi et al., 2021; Epstein & Yanovich, 2019), epidemiologists are increasingly exploring the implications of escalating heat for mental health and behavior (Liu et al., 2021; Obradovich & Minor, 2022; R. Thompson et al., 2018). For centuries, researchers have observed that suicides tend to increase in hotter seasons of the year. In the wake of the modern climate crisis, researchers are revisiting linkages between extreme heat and suicidality in different geographies and socio-political contexts. These studies consistently find positive associations between higher-ambient temperatures and incidence of suicide (Burke et al., 2018; PG Dixon et al., 2007; P. G. Dixon & Kalkstein, 2018). Based on historical and projected trends, Burke et al. (2022) predicts that by 2050, rising temperatures will contribute to 21,000 additional suicides in the United States (1.4 percent rate increase) (Burke et al., 2018).

Researchers posit several pathways through which extreme heat worsens vulnerabilities to suicidality. At a biophysical level, heat stress may worsen mental health symptoms by altering the body's ability to thermoregulate and regulate emotions (Lõhmus, 2018). This may trigger or exacerbate feelings of lethargy, irritability, and sadness, especially for people with psychiatric diagnoses, such as bipolar disorder, generalized anxiety, and depression(Lõhmus, 2018; Noelke et al., 2016; R. Thompson et al., 2018). Self-injurious behaviors associated with suicide are forms of violence, and an extensive literature has linked extreme heat to elevated social volatility, aggression, and violence(C. A. Anderson, 1989; C. A. Anderson & DeLisi, 2011; Mares & Moffett, 2016;

Miles-Novelo & Anderson, 2019). At community levels, studies from around the world have linked heat-waves and rising temperatures to escalations in hospitalization rates for behavioral health symptoms, including substance use; mood disorders; schizophrenia, and delusional disorders; and non-suicidal self-harm (Almendra et al., 2019; Carlsen et al., 2019; Florido Ngu et al., 2021; S. Lee et al., 2018; Nori-Sarma et al., 2022; Pan et al., 2019; Trang et al., 2016; Vida et al., 2012).

Extreme heat poses distinctly dire detriments to the health and safety of the 2.1 millions incarcerated people in the US, who have disparately higher rates of behavioral health conditions compared to the rest of the U.S. population (Colucci et al., 2021; Motanya & Valera, 2016; Skarha et al., 2022). Common features of the built environments of carceral institutions can create and exacerbate heat-related vulnerabilities to health. Many jails and prisons have infrastructures that are not constructed to endure or adapt to the climatological shifts in the environment linked to rising temperatures. Carceral structures are mostly built with materials such as stone, metal, and concrete that retain heat, and have small or closed windows that impede air circulation, which create conditions for indoor temperatures that exceed those outdoors (Colucci et al., 2021; Skarha et al., 2020). Overcrowding is rampant in the U.S. carceral system, with hundreds or thousands of people cramped into poorly-ventilated dormitories or small cells (single or double-bunked), which can intensify the physiological and psychological stress of heat exposures.(Colucci et al., 2021; Skarha et al., 2020) Solitary confinement--broadly defined as being confined in a cell for about 22 hours per day, with limited access to property, visitation, and programming---(D. H. Cloud et al., 2015; Haney et al., 2020) is another feature of carceral environments that

can exacerbate heat-related harms(Holt, 2015; Skarha et al., 2020). As recounted in litigation and recent commentaries, people in solitary confinement are especially susceptible the hazards of extreme heat, because in these enclosed spaces, they are less able to avoid or mitigate heat-related stress than those in the general population units of prisons or in community settings. In units without air-conditioning, people in solitary confinement are physically contained in compact, poorly ventilated spaces, with less access to areas of an institution where they might find shade, air conditioning, ice, cold showers, and reprieve from heat. Litigation and journalistic accounts of heat exposures among people in solitary confinement depict people enduring tormenting heat, and resorting to stripping naked, using toilet water, and sleeping on concrete to cool off during summer months (Skarha et al., 2020).

Policies on temperature regulation inside prisons vary widely by state and facility (Holt, 2015). Especially across the Deep South, carceral institutions sit on landscapes with minimal shade from trees and other natural features to mitigate heat exposures. The spaces where people sleep and work often lack air conditioning, and require incarcerated people to rely on fans, ice, and cold showers to cool down in the summer months(Colucci et al., 2021; Holt, 2015; Skarha et al., 2020). About 95% of households in the South have air-conditioning, but most of the region's prisons, aside from those in Arkansas, do not. In Texas, Louisiana, Florida, and other Southern states, extreme-heat in prisons is an active area of civil rights litigation and advocacy(Holt, 2015). Prisons in these states implement common mitigation strategies, such as flagging people who are vulnerable due to their age, medical condition, or medication regimen and providing access to fans, ice, and cold showers on days when the heat-index reaches a particular

threshold(Holt, 2015). However, these policies are typically intended to avert heat exhaustion or heat stroke, and dehydration, and have been less attuned to the psychological and behavioral effects of extreme heat in carceral spaces.

Only two studies have explored associations between extreme heat and the health of incarcerated populations. A study of the Texas prison system found that an extreme heat day was associated with a 15.1% increased all-cause mortality risk. Comparing prisons with and without air-conditioning, they found that air-conditioning reduced mortality risk; and conversely, a 1-degree Fahrenheit increase above 85°F was associated with a 0.7% increase in the risk of death. They also estimated that about 13% of deaths in Texas prisons may be attributable to extreme heat in prisons without air conditioning(Skarha et al., 2022). Another study found that "intensely hot days", those exceeding the 90th percentile of maximum heat index relative to previous years, increased the probability of severe violent incidents by about 20 percent; and that "unmitigated exposure to heat generates an additional 44 cases of intense violence per year" in the Mississippi prison system(A. Mukherjee & Sanders, 2021) .

Policymakers have paid less attention to the behavioral health implications of heat-related stress in carceral spaces, and its potential influence on suicidality. Self-harm and suicide are among the leading contributors of morbidity and mortality among incarcerated populations. People with serious mental illnesses, such as schizophrenia, bipolar disorder, and major depression, are at increased risk of self-harm and suicide and are overrepresented in correctional settings (Fazel et al., 2008; Fazel et al., 2017; Huey & McNulty, 2005; Sarah Larney & Michael Farrell, 2017). We build on this emerging domain of research by conducting the first study empirically exploring

linkages between extreme heat and behavioral health—specifically, the occurrence of suicide-watch placements as an indicator of suicidality-- in a sample of incarcerated people in a Deep South prison system.

Methods:

This longitudinal panel study merged climatological data with measures of the daily maximum heat index with daily data from the Louisiana Department of Corrections and Rehabilitation (January 2015 to December 31, 2017) and used fixed-effects negative binomial regression models to assess associations between daily exposures to extreme heat and daily incident rate of suicide watch incidents across six Louisiana prison facilities. The unit of analysis was prison-facility days, where "facility" refers to the six prisons in the sample, as described below.

Setting and Study Sample:

The interplay of climate change and mass incarceration is already evident in the Deep South. Louisiana has one of the largest and densely-populated prison systems in the nation. Louisiana averages 35 days a year when heat exceeds dangerous levels, and is projected to experience more frequent, longer, and severe heat-waves, with an average nearly 115 danger days a year by 2050. Louisiana also has one of the largest prison systems in the United States and the highest per capita incarceration rate in the world(Sawyer & Wagner, 2020); and the state been embattled in litigation over solitary confinement and health-related harms of extreme heat and lack of air-conditioning("Bell v. LeBlanc," 2020; Holt, 2015).

Sampling:

About half of people sentenced to imprisonment in Louisiana are sent to local parish jails. The sample for this study included adult men who were in Louisiana's state-operated prisons (n=6) between January 1, 2015, and December 31, 2017. We employed several steps to create a facility-level dataset by aggregating individual-level variables to the facility-days based on theoretical and practical considerations. Our data did not allow for assessing solitary confinement and other relevant information during stays in parish jails. Therefore, our sample was limited to people incarcerated in one of the six aforementioned state-operated prisons for 75% of the days within the observation period (January 2015-December of 2017). People imprisoned at the Louisiana Correctional Institute for Women were also excluded, because this facility was evacuated due to flooding during the observation period, which resulted in temporary displacement of incarcerated women across the state. We also excluded incarceration days for the Allen Correctional Center or Winn Correctional Center, as both of these institutions transitioned from state to local operation during the observation period or temporarily functioned as intake facilities.

Creating the analytic dataset

This is a secondary analysis of data obtained from the Vera Institute of Justice (Vera) that was previously used to produce a report on solitary confinement practices in Louisiana for the Safe Alternatives to Segregation Initiative (SAS-I). This data included raw data files from the Criminal and Justice Unified Network (CAJUN), which is the Louisiana Department of Corrections and Rehabilitation's administrative database that tracks individual-level information on all persons sentenced to imprisonment in Louisiana. A dataset was constructed using different raw files from CAJUN that were

obtained by Vera. These files included demographics, sentencing, mental health, disciplinary records, housing assignments, and solitary confinement exposures for all persons in Louisiana prisons between January 2015 and December 2017. Access to this dataset was obtained through a data-sharing agreement with the Vera Institute of Justice. We created a panel of daily data for each of the six state-operated prisons in Louisiana by aggregating individual level data to facility-level indicators described in more detail below.

Measures:

Focal Dependent variable.

The focal dependent variable was daily count of newly initiated suicide watch incidents at the prison-facility level. These incidents were recorded in CAJUN by correctional staff any time a person was placed on suicide watch. A suicide watch occurs when a correctional staff member believes that a person is a potential suicide risk and notifies a supervisor, and a person is placed under observation. Thus, this indicator plausibly represents a situation where a person expressed or displayed psychological distress that correctional staff deemed to warrant placement on suicide watch status. These data were obtained at the individual level, which allowed us to determine the date and location (i.e. facility) of each suicide watch incident for each day between January 1, 2015, and December 31, 2017.

Focal Independent Variable: Extreme heat days

Extreme heat was the focal independent variable. Heat-related data were downloaded from the U.S. Local Climatological Data (LCD), a publicly available resource that tracks

hourly, daily, and monthly maximum, minimum, and average temperature, heat index, dew point temperature, relative humidity, degree days (heating and cooling), and daily precipitation. These data are collected from 950 U.S . Automated Surface Observing System (ASOS) stations, as well as observations collected every 20 minutes from approximately 1,400 U.S. Automated Weather Observing System (AWOS) stations. For this study, we used LCD data on the daily maximum heat index recorded by the weather station linked to the zip-code of each of the six prisons. Distinct from temperature, heat index is a measure of “”what the temperature feels like to the human body when relative humidity is combined with the air temperature.”(National Weather Surface) and is more frequently used to assess the effects of extreme heat on health(G. B. Anderson, Bell, & Peng, 2013). Guided by extant literature(A. Mukherjee & Sanders, 2021; Skarha et al., 2022), we created two indicators of extreme heat. First we categorized the daily maximum heat index into six bins (Below 30°F, 30-39°F, 40-49°F, 50-59°F, 70-79°F, and 80°F+) based on the distribution of this variable. For modeling, the reference category was 60-69°F (Deschênes & Greenstone, 2011; Heutel, Miller, & Molitor, 2021; A. Mukherjee & Sanders, 2021). Second, we created a dichotomous indicator for any facility-day where the maximum heat index exceeded the 90th percentile of heat indices for all days in observation period, based on guidance of prior studies’ definition of extreme heat.(Skarha et al., 2022)

Daily rate of serious mental illness

We aggregated individual-level files to create an indicator of daily percentages of incarcerated persons at each prison classified as Level 1-3 as a proxy of SMI diagnosis and relative levels of impairment at a facility level (D. Cloud, Jessi LaChance, Lionel

Smith, and Lauren Galarza. , 2019). LDOCR uses a level system to classify the acuity and severity of incarcerated persons' mental health status during the course of their incarceration. It is a time-varying measure, and the date and result of most recent classification is recorded in CAJUN. People classified as Level 1 are assessed as having the most severe level of impairment and requiring intensive clinical care, designated housing units, and ongoing management. Those classified as Level 2 typically were diagnosed with a serious mental illness (SMI) and a pattern of functional instability within the past 6 months. People classified as Level 3 have an SMI diagnosis but have been stable on medication and functionality measures for at least 6 months. People on Level 4 typically have an Axis I (DSM-IV) diagnosis other than SMI and a history of substance dependency.

Daily Rate of Solitary Confinement

We created a daily rate of solitary confinement for each facility as a co-variate in the model. We aggregated individual housing files to calculate the total number of incarcerated persons residing a unit used for solitary confinement each day and then divided it by the total population at each prison-facility that day. More specifically, a person was counted as being in solitary confinement on a particular day, if housing records showed they were assigned to one of the following types of units ,designated by "location codes" in CAJUN: administrative segregation, extended lockdown, closed-cell restriction or death row on a particular day. While living conditions vary in these different units, as described in departmental regulations, we included each of these units in our calculation, based on definitions of solitary confinement in a Vera Institute

of Justice report on solitary confinement in Louisiana prisons (D. Cloud, Jessi LaChance, Lionel Smith, and Lauren Galarza. , 2019).

Daily facility population

Prior studies suggest that overcrowding may increase vulnerability to suicidality in prisons(Fazel et al., 2017; Huey & McNulty, 2005). Daily-facility populations was defined as the total number of people incarcerated at each prison on a given day divided by Louisiana's total imprisoned population. This control variable was calculated using housing files to count the unique individuals in each prison for every day in the observation period.

Analysis

There was very minimal missing data in our dataset, and only for one variable. The Vera Institute of Justice dataset from which solitary confinement exposures were obtained only went from January 1, 2015, to July 3rd, 2017. Therefore we had missing data on facility-level rates of solitary confinement for approximately 15 percent of the 6,576 facility-incarceration days. This data was missing because the Vera Institute did not have solitary confinement data for approximately the last 6 months of 2017, and was not influenced by the presence or absence of other variables in our data.

First, we conducted descriptive analysis to explore facility-level variations in suicide-watch incidents, extreme heat, solitary confinement, and mental health severity over time. We confirmed the accuracy of our data merging procedures, by compared results of our descriptive analysis to those in other sources reporting on prevalence of solitary confinement and prevalence of mental health issues among the population in

Louisiana's state operated prisons(D. Cloud, Jessi LaChance, Lionel Smith, and Lauren Galarza. , 2019; Solitary Watch, June 2019). Next, we conducted bivariate analysis of each theoretically relevant predictor in our data prior to running negative binomial models.

For robustness, we compared results from three different approaches to handling the missing solitary confinement data. First, we ran the models with the data as missing, which excluded daily rate of solitary confinement data at each facility for a period of roughly 6-months. Second, given the relative stability of facility-level rates of solitary confinement across time, we also used a linear interpolation approach, based on the average daily change in rates of solitary confinement, to fill-in daily-average rate of solitary confinement for missing dates. Lastly, we performed multiple imputation by including all predictors in the model, running 500 iterations.(Allison, 2009) As discussed below, the models produces from of these approaches had comparable results.

Since our focal outcome was a count —daily frequencies of suicide watch incidents—that was not normally distributed and over-dispersed (variance exceeded the mean value), we utilized conditional fixed-effects negative binomial regression models to test associations between extreme heat and suicide watch incidents, while controlling for aforementioned covariates (Allison, 2009; Allison & Waterman, 2002). We included fixed-effects for day and facility in the model to account for clustering and potential influence of variations in unobserved factors over time and facility. Extreme heat is an exposure that is independent of facility-level exposures that may shape the incidence rates of suicide watches within and between prisons; especially when considering the ubiquitous absence of air-conditioning in living areas of all prisons in the sample during

the observation period (aside from three cells in the death row unit, as a result of litigation). Prior research suggests that suicidality is more common during certain months of the years, such as those during holiday seasons. Therefore, we also added a fixed-effect for month to our models to account for potential seasonality effects that may influence the incident rate of suicide watch incidents.

Conditional fixed-effects negative binomial regression models were performed using XTNBREG commands in Stata Version 17 (StataCorp LP, College Station, TX). We ran two models to assess the relationship between extreme heat and suicide watch incidents: one using the heat-index-bin indicator (60-69°F as reference group) and a second model using the binary indicator for facility-days exceeding the 90th percentile of heat-index from January 1, 2015, through December 31, 2017. We also re-ran both models using both approaches to addressing the missing solitary confinement data (i.e. multiple imputation vs. interpolation based on daily rate of change). The small number of prisons in our dataset (n=6), precluded utilization of hierarchical linear models

Ethics statement:

This study was approved by the Emory University Institutional Review Board and the data are protected by a federal certificate of confidentiality.

Results

Table 1 reports facility-level descriptive statistics of incarcerated populations at each of the six prisons in the sample. The facility-level sample comprised a total of 6,576 facility-incarceration days. Figure 1 shows the distribution of daily suicide-watch

incidents for all facility-days. Across all facilities, the mean daily number of suicide-watch events was 0.24.

Figure 2 displays the estimated daily maximum heat index for all facility-days. Each facility, experienced similar percentage of days (9.8% or 108 days) during the observation period that met the definition of an extreme heat day (i.e. exceeded the 90th percentile maximum daily heat index), with the exception, except for RLCC, which had (13.9% or 152 days in the extreme heat-range for the observation period. The mean daily maximum heat index across all prisons was 84.5(F) with little variation between prisons (Table 1). Across all six prisons, the daily average percentage of people in solitary confinement was 21.2% (SD=11.6); though it varied by facility and ranged from 6.9 to 28.9 percent. The estimated daily average population with a serious mental illness and classified as having more severe functional impairment (i.e. Level 1-3 mental health status) varied by facility as follows: LSP (10.2%), EHCC (17.4%), RLCC (14.5%), RCC (10.3%), DWCC (9.9%), and DCC (5.8%). In bivariate analysis (negative binomial model with fixed effects for day and prison) all putative predictors reached statistical significance ($p<0.05$) and were included in the final models (Table 2).

Results of the multivariable model suggest a dose-responsive association between extreme heat and the daily incident rate of suicide watches across analyses (Tables 3a and 3b). Table 3a shows that within the hotter daily heat index bins (i.e. those exceeding 60-69°F) the incidence rate of daily suicide incidents increases by 29% when the heat index reaches the level of “caution” (80-99°F) and by 36% when reaching “extreme caution” (99-103°F), compared to days with a heat-index in the 60-69°F range. Moreover, while the cooler heat-index bins (i.e. those below the reference group of 60-

69°F) were not statistically significant, the model indicates that cooler days may decrease the incidence rate of suicide watch incidents. Again, about 9.0% of facility days in this panel dataset exceeded the 90th percentile heat index and defined as "extreme heat' days. Results of Model 2 (Table 3b) corroborate those from Model 1 suggests that compared to all other days, those falling into the extreme heat category were significantly associated with a 30% increase in the incident rate of daily suicide-watch incidents. In other words, extreme heat days contained 30% more suicide watch incidents than days below that range.

Both models suggest facility-level indicators of solitary confinement and level of mental health need were significant predictors of suicide watch incidents. First, both models indicate that one-standard deviation increase in the percent of people held in solitary confinement is associated with a 1.0% increase in the incident rate of daily suicide-watch incidents. These models also suggest that for each standard deviation increase in the daily percentage of incarcerated people classified as having a higher level of mental health need (i.e. Level 1-3 mental health status), the incident rate of daily suicide-watch incidents increases by 6.0%, a finding that is corroborated in model 2 (Table 3b). The models showed consistent findings when using three different methods to account for the missing solitary confinement data.

Discussion

Rising temperatures and heat-waves are an imminent climatologic threat, and a leading cause of weather-related morbidity and mortality on a global scale. Activists, litigators, and journalists have led efforts to hold state actors accountable for health-related hazards attributable to unmitigated heat exposures in carceral settings. Thus far,

public health researchers have paid little attention to these issues. The results bolster a budding body of scholarship elevating the perils of heat exposures for incarcerated populations into the purview of public health discourse(Motanya & Valera, 2016; Prins & Story, 2020; Skarha et al., 2022; Skarha et al., 2020).

To our knowledge, this is the first study to link extreme heat and an indicator of suicidality among a sample of imprisoned people. We found a strong, dose-responsive relationship between extreme heat exposures and the incident rate of suicide watches within six state-operated facilities in the Louisiana prison system. Compared to relatively milder days (i.e. those where the maximum daily heat-index was in the 60-69°F range), the incident rate of suicide watches was 29% greater for days when the maximum heat-index reached 80-89F and 36% greater on days climbing into the 90-103°F range, after controlling for relevant facility-level covariates and potential seasonality effects.

Our observations align with evidence from prior studies linking extreme heat to increases in psychiatric morbidity, utilization of clinical protocols for mental health emergencies, and incidence of suicidality in other geographical and social contexts (Burke et al., 2018; Charlson et al., 2021; Y. Kim et al., 2019; Liu et al., 2021; Nori-Sarma et al., 2022). Through a public health lens, suicidality and self-injurious behaviors are manifestations of violence that require epidemiological surveillance and policy interventions (Dahlberg & Mercy, 2009). By demonstrating linkages between heat and suicidality in a carceral context, this study expands upon theory and empirical evidence showing a positive relationship between heat exposures and incidence of different forms of violence. Similar to our findings, Mukherjee et al. (2021) observed an

effect of heat on daily counts of violent assaults in the Mississippi prison system emerged as the heat-index exceeded 80°F range. Echoing others, Colucci et al. (2022) conceptualizes the hazards of extreme heat in carceral spaces as form of "thermal (in)equity" and urges for geographers, epidemiologists, and environmental scientists to forge partnerships to advance science and formulate intersectoral interventions for preventing and redressing associated harms (Colucci et al., 2021). Our methods, alongside previous studies, provide insights into the promises of merging climatological, correctional, and other sources of data to carry out such studies and visualize hot-spots for emergent environmental injustices (Glade et al., 2022).

Our findings have important policy implications at intersection of environmental justice and health equity. As mentioned, the effects of heat on the health and human rights of incarcerated people is an active area of civil rights litigation, especially in the Deep South("Ball v. LeBlanc," 2018; Holt, 2015). Providing evidence of the relationship between of extreme heat and suicidality may help amplify efforts of activists fighting for air-conditioning and decarceral solutions to climatological hazards in correctional settings. It is important to acknowledge that in response to tireless advocacy and costly litigation, Louisiana's correctional officials recently announced plans to gradually install air-conditioning in several of the prisons included in this study. This welcome news also offers an opportunity for natural experiments to determine whether this action will translate to decreases in indicators of mental distress and improvements in health. Installing air-conditioning is an urgent necessity for abating imminent harms that flow from the "thermal (in)equities" within the aging infrastructure of the nation's carceral enterprise.

However, there are deeper problems to address at the intersection of the climate crisis and mass incarceration that demand structural solutions. The COVID-19 pandemic awakened wide segments of society to horrid conditions that plague the lives of people in U.S. jails and prisons and helped more public health experts embrace decarceration as an imperative action. Decarceration and air-conditioning are the bare minimum of actions needed in response to the humanitarian and public health emergencies that loom on the horizon. Amplifying calls for abolition as a priority in public health discourse is likely where solutions to these issues will arise (Prins & Story, 2020; Purdum et al., 2021; Ranganathan & Bratman, 2021).

There are several limitations in this study to address in future research. First, our data was derived from administrative data that was not created for research purposes. Using recorded suicide watch incidents likely underestimates the magnitude of suicidality and self-injurious behaviors that occurred during the observation period, as correctional officers may have not observed and/or recorded every situation in which a person experienced suicidal intentions. While solitary confinement was included as a co-variate in our model, our analysis could not account for the differences in how extreme heat may influence suicidality vulnerabilities in spaces used for solitary confinement compared to dormitories and other types of housing units. Prior literature on solitary confinement has not fully considered the implications of extreme temperatures as hazard to health. Surveys and qualitative research are a logical next step for bringing attention the distinct harms of extreme heat for people in solitary confinement cells with even less autonomy and options for mitigating its harms. Structural racism saturates the spaces that imprison millions of people churning

through the machinery of mass incarceration (Bailey et al., 2017). Extreme heat is an especially grave threat in Southern states, such as Louisiana, where many prisons sit on landscapes of former plantations that enslaved people pre-Emancipation and later morphed into brutal sites of convict leasing, and continue to disparately exploit the labor of disenfranchised racial minorities through punishment and state-violence (Blackmon, 2009; Loï Wacquant, 2017). Therefore, assessing whether and how heat-related exposures become embodied in inequitable distributions of morbidity and mortality along lines of race and ethnicity is a critical direction of social epidemiologists and environmental scientists.

Additionally, our measurement of heat-index recorded outdoor exposures, and therefore could not account for variations in indoor heat index exposures within and between facilities. However, aside from several cells in a death row unit, and one other tier in one prison, none of the living spaces in the six prisons in this study was air-conditioned(D. Cloud, Jessi LaChance, Lionel Smith, and Lauren Galarza. , 2019). As a result, it is likely that the heat index inside prison cells exceeded the outdoor measure due to the physical infrastructure and lack of tools for heat mitigation, as was documented in the course of recent litigation in Louisiana and other prison systems ("Ball v. LeBlanc," 2018; Holt, 2015). Future studies should attempt to access to indoor heat-index data in correctional systems that have installed instruments for monitoring daily variations in temperature and heat index in specific housing units. Such data would enhance measurement precision and provide environmental scientists with information for developing and testing algorithms for estimating indoor heat exposures when instrumentation does not exist. Lastly, due to the small number prisons in our

sample, it was not possible for use hierarchical modeling techniques, which are better suited for accounting for between and within facility variations in exposures and co-variates influenced the focal relationship. Increasing the number of facilities, enhancing measurement instrumentation, including additional datasets, and expanding the timeframe of the observation period are important goals for subsequent studies on heat and health in carceral settings.

Conclusion.

As the warming of the planet escalates and the U.S. continues to incarcerate more of its population than any sovereignty in modern history, a host of humanitarian and public health emergencies are likely to unfold. This study illuminates one way through which extreme heat can compound the tolls of imprisonment on the mind, body, and spirit of incarcerated people. It offers evidence to enhance the public health rationale for urgent calls for air-conditioning and other heat-mitigation protocols in carceral spaces in the short-term, and underscores the importance of seeking long-term solutions through collective movement building in pursuit of environmental justice, human rights, and the abolition of carceral spaces that produce violence.

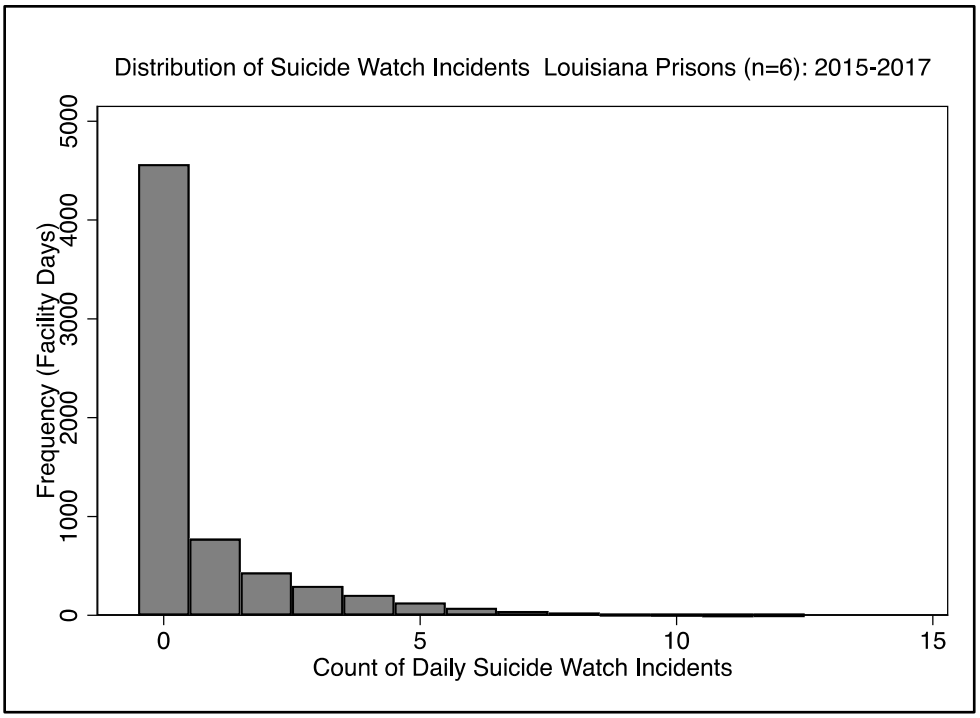

Figure 1 shows the distribution of suicide watch incidents for the six state-operated Louisiana prisons.

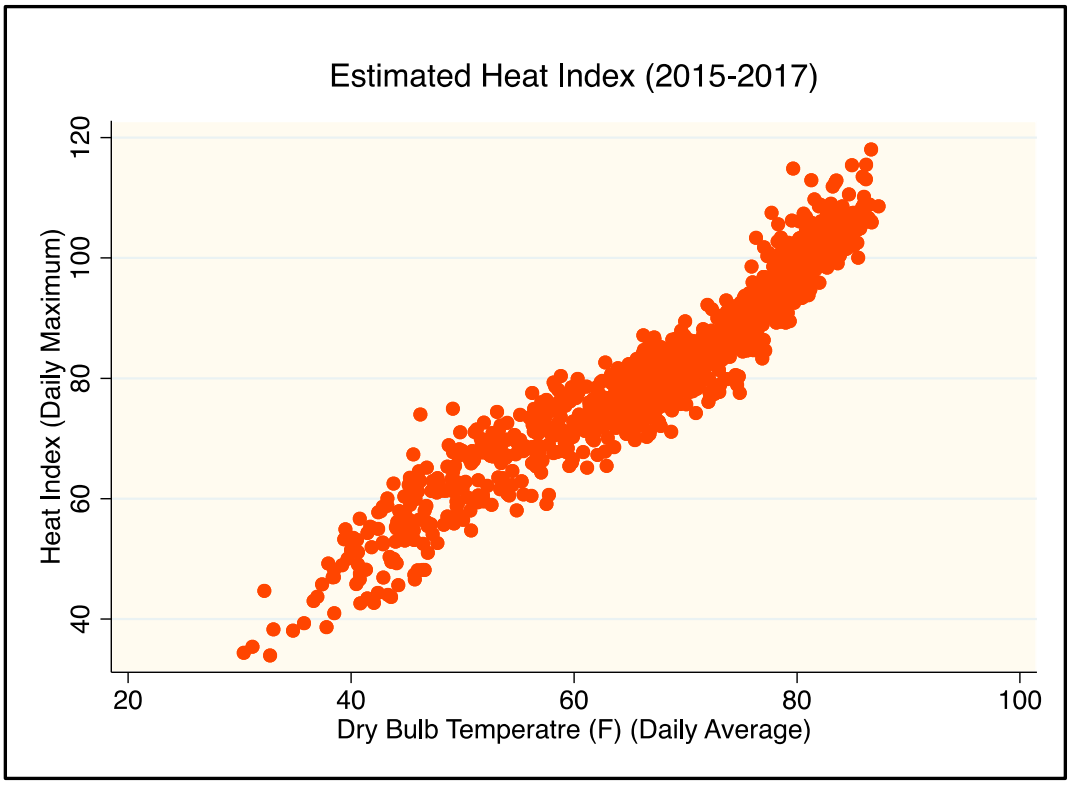

Figure 2 Distribution of estimated heat-index for the six state-operated Louisiana prisons for January 2015 – December 2017.

Table 1. Descriptive Statistics for Focal Variables and Co-Variates						
	Prison Facility					
	LSP	**EHCC**	**DWCC**	**DCC**	**RLCC**	**RCC**
Daily avg. population (SD)	4,200 (117.6)	1,330 (23.0)	854 (14.5)	1,259 (16.2)	1,273 (17.4)	940 (6.7)
Total count of suicide watch incidents	1,561	3,236	109	46	29	195
Daily avg. count of all suicide watch incidents	1.5 (1.7)	3.1 (2.3)	1.0 (0.4)	0.7 (0.3)	0.6 (0.2)	0.2 (0.5)
Percent of facility-days with a suicide watch incident	66.2% days	89.5% days	8.9% days	4.0% days	2.5% days	15.9% days
Daily avg. maximum heat index (degrees Fahrenheit)	84.3F (17.7)	84.8F (16.3)	82.7F (18.3)	84.6F (16.5)	85.7F (17.7)	84.8F (16.3)
Percent of facility-days at extreme heat	9.0%	9.4%	8.3%	8.9%	13.9%	8.9%
Daily avg. % of solitary confinement	25.8% (5.2)	30.2% (6.4)	35.8% (7.0)	7.9% (3.1)	10.0% (4.4)	17.8 (5.3)
Daily avg. % of serious mental illness	10.2% (1.1)	17.4% (1.1)	9.9% (1.0)	5.8% (0.9)	14.5% (1.6)	10.3% (1.1)
Table 1 provides descriptive statistic for key variables for each of the six facilities included in the sample.						

Table 2. Bi-Variate Associations with Suicide Watch Incidents Conditional Negative binomial regression with fixed effects)		
Variable	Incident rate ration (IRR)	95% confidence intervals [CI]
Heat Index Bins (ref. group= 60-69°F)		
(21-29°F)	0.24	(0.112, 0.518)
(30-39°F)	0.83	(0.783, 0.873)
(40-49°F)	0.86	(0.839, 0.887)
(50-59°F)	0.69	(0.661, 0.710)
(70-79°F)	1.07	(1.049, 1.115)
(80-89°F)	1.43	(1.393, 1.458)
(90-103°F)	1.33	(1.264, 1.395)
Extreme Heat Day	1.37	(1.334, 1.397)
Daily % Solitary Confinement	1.01	(1.003, 1.021)
Daily % Serious Mental Impairment	1.04	(1.029, 1.043)
Daily facility total population	0.99	(0.999, .999)
All variables reached statistical significance at $p<0.05$.		

Table 3a. Results of Model 1 for Significant Predictors of Daily Suicide Watch Incidents in Louisiana State Operated Prisons (n=6): 2015-2017			
Variable	**IRR**	**p-value**	**(95% CI)**
Heat Index Bins (reference group 60-69°F)			
(21-29°F)	0.72	0.386	(0.338, 1.522)
(30-39°F)	0.77	0.054	(0.592, 1.00)
(40-49°F)	0.89	0.167	(0.768, 1.047)
(50-59°F)	0.92	0.208	(0.807, 1.048)
(70-79°F)	1.08	0.137	(0.976, 1.193)
(80-89°F)	1.29	<0.001*	(1.173, 1.433)
(90-103°F)	1.36	<0.001*	(1.150, 1.612)
Percent Solitary Confinement	1.01	0.02*	(1.001, 1.019)
Percent Serious Mental Illness	1.06	<0.001*	(1.044, 1.069)
Total daily facility population	1.23	0.825	(0.200 -7.535)
Note. CI=Confidence Intervals; IRR=incidence rate ratio. Final model only included variables whose parameter estimates were significant at the *P*<0.5 level. Model included fixed effects for day and prison facility.			

Table 3b. Results of Model 2 for Significant Predictors of Daily Suicide Watch Incidents in Louisiana State Operated Prisons (n=6): 2015-2017			
Variable	IRR (95% CI)	p-value	**(95% CI)**
Extreme Heat Day	1.30	<0.001*	(1.177, 1.446)
Percent Solitary Confinement	1.01	0.057	(0.921, 1.022)
Percent Serious Mental Illness	1.06	<0.001*	(1.098, 1.803)
Total daily facility population	1.39	0.709	(0.866, 8.115)
Note. CI=Confidence Intervals; IRR=incidence rate ratio. Final model only included variables whose parameter estimates were significant at the *P*<0.5 level. Model included fixed effects for day and prison facility. Extreme heat day refers to any facility-day that exceeded the 90th percentile of the daily Heat Index for the total observation period.			

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Chapter 5.
Summary and Conclusion

Summary of Findings

Since the 1970s, the U.S. prison population has metastasized to such a degree that mass incarceration is recognized as a socio-structural driver of health inequities in public health discourse (D. H. Cloud et al.; D. H. Cloud et al., 2014b; Wildeman & Wang, 2017). Indeed, a growing body of literature links mass incarceration to inequitable distributions of disease, despair and death along lines of race and ethnicity, class, gender, and geography (D. H. Cloud et al., 2020; D. H. Cloud et al., 2014a; Wildeman & Wang, 2017). Though noxious and inhumane conditions of confinement have been thoroughly documented, few scholars have applied theories of social epidemiology to address carceral violence within the walls of jails and prisons; and arguably overlooked the influence of carceral violence in producing trauma and hazardous that precede overdose morbidity and mortality (K. E. McLeod & Martin, 2020).

The studies in this dissertation focused on the influence of two forms of carceral violence, solitary confinement and extreme heat, as potential producers of vulnerabilities to self-injury among people exposed to incarceration in Deep South prison systems. Carceral violence is a term that is primarily operationalized by carceral

geographers and other social scientists who critically contemplate the effects of the criminal legal system through an abolitionist lens (Carlton, Russell, Carlton, & Russell, 2018; Delgado, 2020). Carceral violence is waged upon people suspected, accused, convicted, or sanctioned for individual actions labeled as illegal or set of societal circumstances (e.g. poverty, addiction, houselessness) that are criminalized by the state. From this vantage point, carceral violence can be considered as one form of state-sanctioned violence (SSV), which refers to government entities' infliction of psychological and physical violence to control or punish individuals and communities (Carlton, Russell, Carlton, & Russell, 2018; Delgado, 2020). SSV which is entrenched into many of the social, economic, and political forces that undergird mass incarceration and uphold racial capitalism. The built environments within the walls of carceral institutions are one pathway through which carceral violence can affect the health of directly impacted people and the communities to which they return (D. H. Cloud et al.; Haney, 2012).

Solitary confinement and extreme heat exemplify the dehumanizing, degrading, and dangerous exposures that pervade the built environments of many jails and prisons, but that correctional systems have insufficiently mitigated and that few public health researchers have studied. Solitary confinement--broadly defined as being confined in a cell for about 22 hours per day, with limited access to property, visitation, and programming---(D. H. Cloud et al., 2015; Haney et al., 2020) is consistently linked to clusters of mental, physical, and behavioral harms, many of which are comorbidities among people who overdose, such as depression, anxiety, psychosis, self-injury, and suicide, as summarized elsewhere (Haney et al., 2020; Kaba et al., 2014; P. S. Smith,

2019). An emerging body of research and civil litigation focuses on health-related harms of extreme heat for the millions of incarcerated people, who have disparately higher rates of behavioral health conditions compared to the rest of the U.S. population (Colucci et al., 2021; Motanya & Valera, 2016; Skarha et al., 2022). In many jails and prisons, the spaces where people sleep and work do not have air conditioning, and require incarcerated people to rely on fans, ice, and cold showers to cool down in the summer months(Colucci et al., 2021; Holt, 2015; Skarha et al., 2020). About 95% of households in Southern states have air-conditioning, but most of the region's prisons, aside from those in Arkansas, do not.

Self-harm is widespread in prisons (Lohner & Konrad, 2006; Rodham & Hawton, 2009; Vinokur & Levine, 2019), and suicide and overdose are leading causes of death among currently and formerly incarcerated people in the U.S. and globally (E. A. Carson, 2021; Noonan et al., 2015). Self-harm, suicidality, and overdose are commonly comorbid outcomes that share social, economic, clinical, biological, and behavioral antecedents(Bohnert & Ilgen, 2019; Bohnert, Roeder, & Ilgen, 2010; Oquendo & Volkow, 2018).

This dissertation integrated an interdisciplinary set of ideas, constructs, and principles from ecosocial theory of disease distribution (N Krieger, 2011), carceral geography (Gill, Conlon, Moran, & Burridge, 2018; R. W. Gilmore, 2007; Moran, 2016), and theories of dehumanization (Bandura, 2017; Bustamante et al., 2019; Haslam, 2006) to examine the ways through which two forms of carceral violence, solitary confinement and extreme heat, become embodied to produce vulnerabilities to self-harm, suicidality, and drug-related overdoses, as interpersonal and institutional

manifestations of self-injury. These studies leverage a diverse set of data sources, study designs, and analytic techniques---grounded in an interdisciplinary theoretical framework—to shed light on hidden public health and pressing human rights issues. The knowledge generated from these studies bolsters the body of evidence connecting solitary confinement and extreme heat to psychological harm and self-injurious actions, while drawing attention to distinct public health and human rights issues for future research, arising in the entanglements of mass incarceration, an escalating overdose crisis, and environmental calamities created by climate change.

The first paper, (Chapter 2) bolsters earlier studies showing that solitary confinement increases vulnerability to self-harm (Kaba et al., 2014; E. Lanes, 2009). People who disclosed having a serious mental illness (SMI) were nearly 5 times more likely to engage in self-injury while in solitary confinement than those without SMI, after accounting for relevant confounders. Drawing on the surveys from a sample of adult men in Louisiana prisons, this study brought attention to the cumulative toll of punishments, beyond social isolation, that prison staff inflict upon people in solitary confinement as mediating vulnerabilities to self-injury among people diagnosed with serious mental illnesses. As expected, results also suggest that punitive exertions of power and dehumanization, as permitted by institutional policies and likely shaped by structural forces, may mediate associations between SMI and self-injury. (Liebling, Durie, Stiles, & Tait, 2013; Marzano, Ciclitira, & Adler, 2012). More specifically, each additional type of dehumanization inflicted on incarcerated adult men in Louisiana's solitary confinement units, was associated with nearly a 14% increase in odds of self-injury after controlling for confounders. Looking through an ecosocial lens, this analysis

brings into focus the policies that create carceral power in correctional officers to deprive people of sustenance and inflict physical violence on the bodies, minds, and spirits of incarcerated people, as accountable forces for harm.

The second paper (Chapter 3) examined an issue at the intersection of distinct yet intertwined public health and human rights crises confronting the United States: the escalating scourge of overdose fatalities and the pervasive use of solitary confinement in jails and prisons. Using a constructivist grounded theory approach (Charmaz, 2014), this paper documented the lived-experiences of solitary confinement among a sample of formerly incarcerated people in Georgia who currently or recently used drugs (n=22), and explored the potential mechanisms through which this widely adopted carceral practice of solitary confinement may create and shape post-release drug-related overdose. Participants who had overdosed following their release from prison had endured greater degrees of social isolation, dehumanization, physical violence, and denials of care. Findings suggest that these exposures were embodied through a variety of social and individual pathways, as contributing to overdose vulnerability. Social positionality appeared to shape the frequency and durations of placements in solitary confinement, the degrees of deprivation and isolation people experienced within these settings, and their abilities to mitigate or resist exposures to and harms of deprivation of sustenance, social isolation, and denials of care. This paper called attention to distinct ways through which people who use drugs experience solitary confinement (Bunting et al., 2023; Maradiaga et al., 2016; Wakeman & Rich, 2015). Indeed, participants shared harrowing accounts of being subjected to solitary confinement not only as a punishment for using drugs, but also in situations involving mental health crises fueled by agonizing

experiences of forced withdrawal from heroin, cocaine, and/or methamphetamines, compounded for some by dehumanizing conditions and traumas while on suicide watch.

The third paper (Chapter 4) examined associations between daily exposures to extreme heat and daily incident rate of suicide watch incidents across six prison facilities in Louisiana, through an analysis of a longitudinal dataset that merged daily climatological data with administrative data from the Louisiana Department of Corrections and Rehabilitation. Few previous studies have examined the effects of extreme heat on mortality among correctional populations(Skarha et al., 2022; Skarha et al., 2023). The current study is among the first to link extreme heat and an institutional-level indicator of suicidality among a sample of imprisoned people. Results suggest a dose-responsive association between extreme heat and the daily incident rate of suicide watches across analyses. Compared to days with relatively milder, more comfortable heat indices (i.e. those where the maximum daily heat-index was in the 60-69°F range), the incident rate of suicide watches was 29% greater for days when the maximum heat-index reached 80-89F and 36% greater on days climbing into the 90-103°F range, after controlling for relevant covariates and seasonality effects. Results also found that solitary confinement and the levels of mental health need were significant facility-level predictors of suicide watch incidents. These findings corroborate earlier studies connecting extreme heat to increases in psychiatric morbidity, utilization of clinical services for mental health emergencies, and incidence of suicidality in other settings (Burke et al., 2018; Charlson et al., 2021; Y. Kim et al., 2019; Liu et al., 2021; Nori-Sarma et al., 2022).

Future Research

This dissertation is among the first to investigate associations between solitary confinement, heat, and self-injury among incarcerated people. Several common themes emerged during the course of analysis, which may help inform future research.

First, each study strengthened the expansive literature linking solitary confinement to diminished mental health outcomes and self-injurious behavior. Results underscored interplays between solitary confinement and extreme heat as forms of carceral violence to be addressed through an interdisciplinary praxis for interventions that bring together human rights, environmental justice, and abolitionist creativity as public health imperatives. In qualitative interviews, people who were asked about their exposures to solitary confinement frequently recounted experiencing troubling levels of physical discomfort, exhaustion, and psychological anguish, which they attributed to being unable to escape or mitigate heat and humidity. While this issue has been raised in civil litigation, the hazards of heat-related stress are still only an ancillary topic in the public health literature on solitary confinement. Given the escalating frequencies and severity of heat waves across the country, continuing to investigate the interplays between temperature and solitary confinement is an important area for future research. Other scholars interested in this issue can glean insights from each of the studies in this dissertation. For example, the first study involved a secondary analysis of surveys collected through legal mail, which helped overcome institutional barriers to conducting research in correctional settings. Collaborations between civil litigators and public health researchers to conduct surveys through constitutionally-protected rights to legal mail is one methodological strategy that can give voice to marginalized people in the deepest ends of prison systems, and maximize the potential for producing empirical

findings that are disseminated in ways that may help substantiate litigation, bolster legislative advocacy, and raise public awareness about human rights issues that evade mainstream public health surveillance efforts.

Relatively few studies have examined the effects of solitary confinement among formerly incarcerated people (Hagan et al., 2018), prompting calls for more research on how this practice may worsen morbidity and mortality as people transition out of prison and into communities (Kupers, 2008; Luigi et al., 2020; K. E. McLeod & Martin, 2020). The grounded theory developed in the analysis of Paper 2 (Chapter 3) paves a path for scholars to delve into distinct ways through which exposure to solitary confinement may increase vulnerabilities to riskier drug use, overdose and related harms among people who use drugs. So far, inquiries into how solitary confinement may shape vulnerabilities to overdose (and other drug-related harms) is largely absent in health research and disjointed in discourses of stakeholders seeking to minimize or abolish it and from others pushing for anti-carceral approaches to the overdose crisis. Recognizing how solitary confinement can operate as a producer and accelerant of overdose vulnerability (and other drug related harms) can strengthen alliances among harm reductionists, human rights advocates, and other key stakeholders invested in advancing more humane, evidence-based drug policy platforms. Focusing on how solitary confinement shapes reentry outcomes for people who use drugs may help foster the development of trauma-informed harm reduction services and overdose prevention interventions. Though, such research should also investigate the extent to which correctional policies and practices permit placing people with substance use disorders in solitary confinement as a punishment for using drugs or as part of detoxification and suicide

watch protocols. Empirical documentation of the scope and scale of the experiences described among our sample is needed to hold state actors accountable for correctional practices that deprive people access to treatment while subjecting them to conditions that worsen susceptibilities to heavier, chaotic drug use behaviors that often lead to overdose.

Ecosocial theory of disease distribution is apt for illuminating the pathways through which exposures to incarceration produce health inequities across ecological levels (Bowleg, Maria del Río-González, Mbaba, Boone, & Holt, 2020; Brinkley-Rubinstein & Cloud, 2020; Jahn, Chen, Agénor, & Krieger, 2020). Future studies should build upon the theoretical frameworks in these studies. First, social epidemiologists should explore additional pathways of embodiment (e.g. exposure to hazardous conditions) through which other forms of carceral violence increase odds of self-injury and other health outcomes. Researchers should draw on policy analysis, administrative records, as well as surveys and interviews with incarcerated people to identify the laws and institutional forces undergirding the power of carceral entities to inflict violence on people in their custody. These studies conceptualized solitary confinement as a socially inflicted trauma, though future studies should explore other pathways of embodiment through which carceral policies, practices, and institutions influence health outcomes across social-ecological levels.

Each study in this dissertation further substantiates the stark reality that people with serious mental illness are disparately subjected and especially vulnerable to the harms of solitary confinement, which include increased susceptibility to self-harm, suicidality, and overdose. Integrating theories and methodological approaches within

and across the subfields of carceral geography, dehumanization, and harm reduction may be a fruitful endeavor, not only for measuring the influence of carceral violence on health inequalities, but also for mobilizing multi-level interventions focused on de-constructing power structures that produce harm.

Resilience and resistance emerged in qualitative analysis as essential topics for public health researchers to consider when studying prison conditions and carceral violence. The extent to which people were able to prevent, mitigate, or counteract the negative consequences of carceral violence was shaped by intersectional forces of social positionality. Qualitative methods are essential for studying whether and how incarcerated people enhance resilience and engage in resistance to carceral violence. For example, scholars might consider documenting how incarcerated people organize and resist against punitive practices through internal grievance processes, litigation, and actions of solidarity, such as hunger strikes as mechanisms to drive change. Incorporating resilience and resistance into study questions is important for analysis that leverages ecosocial theory for describing carceral environments and understanding how different people experience and respond to living conditions within these hidden spaces (Drake, Earle, & Sloan, 2015). Moreover, qualitative and ethnographic approaches enable deeper exploration of social contexts, personal narratives and depictions of lived-experience directly from incarcerated people that surveys and administrative data cannot convey, and have the advantage of generating vivid narratives about lived-experiences and giving voice to people in opaque and oppressive carceral settings (Loïc Wacquant, 2002a; L. J. Wacquant, 2009). Qualitative analysis also offers the advantage of generating theoretical insights into the interplay of macro-

level, institutional, and facility level structures that contribute to complex human experiences, and for guiding the development of interventions.

Policy Implications

Together, the findings from these studies may have important policy implications at intersections of environmental justice, drug policy reform, health equity, and human rights. Ending solitary confinement in carceral systems is a critical and complex imperative for public health scholars, practitioners, and activists to pursue. Researchers, practitioners, and activists working in each subdiscipline within the field of public health--epidemiology, behavioral sciences, environmental science, biostatistics—have an important role to play in mobilizing a movement to end mass incarceration in the United States. Between 2018 and 2020, twenty-five states introduced legislation to limit exposures to solitary confinement. Citing the extant literature, a primary provision of such legislation prioritizes limiting or prohibiting exposures to solitary confinement for groups especially vulnerable to its harms due to an underlying health status, including pregnancy, serious mental illness, intellectual disabilities, among others (Dillon, 2018; Paltrowitz, 2023; Shalev, 2022). Public health researchers and practitioners should conduct quasi-experimental studies to assess the impacts of statutory reforms, and develop health-driven implementation strategies to achieve legislative intent. The roles for public health actors go beyond research. Ending the use of solitary confinement will require creating clinically-oriented interventions tailored to the tasks of progressing people harmed by long-term solitary confinement into supportive environments, establishing proactive and trauma-informed approaches to responding to mental health crises, and developing alternative ways to hold people accountable who commit acts of

violence against their peers and staff without isolation and violent force (D. H. Cloud et al., 2021a).

The effects of heat on the health and human rights of incarcerated people is an active area of civil rights litigation, especially in the Deep South ("Ball v. LeBlanc," 2018; Holt, 2015). Providing evidence of the relationship between of extreme heat, suicidality, and other health outcomes can advance advocacy to install air-conditioning and other heat mitigation approaches as urgent necessities. Environmental scientists, carceral geographers, and social epidemiologists have important opportunities for continuing to forecast the impacts of extreme heat, natural disasters, and other climatological scenarios for the health and safety of people who live and work in prisons. Such research can help advance disaster response planning, emergency response preparedness, while also strengthening the humanitarian case for reform, decarceration and abolition on environmental health grounds.

The grounded theory developed in paper 2 may provide guidance to drug policy researchers and harm reductionist in scrutinizing the influence of correctional practices on overdose vulnerabilities. Chapter 3 underscores the importance of bringing attention to the distinct harms of solitary confinement among people who use drugs, and continuing to strengthen harm reduction interventions for people who are transitioning from incarceration to the community. Contamination of the drug-supply with fentanyl and other synthetic adulterants has increased susceptibilities to overdose not only in communities, but also in jails and prisons (Kaplowitz et al., 2021). The predictors of overdose behind bars are poorly studied, though one report found that 80 percent of non-fatal overdoses occurring in North Carolina prisons occurred in solitary

confinement units (J. B. Williams et al., 2022). Gaining access to data from correctional agencies is an important research strategy that can provide vital information for tracking the incidence of violence in carceral settings and contextualizing the lived-experiences of incarcerated people. Future studies should continue integrating correctional data sources to better understand how built-environments of prisons may engender and intensify health inequalities. There is a need for more research into the risk environments within the walls of carceral institutions in shaping overdose among currently and formerly incarcerated people. Future studies should also continue linking correctional and community health datasets to better understand how carceral conditions shape vulnerabilities to overdose, self-injury, and other drug-related harms at a population level.

However, there are deeper problems to address at the intersection of the climate crisis, the overdose epidemic, and mass incarceration that demand structural solutions. Contemplating the policy implications, through an ecosocial lens, must involve contextualizing the findings in historical context, which requires contemplative reckoning with the ways through which this form of carceral violence is interwoven into structural racism that produce "social death" (Guenther, 2013), and bounded into lineages of enslavement, anti-Blackness, and systemic oppression of and "colonial violence" against marginalized people (Chavez, 2021). This dissertation sought to situate the lived-experiences of incarcerated people within the system-level contexts of mass incarceration and its socio-structural and historical ties the legacies of the plantation economy in Louisiana and institutionalized forms of state-sanctioned and racialized violence in the Deep South (C. A. Woods, 1998). The 13th Amendment of the U.S.

Constitution was ratified in 1865 after the Civil War and abolished “slavery nor involuntary servitude…except as a punishment for crime”(Armstrong, 2011). This clause provided a constitutional premise for the rise of convict leasing and other brutal practices where sheriffs and courts subjected newly emancipated people to strenuous labor, often on the same plantation where they were enslaved, because they were unable to pay fines levied by courts for crimes such as vagrancy, loitering, or other ordinances known as Black Codes (Armstrong, 2011; K. Gilmore, 2000). In Louisiana and other Southern States, maximum security prisons were built on the same landscapes that used to be slave plantations owned by wealthy capitalists. Even today, lines of incarcerated people, the vast majority black descendants of enslaved people, are escorted by an armed correctional officer on horseback and required to hand pick crops from a field for an hourly wage counted in pennies (Adamson, 1983; Allen-Bell, 2011; Armstrong, 2011) Historians, legal scholars, and carceral geographers have drawn linkages between the corporeal embodiment of oppression among black men during slavery, convict leasing, and into the persistence of brutal prison conditions in the mass incarceration era (Allen-Bell, 2011; Armstrong, 2011; CARDON, 2017; Gillespie, 2018; Kennedy, 2013). These historical trajectories should be acknowledged in public health scholarship focused on carceral violence and population health.

Additionally, historical failures and ongoing shortcomings of the U.S. community mental health and social welfare systems share the blame with correctional systems for the systemic caging and warehousing of human beings with mental health and substance use needs in jails and prisons. Perhaps there are lessons to draw on from the deinstitutionalization movement, which in part entailed exposing the abhorrent

conditions within these settings while pointing to the futility of incremental reforms that fail to address the structural foundations of mass incarceration. Re-examining the forces that facilitated closures of asylums and reinvigorating calls for federal interventions focused on siphoning resources from the carceral state to create and expand community-level capacities for housing, economic support, behavioral health services, and harm reduction is an example of a longer-term strategy for solitary confinement abolition.

The emergence of anti-carceral ethos and prison abolition in mainstream public health discourse sets the stage for more comprehensive theoretical frameworks to drive research and activism. As McLeod (2018) states, "To realize justice in abolitionist terms thus entails a holistic engagement with the structural conditions that give rise to suffering, as well as the interpersonal dynamics involved in violence"(A. M. McLeod, 2018). What this research has taught me is that imagining a world without prisons and pushing for change at a structural level requires reflecting upon just how our society got to a place where we put tens of thousands of people in cages within cages who often have overlapping lived-experiences before their imprisonment. It is often easiest and appropriate to focus on jails and prisons, and the actors within them, as the source of the profound harms that pervade the carceral enterprise. Yet, issues like solitary confinement require a more critical lens that ask bigger questions about who and what are collectively responsible and accountable? Decarceration, harm reduction interventions, and air-conditioning are examples of bare minimum actions needed in response to the humanitarian and public health emergencies that loom on the horizon. Amplifying calls for abolition as a priority in public health discourse is likely where

solutions to these issues will arise (Prins & Story, 2020; Purdum et al., 2021; Ranganathan & Bratman, 2021)

Conclusion

Public health scholars are increasingly bringing attention to the various ways through which the nation's expansive carceral enterprise produces and exacerbates health inequities. Decarceration and prison abolition are public health objectives among a growing group of scholars, activists, and practitioners. Social epidemiologists, behavioral scientists, health educators, and environmental health experts have important roles to play to advance these goals. Interdisciplinary research can help make a public health case for closing carceral institutions or preventing their construction, remedying urgent human rights abuses behind bars, and creating community-driven capacities to reduce harm, achieve accountability, and negate society's reliance on cops, courts, and corrections for interpersonal problems rooted in macro-level inequities.

For more than a decade, policymakers across political divides have called for reforms to reduce societal levels of incarceration. Indeed, some states and localities have made progress by changing sentencing laws, expanding opportunities for release, creating programs to divert people from incarceration, and closing down institutions. Similarly, state legislatures and courts have enacted restrictions on use of solitary confinement, and in the course of an unrelenting overdose crisis, policymakers are slowly embracing approaches to drug policy rooted in harm reduction and evidence-based medicine. Yet, the progress made so far in these areas is fragile, especially as the same racialized 'tough-on-crime" narratives that produced mass incarceration are once again finding traction in electoral politics.

However, there are deeper problems to address at the intersection of the climate crisis, the war on drugs, and mass incarceration that demand structural solutions. Decarceration, solitary confinement eradication, and air-conditioning are the bare minimum for curtailing the humanitarian and public health emergencies looming on the horizon. Fully addressing the issues raised in these studies will need to go beyond incrementalistic reforms and strive for actions on an abolitionist praxis, that is those committed to principles of justice that "involve[s] at once exposing the violence, hypocrisy, and dissembling entrenched in existing legal practices, while attempting to achieve peace, make amends, and distribute resources more equitably"… "an integrated endeavor to prevent harm, intervene in harm, obtain reparations, and transform the conditions in which we live" (A. M. McLeod, 2018).

Mobilizing calls for abolition of carceral structures and the creation of equitable systems that prioritize health, justice, and safety in their place, as a priority in public health discourse will be paramount to meaningful progress (Prins & Story, 2020; Purdum et al., 2021; Ranganathan & Bratman, 2021). Jails and prisons are not siloed institutions. Elevating abolitionist ethics into public health discourse, will require infusing calls to abolish solitary confinement, end the drug war, and other anti-carceral movements into broader social movements seeking to dismantle intersecting forms of structural racism, militarization, oppression, and economic inequity. Public health institutions have an obligation to help untangle the web of extra-judicial barriers and social stigmas that people involved in the criminal legal system frequently encounter in the arenas of healthcare access, education, housing, voting, and social benefits. Health departments, schools of public health, community organizations, and other entities

should implement strategies that provide employment opportunities, economic support, and tailored social services whose success is measured by their capacity to promote racial equity and break intergenerational cycles of policing and incarceration while creating structures for mutual aid to thrive over state-intervention.

Efforts to end solitary confinement and remedy strains of extreme heat present a paradox for public health scholars aligned with abolitionist values. Angela Davis and Dylan Rodriguez (2000) underscore the importance of striking a balance between the pursuit of immediate reforms that are critical for protecting the lives of incarcerated people now (e.g. solitary confinement and extreme heat), and those visionary tactics that advance the longer-term goal of prison abolition. Fading the footprints and healing the intergenerational wounds of forty years of mass incarceration in marginalized communities will likely require revolutionary actions to dismantle the socio-structural foundations of the U.S. criminal legal system and disarm its power to punish through state-sanctioned deprivation, dehumanization, and violence. Now is the time for public health scholars, activists, and practitioners to play our roles in imagining and creating a future world without carceral systems of violence, and in the same motion, relentlessly fighting for the health and humanity of those presently burdened by its abuses. Giving voice to survivors of solitary confinement and people directly harmed by mass incarceration is essential. The solutions we propose must look beyond the walls of jails and prisons and outside the halls of academia—to the social, political and economic relations that reproduce it—in order to remedy the violence these institutions produce.

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