

*Annual Review of Criminology***COVID-19 in Carceral
Systems: A Review**

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Keywords

COVID-19, prison, jail, incidence, mitigation, vaccination

Abstract

As with past pandemics of influenza, COVID-19 tore through US prisons and jails; however, the COVID-19 pandemic, uniquely, has led to more health research on carceral systems than has been seen to date. Herein, we review the data on its impact on incarcerated people, correctional officers, health systems, and surrounding communities. We searched medical, sociological, and criminology databases from March 2020 through February 2022 for studies examining the intersection of COVID-19, prisons and jails, and health outcomes, including COVID-19 incidence, prevalence, hospitalizations, and vaccination. Our scoping review identified 77 studies—the bulk of which focus on disease epidemiology in carceral systems, with a small minority that focuses on the efficacy or effectiveness of prevention and mitigation efforts, including testing, vaccination, and efforts to depopulate correctional facilities. We highlight areas for future research, including the experiences of incarcerated people and correctional staff, unanticipated health effects of prolonged quarantine, excess deaths due to delays in healthcare, and experimental studies on vaccine uptake and testing in correctional staff. These studies will enable a fuller understanding of COVID-19 and help stem future pandemics.

INTRODUCTION

Life and work in carceral facilities in the United States have been profoundly impacted by COVID-19 during every stage of the pandemic. As was anticipated and has been the case with every modern respiratory pandemic, prisons and jails were early hot spots of infection. Carceral facilities were a source of cluster outbreaks (Terebuh et al. 2021) and accounted for 90 of the 100 largest cluster outbreaks in the country by August 2020.

Carceral facilities are amplifiers of infectious diseases for several structural reasons: (a) dormitory-style living and overcrowded conditions make physical distancing nearly impossible; (b) security is prioritized over health; and (c) healthcare systems are under-resourced and often disconnected from local public health agencies (Wang et al. 2020). Furthermore, incarcerated people and correctional officers have higher rates of chronic health conditions, putting them at increased risk of COVID-19 infection and morbidity.

Early on, the National Academies of Science, Engineering, and Medicine and the Council of Criminal Justice each convened committees to examine the intersection of COVID-19 and the criminal legal system. Both concluded that given structural vulnerabilities, carceral facilities must be the focus of urgent research and intervention, especially understanding how COVID-19 spreads in jails and prisons and identifying durable long-term strategies to reduce transmission, including testing, vaccines, and decarceration, a term used to refer to policies and procedures enacted to decrease the number of people who are incarcerated (Engel et al. 2020, Wang et al. 2020). Both forewarned that the management of COVID-19 in jails and prisons had the potential to exacerbate or mitigate COVID-19-associated racial disparities in the community at large, given the disproportionate incarceration of minoritized populations in the United States, especially Black men and women.

But carceral settings were not and have not been fully integrated into public health responses to the pandemic despite their national importance for COVID-19 prevention and mitigation. Few local governments have meaningfully incorporated prisons and jails into their strategies for COVID-19 response and preparedness. In recent policy reviews of public health guidance, most correctional systems have not aligned their policies with Centers for Disease Control and Prevention (CDC) recommendations for testing, quarantine, or provision of personal protective equipment (Klein et al. 2022, Maner et al. 2021).

Furthermore, the implementation of targeted prevention and mitigation efforts in correctional systems has not been successfully sustained to minimize the harms of the ongoing COVID-19 pandemic. For instance, early in the pandemic, there were some unprecedented efforts to decarcerate, including closing courts, minimizing arrests for parole and probation violations, eliminating cash bail, and, to a lesser extent, facilitating early releases (Heiss et al. 2020). But the incarcerated population has again rebounded to pre-pandemic levels in most jurisdictions.

Testing and vaccination efforts were also implemented with some success in prisons and less so in jails, and yet two years into the pandemic, the rates of COVID-19 are still disproportionately high in carceral systems and deaths skyrocketed during the omicron wave. As of March 25, 2022, the COVID Prison Project notes that approximately 582,601 people incarcerated in prisons and 197,588 staff have been diagnosed with SARS-CoV-2 infection, and approximately 3,143 total have died from infection. On average, the COVID-19 case rates and mortality rates in state and federal prisons are higher as compared with the general population (Saloner et al. 2020), and communities that have carceral facilities have higher rates of COVID-19 infection (Sims et al. 2021).

Literature on respiratory pandemics and preparedness in carceral facilities was scant prior to COVID-19, leaving healthcare practitioners, correctional system leaders, and public health officials with minimal guidance about how to respond efficiently and ethically in the face of a novel

pandemic. Beaudry et al. (2020) conducted a systematic review to synthesize prior evidence on infectious disease outbreaks in prison published between 2000 and 2020 and found only 28 relevant studies documenting outbreaks of tuberculosis, influenza (types A and B), varicella, measles, mumps, adenovirus, and COVID-19 that provide general guidance on the role of interagency collaboration, health communication, isolation and quarantine, and vaccination programs. But during the past two years, there has been an intense uptick in publications focused on carceral facilities and COVID-19.

This review systematically synthesizes what is known about the impact of COVID-19 on the health of incarcerated people, correctional officers and medical staff, and communities that are impacted by mass incarceration and what works to mitigate or prevent infection within carceral facilities. We use this review to explore remaining gaps in knowledge about COVID-19 in carceral systems and outline a research and public health agenda for this and future pandemics.

METHODS

We conducted a scoping review to map the existing literature on the health impacts of COVID-19 in carceral systems in the United States. A scoping review is a systematic process that identifies and summarizes the available evidence to assess the breadth and depth of a research topic and identify knowledge gaps. It is often used in the health services research literature as a preamble to a systematic review, which enables asking a single and precise question about feasibility, appropriateness, or effectiveness of a certain treatment or practice.

We chose the scoping review methodology given the complex and heterogeneous nature of studies on COVID-19 in carceral systems and, especially, to examine the extent, range, and nature of research activity and identify research gaps in the existing literature (Arksey & O'Malley 2005, Levac et al. 2010). We developed a protocol using the PRISMA Extension for Scoping Reviews and Levac et al.'s (2010) recommendations for scoping review methodology (Tricco et al. 2018).

Eligibility Criteria

Our review is guided by a socioecological model of health outcomes in prisons and jails, which recognizes the unique ecosystem of prisons and jails and also their spillover effects on surrounding communities. We included studies that provided original data on (a) the epidemiology of COVID-19 in jails and prisons (inclusive of health impacts of COVID-19 on incarcerated people, staff, and the surrounding communities), (b) care delivery for incarcerated people, and (c) COVID-19 mitigation and prevention strategies in carceral systems. Given the significant number of modeling studies conducted, we only included studies that described mathematical models that used primary data obtained in partnerships with the state correctional systems or local jails. We excluded modeling studies that used synthetic data sets.

We included peer-reviewed manuscripts published between March 2020 and February 2022. For studies that were initially identified as a preprint submission, we sought to confirm eventual peer-reviewed publication. If no peer-reviewed publication could be identified after an Internet search, we excluded the article. This search strategy did include some top working paper series, such as NBER, but these papers met inclusion criteria only if they were eventually published after peer review.

Studies were excluded if they were not written in English or if the study population was incarcerated outside of the United States. Published commentaries, perspective pieces, and position statements were excluded. We also excluded studies that focused exclusively on people detained in immigration detention centers, given differences in jurisdictional control, governance, and operations.

Information Sources

The search strategies were developed in partnership with a clinical librarian and were peer-reviewed (McGowan et al. 2016). The search included a mixture of keywords and controlled vocabulary about justice-involved persons and COVID-19. We defined incarceration as confinement to jail or prison for any reason. We defined health as any reported health information such as self-reported or administrative data on SARS-CoV-2 testing results, COVID-19-related health outcomes, physical health, mental health, substance use, healthcare utilization, and healthcare quality. The following databases were searched to identify potentially relevant studies: Criminal Justice Abstracts, Google Scholar, JSTOR, National Criminal Justice Reference Service, Ovid Embase, Ovid Medline, Ovid PsychInfo, PAIS Index, PubMed, Scopus, Sociological Abstracts, and Web of Science Core Collection. The final search was performed on February 10, 2022.

Selection of Sources of Evidence

We performed all study screening using Covidence, an online software designed for systematic reviews, in a two-staged process using a team of three reviewers. During the first stage, two independent reviewers read study titles and abstracts to assess them according to the inclusion and exclusion criteria, and any discrepancies were resolved by a third reviewer. The three reviewers met before screening was initiated to develop a standardized study inclusion form and met periodically during the screening process to resolve discrepancies. The form was iteratively updated throughout the first stage of the screening process to refine the inclusion criteria based on abstracts that presented uncertainty. During the second phase of screening, one independent reviewer reviewed the full text of all studies that were included from the first phase, and any discrepancies were resolved by discussion with another reviewer.

Data Items

After the list of studies that met inclusion criteria was finalized, relevant data were extracted from full text articles using a Microsoft Excel spreadsheet. The data that we extracted included general study characteristics and methodology, study participant characteristics (sample size, demographics, incarceration history), and any health information collected. We also captured qualitative findings in brief summaries.

RESULTS

Of the 2,226 studies identified during the initial search, 19 duplicates were removed and 2,073 studies were found to be not relevant to the research question. One hundred and thirty-four full text studies were assessed for eligibility, 57 were excluded largely because of the study design outcomes or population studied, and 77 were included in the final analysis.

Of the included studies, 38 studies focused on incarcerated people as the primary study population, 4 focused on correctional staff, 16 focused on incarcerated people and correctional staff, 7 focused on people recently released or living in the community with prior criminal legal system involvement, 6 focused on impacts in communities, and 6 focused on other primary populations, such as correctional health workers and prison addiction treatment programs (**Table 1**). Additionally, 68 were epidemiological studies, one was an experimental or pseudoexperimental study testing the effectiveness of an intervention, four were modeling studies based on data obtained from a correctional facility, and four focused on qualitative data or mixed methods. There were 19 studies that were national in scope, and other studies that focused on local data from 21 states, Washington, DC, and Puerto Rico (12 studies from the Northeast, 12 from the South, 11 from the Midwest, and 15 from the West, and 2 that did not state the region).

Table 1 Characteristics of studies included in the review

Domain	N (77)	References
Primary study population		
Incarcerated people	38	Abdalbary et al. 2022; Altibi et al. 2021; Belcher et al. 2021; Brinkley-Rubinstein et al. 2021a; Chan et al. 2021; Chin et al. 2021a,b,c, 2022; Davlantes et al. 2020; DePalma et al. 2022; Duncan et al. 2021; Dunne et al. 2021; Epting et al. 2021; Hagan et al. 2020, 2021b; Jimenez et al. 2020; Kennedy et al. 2020; Leibowitz et al. 2021; Lemasters et al. 2020; Lewis et al. 2021; Liu et al. 2022; Marquez et al. 2021, 2022; Marusinec et al. 2022; Montgomery et al. 2022; Njuguna et al. 2020; Nowotny et al. 2021a; Parsons & Worden 2021; Pettus-Davis et al. 2021; Pyrooz et al. 2020; Ryckman et al. 2021; Saloner et al. 2020; Stern et al. 2021; Toblin & Hagan 2021; Vest et al. 2021; Wadhwa et al. 2021; Wallace et al. 2021b
Correctional staff	4	Nowotny et al. 2021b, Sami et al. 2021, Toblin et al. 2021, Ward et al. 2021
Incarcerated people and correctional staff	16	Berk et al. 2021; Brinkley-Rubinstein et al. 2021b; Chidavaenzi et al. 2022; Gibson 2020; Hagan et al. 2021a; Hershow et al. 2021; Khorasani et al. 2021; Kirbiyik et al. 2020; Lehnertz et al. 2021; Malloy et al. 2021; Pringle et al. 2020; Puglisi et al. 2021; Tompkins et al. 2021; Wallace et al. 2021a,b; Zawitz et al. 2021
Recently released/criminal legal system involvement	7	Barrenger & Bond 2021, Cheng et al. 2022, Geana et al. 2021, Gutierrez & Patterson 2021, Lorvick et al. 2020, Quan et al. 2021, Schneider et al. 2021
Community	6	Pocock et al. 2020; Reinhart & Chen 2020, 2021a,b; Sims et al. 2021; Tan et al. 2022
Other	6	Bandara et al. 2020, Cavanagh et al. 2021, Dadiomov et al. 2022, Grubestic et al. 2021, Hartmann et al. 2021, Wallace et al. 2021a
Study region		
Northeast	12	NA
South	12	NA
Midwest	11	NA
West	15	NA
Puerto Rico	1	NA
Multisite	5	NA
National	19	NA
Unstated	2	NA
Study design		
Observational	68	NA
Qualitative or mixed methods	4	NA
Modeling	4	NA
Experimental or quasi-experimental	1	NA
Writing group		
Centers for Disease Control and Prevention	20	NA
Covid Prison Project	5	NA
UCLA Law COVID Behind Bars	4	NA
Stanford	6	NA
Reinhart & Chen	3	NA

Abbreviation: NA, not applicable.

Epidemiology: Infectious Potential

Carceral facilities experienced COVID-19 cases very early in the pandemic. The first report of confirmed cases in carceral facilities was published by the CDC in May 2020 and showed, even at that time, that among a total of 420 correctional and detention facilities in 37 states and territorial jurisdictions, 86% reported at least one laboratory-confirmed case (Wallace et al. 2020). Even a single person infected with SARS-CoV-2 entering a correctional setting has been shown to be able to lead to an outbreak, as supported by whole-genome sequencing of positive specimens collected during outbreaks in March and June 2020 in two detention centers in Minnesota (Lehnertz et al. 2021). This study demonstrated genetic relatedness in 110 specimens to a single genetic sequence unique to each facility. This level of infectivity is supported by another study, which found that the basic reproduction ratio (i.e., the number of people infected by one person with active infection) of SARS-CoV-2 in a large urban jail was estimated at 8.44 early in the pandemic, meaning that for every single person infected, the infection spread to an additional 8 cases in staff or incarcerated people (Puglisi et al. 2021). This was noted to be much larger than the basic reproduction ratio in other high-risk settings at the time, such as cruise ships. An outlier study from Puerto Rico showed a very low rate of transmission in a correctional facility when two individuals who tested positive did not end up spreading the infection to anyone else (Davlanes et al. 2020). Although it is not certain why, the authors note broad mitigation efforts in Puerto Rico, which included widespread testing regardless of symptoms and cohorting of those quarantining on admission to the facility in groups no larger than twenty.

COVID-19 Transmission Between Correctional Staff, Incarcerated People, and Their Family Members

Two studies suggest that correctional officer infections sparked outbreaks in the workplace (Hagan et al. 2020, Marusinec et al. 2022). For instance, an analysis of the relationship between infections in correctional staff and incarcerated people in the Federal Bureau of Prisons found that upticks in the staff incidence rate preceded upticks in the rate for incarcerated persons, particularly during the first and third waves of COVID-19 infections (Hagan et al. 2021b). These data are especially important when considering mechanisms for preventing outbreaks. In a modeling study using data from the California state prison system from January 2020 to May 2021, there was a substantial increase in potential infections and hospitalizations when the likelihood of bringing infection from the community into the prison system was high, highlighting the important role that limiting staff infections may have on preventing prison outbreaks (Ryckman et al. 2021). Furthermore, evidence from the only network analysis of an outbreak from the Cook County Jail found fewer transmitted infections between detained persons with COVID-19 than expected, suggesting that infections were not being spread between incarcerated people. This study, however, did not look at connections between staff and incarcerated people and is unable to inform how interactions between staff and incarcerated people may contribute to viral transmission (Kirbiyik et al. 2020). In smaller and rural communities, there has been some evidence of incarcerated people being released and infecting household contacts (Pocock et al. 2020), although there has not been evidence of this in urban communities.

COVID-19 Incidence and Prevalence in Correctional Facilities

The bulk of published studies described the incidence or prevalence of COVID-19 in correctional facilities. Three studies found that COVID-19 incidence was higher in incarcerated people than in surrounding counties and communities, nationally and as specifically measured in Massachusetts, ranging from 3 to 15 times higher (Jimenez et al. 2020, Leibowitz et al. 2021, Marquez et al. 2021).

In national studies, the case rate for incarcerated people in state and federal prisons was found to be 5.5 times that of the US population in both 2020 and 2021 (Marquez et al. 2021, Saloner et al. 2020). A year into the pandemic, comparing incarcerated populations in state and federal prisons, the cumulative incidence rate per 100,000 persons was 30,780 cases for the prison population and 9,350 cases for the US population, with a prison-to-US cumulative incidence ratio of 3.3 (95% CI, 3.3–3.3) (Marquez et al. 2021). Although these studies have contributed to our understanding of the scope of the pandemic in correctional sites across the country, a serious limitation continues to be the reliance on data voluntarily reported by state correctional systems, as there is no mandate or public oversight relevant to data reporting, quality, or accountability.

Similarly limited were robust studies of facility prevalence. A systematic study of SARS-CoV-2 prevalence among persons admitted to Puerto Rican correctional facilities from March to July 2020 showed 0.1% positivity via polymerase chain reaction (PCR) testing and no spread among cohorts who were quarantined together (Davlandes et al. 2020). And in the same system, in a one-time serological evaluation of prevalence, 0.3% of the 8,619 incarcerated persons tested had IgG antibodies. This study, however, failed to note community-level positivity in Puerto Rico at the time of the evaluation (Davlandes et al. 2020). In contrast, early in the pandemic, when multiple correctional facilities conducted mass testing, there were studies showing that point prevalence was as high as 90% during an outbreak (see section titled Mass Testing below). Here again, studies on COVID-19 prevalence varied by measurement modality (PCR, antibodies, self-report), population sampling, community-level positivity rates, and whether or not the study was conducted amid a known outbreak in the facility.

Racial and Ethnic Disparities in COVID-19 Prevalence in Correctional Facilities

Despite the disproportionate incarceration of people of racialized minority groups and the high rates of COVID-19 in these populations, research on racial disparities in COVID-19 incidence, prevalence, and severity among incarcerated people was essentially nonexistent in the studies identified by this review. Only a few studies reported race or ethnicity of participants with COVID-19, and only one survey explicitly examined racial disparities in COVID-19 prevalence. In fact, only four public-facing departments of corrections COVID-19 dashboards (Massachusetts, Vermont, Tennessee, and Washington) reported any COVID-19 data disaggregated by race. Much of the state data provided were difficult to interpret because of missing data, but in Vermont, the cumulative prevalence for Black people who are incarcerated was more than double the risk compared to their White counterparts (Nowotny et al. 2021a). Based on data from the National Commission on Correctional Health Care's weekly survey distributed to 514 correctional facilities across the country (70% jails, 20% prisons, 5% juvenile facilities, and 5% other facilities), there was a 3.5 times higher disease prevalence among Black incarcerated people when compared to White incarcerated people, and a 5.9 times higher prevalence in Hispanic versus non-Hispanic individuals (Gibson 2020). However, it is important to note that a limitation of this study was that it did not report on the level of heterogeneity in how facilities were testing for infection that early in the pandemic (i.e., what tests were they using) and did not present data on how facilities collect race or ethnicity data, especially whether it is self-reported or interviewer-assigned data.

COVID-19 Morbidity and Mortality in Correctional Facilities

Incarcerated people, despite on average being younger than the general population, have had far higher rates of dying from COVID-19. The reported standardized COVID-19 mortality rate for the prison population has been shown to be about 2.5–4.5 times greater than the US population in four studies (Marquez et al. 2021, 2022; Saloner et al. 2020; Toblin & Hagan 2021). For example,

in Florida, the standardized mortality rate was 4.45 times that of the state's population (IRR = 4.45, 95% CI = 3.85, 5.15, $p < 0.001$) (Marquez et al. 2022). Likewise, among incarcerated people in state and federal prisons, a year into the pandemic, the standardized mortality rate per 100,000 persons was 199.6 deaths for the prison population and 80.9 deaths for the US population. This is equivalent to a cumulative mortality rate ratio of 2.5 times higher among incarcerated people compared to the nonincarcerated US population (95% CI, 2.3–2.7) (Marquez et al. 2021). And the case fatality rate among staff and incarcerated people during a large jail outbreak was found to be 1.1% for both (Zawitz et al. 2021).

Conversely, studies that looked at hospitalization rates based on observational data, even early in the pandemic, found relatively low rates of hospitalizations in community-based hospital systems. For example, in a large New York City jail, close to 1,000 people tested positive for SARS-CoV-2 in the first month of the pandemic; 8% were hospitalized and 0.5% died (Chan et al. 2021). Older age (aged ≥ 55 versus 18–34) [adjusted hazard ratio (aHR) = 13.41; 95% CI, 3.80–47.33] and diabetes mellitus (aHR = 1.99; 95% CI, 1.00–3.95) were associated with higher levels of hospitalizations. Because there are too few studies, we cannot draw conclusions on the connection between COVID-19 incidence in correctional facilities and hospitalizations.

However, preliminary evidence does suggest that when incarcerated people were hospitalized their outcomes were worse. A study that used a national database of hospital system records from a broad sample of 892 hospitals found that incarcerated people hospitalized for COVID-19 had longer lengths of stay and were more likely than the general population to require intubation with mechanical ventilation [410 (18.9%) versus 88,897 (14.2%); adjusted risk ratio (aRR), 1.16; 95% CI, 1.04–1.30] and experience in-hospital mortality [308 (14.2%) versus 84,725 (13.6%); aRR, 1.28; 95% CI, 1.11–1.47], even after adjusting for age and other covariates (Montgomery et al. 2022). Readmission to the hospital for COVID-19 within 30 days of discharge from hospitalization was also more common in the group experiencing incarceration. Similarly, an analysis of more than 500 consecutive hospital admissions to a Michigan hospital system, where 15% of admissions were from those who were incarcerated, found that incarcerated people were more commonly admitted to the intensive care unit (ICU) (26.9% versus 18.7%) and had higher rates of requiring vasopressors (24.1% versus 9.9%) and intubation with mechanical ventilation (25.0% versus 15.2%) (Altibi et al. 2021). They had higher unadjusted inpatient mortality (29.6% versus 20.1%) and 30-day mortality (34.3% versus 24.6%). In the adjusted models, incarceration status was associated with higher in-hospital death (odds ratio, 2.32; 95% CI, 1.33 to 4.05) and 30-day mortality (hazard ratio, 2.00; 95% CI, 1.33 to 3.00). One possible explanation for these findings is that incarcerated people present to the hospital sicker, suggesting delays in care prior to admission.

Only one study examined how self-reported health and chronic health condition management changed during the COVID-19 pandemic for incarcerated people. In a study from a statewide prison system, older incarcerated persons ($N = 157$) experienced worsening mental health, which was associated with worsening self-rated health (DePalma et al. 2022). Anxiety symptom scores (6.4 ± 5.7 to 7.8 ± 6.6 ; $p < 0.001$), depressive symptom scores (5.5 ± 6.0 to 8.1 ± 6.5 ; $p < 0.001$) and self-reported health scores (3.0 ± 0.2 to 2.6 ± 0.2 ; $p < 0.001$) all worsened. Worsening depressive symptoms mediated the relationship between anxiety and self-rated health.

Factors Placing People at Increased Risk for COVID-19 and Related Morbidity and Mortality in Correctional Facilities

Although many studies examined the increased morbidity and mortality for incarcerated people with COVID-19, fewer addressed the underlying factors that placed people at increased risk

for these poor outcomes. Those that did focused primarily on the impact of congregate living environments and crowding and predisposed underlying medical conditions and hospitalization outcomes. No studies addressed facility-level medical protocols and other policies that may have impacted the cascade of care prior to hospitalization.

Medical comorbidities. Several studies have noted risk factors for worse COVID-19 disease outcomes in incarcerated people, including older age, obesity, diabetes, and hypertension (Chan et al. 2021, Zawitz et al. 2021). Among incarcerated people at a federal medical center admitted to a Kentucky hospital system for COVID-19, a greater percentage had chronic health conditions at the time of admission, but they also had a higher risk for developing kidney injury when compared to hospitalized patients admitted from the community (68% versus 38%, $p = 0.008$, respectively) and less recovery of kidney function by the time of discharge (Abdalbary et al. 2022). Thus, they suffered more lasting health outcomes even after hospitalization.

History of criminal legal system involvement for community-dwelling adults was also found to be associated with increased risk factors for COVID-19. In a study using nationally representative data from the National Survey on Drug Use and Health, nearly two-thirds (64.3%) of men under community supervision were at risk for severe COVID-19 illness (based on CDC-established health risks) compared with less than half (47.9%) of men without criminal legal involvement (Gutierrez & Patterson 2021). Men under community supervision in the 26–34 age group shared a similar risk profile for severe COVID-19 illness as men without criminal legal involvement in the 50–64 group (57.5% versus 58.3%, respectively).

Congregate living and physical distancing. Occupancy in dormitories also affected COVID-19 incidence rates, as did the overall occupancy of correctional facilities. Prisons operating at above their design capacity have a 3–5 times higher incidence rate of COVID-19 (Leibowitz et al. 2021). Furthermore, dormitory settings have been found to carry a significant risk of SARS-CoV-2 spread, with 72.4% testing positive in a quarantined dormitory setting after an exposure, almost half of whom were asymptomatic, and a quarter of whom were identified only through serial testing. The proportion of people at risk who developed COVID-19 after exposure during these outbreaks in dormitory settings, also known in epidemiology as the attack rate, ranged from 57% to 82% (Njuguna et al. 2020). A similar attack rate of 76% was found in dormitory-style or open cell blocks compared with 64% in areas with single or paired closed-door cells during a cluster outbreak at a Utah correctional facility (Lewis et al. 2021). In a study in the statewide Connecticut correctional system, the odds of SARS-CoV-2 infection, as detected via real-time reverse transcription PCR, were 35 times higher for those in a dormitory setting as compared to other housing units (Kennedy et al. 2020). Perhaps the most compelling data supporting the risk of congregate living come from California. Although the California state prison population decreased by one-fifth and room occupancy halved during 2020, a study found that residents living in rooms with more than two others had a 2.5-fold higher infection rate (Chin et al. 2021c).

Facility capacity. Using latent profile analysis, researchers sought to identify facility-level characteristics of 103 Texas prisons that were associated with increased levels of COVID-19 cases and deaths among incarcerated residents. Using data from the Texas Department of Criminal Justice collected from March 1, 2020, to July 24, 2020, researchers identified relevant facility profiles from the data: a low-outbreak profile, a high-outbreak profile, and a high-death profile. They concluded that facilities that were at 85% capacity were at lower risk for COVID-19 outbreaks than those that were at 94% and 102% capacity, which defined facilities that had high death and outbreak numbers (Vest et al. 2021).

Impact of COVID-19 on Healthcare Delivery in Carceral Systems

No studies were conducted on healthcare delivery for COVID-19 patients in correctional healthcare systems, and none were conducted on the quality of care, perception of care, or receipt of new therapeutics. This is not entirely surprising given the general lack of systematic data collection or reporting of healthcare delivery and health outcomes in correctional healthcare. The few studies that were conducted focused on how COVID-19 influenced other facets of healthcare delivery, especially substance-use treatment.

A survey study of substance-use treatment programs in prisons or jails that offered medications for opioid-use disorder was conducted very early in the pandemic. It found significant downscaling of programs. One specific barrier was that some carceral systems that were not licensed opioid treatment programs reported no longer being able to transport individuals to community-based opioid treatment programs for required face-to-face methadone initiation (Bandara et al. 2020).

Subsequent studies looking at the use of telemedicine to initiate or continue medications for opioid-use disorder found that the pandemic restrictions did not present a barrier to provisioning medications in carceral settings (Belcher et al. 2021). And this is further supported by a description of the expansion of an opioid-use disorder program at the Hennepin County jail in Minneapolis, Minnesota. In this program, which offered all three evidence-based medications for treatment of opioid-use disorder before the pandemic started (buprenorphine, methadone, naltrexone), they were able to expand services with the inclusion of buprenorphine for a taper as well as treatment (Duncan et al. 2021). The addition of telemedicine and the reduction of their jail population by nearly half enabled healthcare providers to expand services such that 2.8% (137/4,912) of all discharges received buprenorphine pre-pandemic in January–February 2020 versus 7.8% (219/2,794) of all discharges receiving the medication under pandemic conditions in April–May 2020.

There are some observational data to suggest that this trend held nationally. A study by Dadiomov et al. (2022) showed that from March to October 2020, purchasing of medications for opioid-use disorder by city jails and county and state correctional facilities showed a four-fold increase compared to pre-pandemic levels, and this was led primarily by the purchase of buprenorphine.

Lastly, two studies focused on the transition of care for people with opioid-use disorders. A small study of 16 opioid treatment programs in correctional facilities showed that the majority was still able to make follow-up appointments in the community for people being released from correctional facilities (Bandara et al. 2020). However, another study found that the technology needed to participate in telemedicine was not always enough, as some people with years of incarceration were unfamiliar with how to use features on their phones that would allow participation in telemedicine (Barrenger & Bond 2021).

Effective Approaches for Mitigating and Preventing COVID-19 Transmission in Correctional Systems

Multiple strategies have been identified during COVID-19 for effectively mitigating the health impacts of COVID-19 on incarcerated people, correctional staff, and community members. Although the strategies detailed below have been found to be effective in reducing COVID-19 transmission, it is important to note that there is a dearth of research on the unintended negative consequences of some of these strategies on the physical and mental health of incarcerated people especially. The implications of implementing these COVID-19 prevention and mitigation strategies must be considered on balance with other health and well-being consequences.

Single celling. Data strongly suggest that housing people alone in a cell, which we refer to as single celling, is effective in reducing COVID-19 cases. For each 10% increase in the percentage

of people housed in single-cell units, one study found that facility COVID-19 incidence rates were reduced by 18% (Leibowitz et al. 2021). Furthermore, single celling, in addition to routine prevention measures, reduced infection rates in an urban jail by half (Malloy et al. 2021). It is not clear when during an outbreak single celling should start and how long it should last, especially when considering the rates of community or correctional facility transmission.

Reducing intra- and interfacility transfers. Movement of people within and between facilities has also been associated with increased spread of COVID-19 (Parsons & Worden 2021). In a large prison system in the South, researchers found significant associations between weekly transfers and positive COVID-19 cases. The number of cases was positively correlated with the number of transfers three to five weeks before (cross-correlations greater than 0.4, $p < 0.05$) (Brinkley-Rubinstein et al. 2021a).

Contact tracing. Despite the success of contact tracing in community settings to reduce transmission, contact tracing is an example of community recommendations possibly not applying in correctional facilities and needing to be adapted for the setting. One study of contact tracing in a Vermont prison used video surveillance footage to identify close contacts of infected people (defined using the community definition of being closer than 6 feet for more than 15 minutes to a person who tests positive for SARS-CoV-2) (Pringle et al. 2020). The study describes a case of a correctional officer who ended up testing positive even though he was never found to have a close contact with a person who was infected by video in prison or self-report, suggesting that the community definition of close contact may not work for correction facilities. To be sure, the video surveillance did not continue when the person returned home, so it is possible that the infection was acquired outside of the correctional system.

Serial testing. During the early stages of the pandemic, testing and case rates varied widely from state to state, but, overall, more testing led to more case identification (Lemasters et al. 2020). A study in the Cook County jail evaluated rates of development of SARS-CoV-2 in individuals who were quarantined after exposure. They found most of those individuals developed positive tests; 84% were positive on day 1 testing and 5% on day 3–5, using a serial testing approach. This approach identified many more positives than testing on day 14 alone, which identified 11% of cases (Wadhwa et al. 2021). Further studies led by the CDC have shown that once SARS-CoV-2 is suspected or confirmed in a correctional or detention facility or even a work-release program, widespread serial testing of detained persons and staff at short intervals could quickly identify infections and inform cohorting by infection status to prevent further transmission (Dunne et al. 2021, Wallace et al. 2021b). Testing incarcerated people frequently has been found feasible in a small rural jail as well (Chidavaenzi et al. 2022).

One program in Colorado implemented a proactive testing program early in the pandemic and showed that even when there were a few individuals who were released with COVID-19 (4/165 people tested), implementation of quarantine and prevention measures in the reentry facility was successful in minimizing outbreaks. These data were generated from a facility where 60% of incarcerated individuals were released from another facility with previous or existing COVID-19 outbreaks (Quan et al. 2021). Questionnaire responses suggested that this screening program improved the trust of the formerly incarcerated individuals in the healthcare system and provided a forum to discuss COVID-19 prevention and pathways for reintegration into the community.

Mass testing. In the six studies that have reported on mass testing efforts, there has been a range of asymptomatic infections identified, from 4.6% to 81.2% (Epting et al. 2021, Tompkins et al. 2021), showing the effectiveness of mass testing when an outbreak is suspected. Four studies found that close to two-thirds of infections identified were asymptomatic (Dunne et al. 2021, Tompkins

et al. 2021, Wadhwa et al. 2021, Wallace et al. 2021b). A CDC-led evaluation of SARS-CoV-2 prevalence among 16 adult facilities that had at least one positive symptomatic case and conducted mass testing found infection rates ranged from 0% to 86.8% (median = 29.3%) (Hagan et al. 2020). During an outbreak in a Wisconsin prison, mass testing combined with targeted testing identified 95.4% (829/869) of cases in incarcerated people and 42.0% (29/69) of cases in staff members (Hershow et al. 2021).

Decarceration. Three studies that looked at the impact of decreasing incarcerated populations (both by releasing people into the community and limiting new incarcerations) show that decarceration limits COVID-19 disease burden in both prisons and jails. In a modeling study based on data from an anonymized urban jail, decarceration that enabled single celling reduced the risk of transmission by 56% percent (Malloy et al. 2021). In other words, reducing the overall jail population makes implementing other mitigation strategies, including physical distancing and the ability to quarantine and medically isolate the incarcerated population, easier. Given physical crowding in many facilities, even when overall incarcerated populations are at record lows, increasing access to single-occupancy cells will not be feasible without depopulation efforts and alone may not lead to a reduced transmission rate.

In a longitudinal ecological study, when controlling for other community-level anticontagion policies (such as school closures and mask mandates), mass release events from jails were associated with a 3.1% (95% CI, 1.9% to 4.3%) decrease in community COVID-19 growth rates two weeks later (Reinhart & Chen 2021a). This result is notable given that it provides counterfactual evidence against the theory that releasing people from facilities where spread of COVID-19 was more extensive and outbreaks were common would lead to higher rates of spread in the surrounding community.

Lastly, in a cross-sectional study, case incidence was lower among correctional facilities that released a higher proportion of their baseline population (Jimenez et al. 2020). In this study, the Massachusetts state prison case rate was 52 cases per 1,000 persons with a population decrease of 9%, whereas all county jails had a case rate of 36 cases per 1,000 persons and decreased their overall population by 21%.

Vaccinations. Several studies have documented the efficacy of vaccinations in correctional facilities. Vaccines have shown to be highly effective in carceral settings with estimated effectiveness in the statewide California prison system of 97% (95% CI, 88%–99%) as of March 2021 and 92% for those at moderate to high risk for disease (Chin et al. 2022). They have remained effective even during COVID-19 waves with more infectious variants (Chin et al. 2021b, Hagan et al. 2021b). During a delta variant outbreak in a low-to-medium-risk prison in California, the Moderna vaccine was shown to be effective at preventing symptomatic infection (84.2%; 95% CI, 56.4–94.3), infection in those who were fully vaccinated compared to matched peers who were unvaccinated (56.6%; 95% CI, 42.0–67.5), and infection in those who had previously had COVID-19 infection (80.5%; 95% CI, 52.8–92.0) (Chin et al. 2021b). Similarly, a study in Rhode Island where there were high rates of vaccination showed low rates of positive testing (1.3% and 0.8% among incarcerated people and staff, respectively) among those who had received at least one dose of the Pfizer or Moderna COVID-19 vaccine (Brinkley-Rubinstein et al. 2021b).

And yet, vaccination alone in congregate prison and jail settings is inadequate to prevent future outbreaks. In a microsimulation modeling study calibrated with extensive data from the California Department of Correction and Rehabilitation, Ryckman and colleagues found that mitigation strategies, such as masking and distancing, are still impactful in settings where immunity is high at baseline. In this scenario, high vaccination coverage (90%) can at least halve the size of an outbreak with a new variant (Ryckman et al. 2021). Data from Texas may provide some evidence on

the limitations of vaccinations in overcrowded spaces. During a delta variant COVID-19 outbreak, among symptomatic persons providing swabs for serial testing, no significant difference was found in the median interval between reported symptom onset and last positive RT-PCR result among vaccinated versus unvaccinated persons (9 versus 11 days, respectively; $p = 0.37$) (Hagan et al. 2021b). This is to say that fully vaccinated individuals had virus in their nasal passages for nine days on average, making them possibly able to serve as sources of ongoing transmission of disease.

Furthermore, for those who have medical illnesses and are incarcerated, even vaccination is not ultimately as protective as it would be in a community setting. In the same microsimulation study (Ryckman et al. 2021), authors estimated that a new variant could still cause high rates of hospitalization among vaccinated people even in medical wards, which typically are expected to have the lowest levels of cumulative infections compared to other prison types (given fewer overall contacts reducing opportunities for spread across the prison). Presuming a moderate vaccination level and resumption of normal activities, a new variant could lead to hospitalizations in medical prisons as high as 23 per 1,000 residents, translating to almost 20 COVID-related deaths in a prison of 3,000 people. Notably, these microsimulation data stand in contrast to the data regarding overall hospitalization rates among incarcerated people or correctional staff due to COVID-19.

Vaccine acceptance and deliberation. Studies on vaccine acceptance rates have shown mixed results. In Rhode Island, four months after the first vaccine was offered, 77.7% (1,124/1,447) of the sentenced population were fully vaccinated (Berk et al. 2021). A study of vaccine acceptance in the Federal Bureau of Prisons immediately after vaccine availability found an acceptance rate of 64.2% among incarcerated people (Hagan et al. 2021a). At the time of analysis, vaccination coverage in incarcerated people was comparable to coverage in the overall adult population in the states and territories where facilities were located.

A survey study in a Massachusetts jail, with a response rate of 82%, that was conducted just as vaccines were becoming available (December–January 2021) showed vaccine deliberation among incarcerated people—with 59% saying they did not want a COVID-19 vaccine (Khorasani et al. 2021). Furthermore, Black incarcerated people were almost half as likely to accept a vaccine compared to White people (adjusted OR 0.55). Reasons for deliberation varied but half of study participants shared concerns about vaccine safety or a general mistrust of vaccines. Other studies have found that younger and healthier incarcerated people were least likely to accept vaccination (Hagan et al. 2021a, Stern et al. 2021). In a survey study of willingness to accept a COVID-19 vaccine among incarcerated people in 3 prisons and 13 jails, willingness was higher among Hispanic/Latino participants (52.5%) and among participants in prisons compared with those in jails (50.6% versus 43.7%; $p < 0.001$) (Stern et al. 2021). Here too, reasons for refusal included distrust of healthcare, correctional, or governmental personnel or institutions; concerns about efficacy or safety; and low perceived risk of COVID-19. One study in the Federal Bureau of Prisons found that those with a history of COVID-19 infection were more likely to accept a vaccine (Hagan et al. 2021a), whereas this was not the case in the California statewide prison system (Chin et al. 2021a). A qualitative study in March 2021 of predominantly White women in the Midwest who were recently released from jail found that the predominant reasons were distrust of pharmaceutical companies, misinformation, and conspiracy theories (Geana et al. 2021).

A particularly important finding in the Chin et al. (2021a) study was that vaccine acceptance decisions are not immutable. Among those who had initially declined and were subsequently re-offered vaccination, 45.9% accepted at least one dose. In a California jail, when 2,654 residents were initially offered COVID-19 vaccination, 56.2% accepted at least one dose, with vaccine uptake higher among older individuals, women, those with recent flu vaccination, and those living in shared housing (Liu et al. 2022). Among the vaccinated, 497 (34.5%) had initially refused, showing

that more than a third eventually changed their decision and accepted vaccination. Leading reasons offered for declining the vaccine initially were concerns around side effects and suboptimal efficacy, with cost and the need for an annual booster being other deterrents to vaccination.

Health communications. A few studies have been published on health communication during the time of COVID-19. In a survey administered to 327 individuals incarcerated or recently released from prison in two Midwest states and a southeastern state, researchers found that nearly a third of people learned about COVID-19 from correctional officers and two-thirds got the information from television (Pettus-Davis et al. 2021). Relatively few participants (15.9%) agreed that they had sought out a session with correctional healthcare staff to learn more about COVID-19 and additional strategies they could implement to reduce their risk. Another survey of women living in the community with past criminal legal system involvement found that a relatively small proportion of women (13%) thought medical providers were their most trusted source of information about COVID-19 (Lorvick et al. 2020). Black women had higher odds of choosing television as the most trusted source than the other groups of women, after controlling for age and study site. White women had higher odds of citing government or social service agencies as their most trusted source of information. Importantly, 15% of women said they did not trust any source of information about COVID-19.

IMPACT OF COVID-19 ON CORRECTIONAL STAFF

COVID-19 Incidence and Prevalence

Unlike with incarcerated people, there were very few studies conducted explicitly on COVID-19 incidence or prevalence in correctional staff, or even studies that included their data in modeling studies. In a study of COVID-19 infection prevalence rates among correctional officers in the Federal Bureau of Prisons, the staff prevalence rate was starkly higher than the prevalence rate for incarcerated persons, particularly from mid-July through December 2020 (Toblin et al. 2021). Likewise, in a study of staff using publicly available data on correctional facilities from 45 states and Puerto Rico, the risk of COVID-19 was significantly greater among prison staff than the general state population, with risk ratios ranging from 1.18 in Arkansas to 17.25 in Washington (Nowotny et al. 2021b). The mean risk was three times higher for correctional staff compared with the community population, and the study authors noted that it is likely that staff cases are undercounted as most correctional systems relied on staff to self-report infection. Another study that also used publicly available data found rates among staff from the start of the pandemic to the end of 2020 that were similar at 3–5 times higher than the national general population (Ward et al. 2021). One study demonstrates an elevated risk, even after adjusting for other risk factors such as health indices and household exposures; correctional workers in New York City were found to have the highest likelihood of seropositivity, i.e., having SARS-CoV-2 antibodies [adjusted odds ratio = 2.55 (95% CI, 2.18–2.99)] after adjusting for age, race, weight, borough, and household contact, compared with other first responders in the city (Sami et al. 2021).

Only one study examined occupational risk factors for SARS-CoV-2 infection in correctional settings. Among staff in the Federal Bureau of Prisons, working in a stand-alone low-security institution (dormitory setting) and correctional complex with multiple facilities placed people at higher risk for COVID-19, and working at a detention center or a stand-alone high-security institution (cell-based housing) was protective (Toblin et al. 2021).

Correctional healthcare workers also likely had a higher risk for COVID-19 given their occupational exposures, but very little has been studied about the impact of COVID-19 on this population. One study from Los Angeles County found that early in the pandemic, correctional

healthcare workers accounted for 1.1% of infections among healthcare workers in the county (Hartmann et al. 2021). Although most cases came from long-term care workers and hospital healthcare workers (75% in total), correctional healthcare workers accounted for more COVID-19 cases than those healthcare workers from other high-risk settings such as dialysis centers, urgent care centers, and substance-use treatment programs.

COVID-19 Vaccines Uptake in Correctional Staff

Few studies have investigated vaccine sentiment and uptake among correctional staff. In a survey study that took place in a Massachusetts jail, vaccine willingness was common among correctional staff, with 82% of the total staff and 76% of correctional officers reporting vaccine willingness (Khorasani et al. 2021). It is hard to draw conclusions from these results, as the response rate was low at 37% and the study did not provide characteristics of nonresponders. In Rhode Island, four months after vaccines were offered, 69.6% (1,026/1,474) of staff were fully vaccinated (Berk et al. 2021), and early after availability of vaccines 50.2% of staff in the Federal Bureau of Prisons had accepted a COVID-19 vaccine (Hagan et al. 2021a).

Impact of COVID-19 on Local Communities that Surround Correctional Facilities

A handful of studies examined the associations between COVID-19 in correctional systems and surrounding local communities. The presence of a state or federal prison in a county corresponded with a 9% increase in the COVID-19 case count during the first wave of the pandemic, ending July 1, 2020 (Sims et al. 2021). The number of county cases increased when prison capacities were higher such that each 1,000-person capacity increase was correlated with a 4.96% increase in cases. This study found no evidence that the presence of a prison in a county was correlated with COVID-19-related deaths in the county. However, a different geospatial analysis supports the finding of increased community risk with the presence of a correctional facility in the community. Researchers found that mean COVID-19 case rates were higher in census tracts in Wisconsin that were within a 15-minute drive time to correctional facilities when compared to those that were not (Grubestic et al. 2021). For census tracts within a 10-minute drive time, cumulative case rates increased as the number of local correctional facilities increased—a finding that held in rural areas as well. Likewise, a study of the correlation between releases from the Cook County jail and per capita COVID-19 rates in the city of Chicago and the state of Illinois found that jail to community cycling accounted for 55% of the variance in COVID case rates in Chicago and 37% of the variance in the state of Illinois. Authors report that for each person who cycled through the jail in March 2020, nearly five additional cases are observed in their ZIP code of residence (Reinhart & Chen 2020). Jail cycling in March 2020 also was found to account for 21% of racial disparities in COVID-19 in Chicago five months later (Reinhart & Chen 2021b).

DISCUSSION

The centrality of correctional systems in the spread of COVID-19 in the United States is irrefutable. SARS-CoV-2 virus entered carceral facilities early in the pandemic and spread rapidly among incarcerated people, staff, and surrounding communities. US prisons and jails were unique in the potential for spread given a host of environmental factors (especially overcrowding and their reliance on congregate living environments) and the medical vulnerabilities of incarcerated people and correctional officers. Early estimates of the basic reproductive number—essentially the infectious potential—were higher in a large urban jail than in any other setting reported in

the United States, inclusive of cruise ships, nursing homes, and college campuses. Although studies designed to measure incidence and prevalence used inconsistent methodologies (self-report, antibodies, antigen, and even PCR), which evolved as measurement of viral infection improved in accuracy and ease of administration over the course of the pandemic, the estimates of facility incidence and prevalence were consistently at least 3–5 times higher than the general US population. And estimates of COVID-19 morbidity and mortality, which were not affected by test availability or testing rates, were consistently worse. Mortality rates were 2–4 times higher among both staff and incarcerated people. And when incarcerated people were hospitalized, they had significantly worse in-hospital outcomes, including intubation, use of intravenous medications to increase blood pressure, ICU stays, in-hospital deaths, and readmission rates.

Furthermore, there are now substantive data answering the important question of whether carceral systems were fueling infections in the community or community rates were driving infections in correctional systems. Cross-sectional ecological studies show that communities with correctional facilities have higher rates of COVID-19 than those without correctional facilities, even after adjusting for local community mitigation practices (mask mandates, etc.). And now a limited number of longitudinal studies show that rates of COVID-19 infection in correctional facilities typically lagged and spiked after high community incidence was identified; peaks of correctional staff infection preceded peaks in incarcerated people; and reentry did not contribute much to infection rates in communities, especially when testing and quarantining were implemented according to best public health practices. To be sure, these data come from only a limited number of communities but suggest that COVID-19 was more an “outside-to-inside” problem. And once inside, given the built environments of correctional systems, the reliance on congregate spaces, overcrowding, the inability of incarcerated people and correctional staff to fully protect themselves with true physical distancing, and the under-allocation of tests/vaccines, the virus exploded.

Although there are multiple published examples of how carceral facilities can serve as tinderboxes for infectious diseases, so too can viral spread be contained with swift and dramatic measures, such as decarceration, systemwide serial testing at entry, mass testing during suspected outbreaks, and vaccination of staff and incarcerated people. Our review identifies several evidence-based interventions that provide pathways to reducing the burden of COVID-19 in carceral systems. Decarceration, especially that which enabled single celling, has the possibility of reducing infections among both incarcerated people and staff by more than 50%. Importantly, reducing the correctional population and especially overcrowding is critical to the implementation of other effective strategies such as vaccination. A goal of getting below 85% occupancy is supported by the literature.

Over the course of the pandemic, we have seen that decarceration is possible, safe, and associated with positive criminal legal system metrics, including recidivism (Miller et al. 2022), in addition to public health benefits. However, the incarcerated population levels have again rebounded to pre-pandemic levels, as the standard operations of the criminal legal system have returned to pre-pandemic states. Despite the public health benefits of decarceration, the general public largely has not supported broad decarceration efforts. In a nationally representative survey, researchers found that just over half of respondents said they agreed with releasing those already eligible for release, and only a quarter of respondents agreed with releasing as many people as possible (Denney & Valdez 2021). Although decarceration may be more a question of political will, public health research that better articulates the health impacts of sustained decarceration for incarcerated people, criminal legal system actors, and surrounding communities will move this conversation forward.

Our review reveals that two testing strategies (in concert with appropriate isolation mechanisms) are effective in reducing transmission: serial testing on day 1 and again on days 3–5 and systemwide mass testing events. Both testing strategies identified many asymptomatic infections. A strategy that has not been studied is pooled testing across a facility, which can be cost and resource saving when prevalence is low (Mutesa et al. 2021), nor are there data on the utility of wastewater monitoring for SARS-CoV-2 in carceral sewage systems, despite reports of correctional facilities taking on both types of monitoring. Wastewater monitoring, especially, has been extensively used and studied in other congregate living environments such as university dormitories (Scott et al. 2021). Furthermore, contact tracing by video monitoring was not shown to be particularly helpful for reducing transmission especially when definitions of close community contact were applied and because video monitoring cannot track contacts outside of correctional facilities, especially when employees return home.

Like in the community, vaccinations have been highly effective in reducing infection and morbidity and mortality among incarcerated people. The effectiveness, however, is slightly less than observed in community settings. There are two possible reasons: lower overall vaccination rates (especially given correctional officers' lower rates of vaccination) and significant overcrowding. Prisons that can achieve high vaccination rates across their populations should expect to continue standard mitigation practices, such as continued decarceration, distancing, and masking. This is to say that those facilities that have depopulated and have thus opened up housing options, including smaller pods as was done in Puerto Rico with less than 20 people or single celling, should continue these practices for the foreseeable future. This is with the caveat, however, that there has been almost no research that elucidates the toll of these practices on the physical and mental health of incarcerated people and staff and that leaving individuals locked indefinitely in cells to avoid congregation and viral transmission in facilities with perpetual outbreaks also cannot be a strategy.

These findings suggest that federal and state policies and funding that support decarceration, testing, and vaccinations in correctional systems are critical to the mitigation of COVID-19 and prevention of future pandemics. This will likely become even more important as federal dollars that have covered much of COVID-19-related expenses thus far are likely to fluctuate over time.

FUTURE DIRECTIONS

Our review also indicates that there is a large role for increased data sharing, data transparency, and harmonization of metrics and reporting formats. Initially in the pandemic, the four most prominent initiatives that were dedicated to compiling publicly available data from correctional systems differed in their estimates and there were significant missing data in correctional system reports. Although this has improved, increasing access to data and transparency will increase the role that the public can play in holding correctional facilities accountable for these publicly funded services. It is also notable that even during periods of outbreaks, there were carceral systems that did not partner with the CDC for support. At the start of the pandemic, CDC requested data from 15 jurisdictions (the Federal Bureau of Prisons, 10 state prison systems, and 4 local jails) and only 6 jurisdictions provided data. There are carceral operational costs that are required for meaningful data sharing and collaboration, and this too should be considered when trying to develop partnerships and is important to overall pandemic preparedness, as the evidence is so clear that infectious outbreaks in carceral facilities can directly impact community health.

Issues with data transparency are also made evident in that close to half of the articles that met the criteria for our review were from a few small groups of researchers, the CDC prison group being the biggest contributor. Although it is possible that this represents pockets of interest in correctional health and infectious disease, it is also plausible that only a small group of people

had enough access to data to conduct meaningful research. Aside from the CDC's work in several carceral systems around the country and that of a handful of research teams, there are very few papers that represent correctional-academic-public health partnerships. The NIH's investment in RADx-UP is one step toward improving collaborations between academics and correctional systems, but other federal and state investment should be made to broaden the infrastructures necessary for partnerships between public health researchers and correctional systems. This is a missed opportunity.

Given the clear and well-documented benefit of vaccination of incarcerated people and correctional staff, vaccination efforts are critical for stemming the next tides of COVID-19 and for preemptive planning for future pandemics. However, there are many obstacles to successful and widespread vaccination. Certainly, state governments are a very important lever to change. Only half of states explicitly prioritized incarcerated people in phase 1 (22%) or phase 2 (29%) in their vaccine distribution plans, even when national recommendations categorized incarcerated people and correctional officers as priority populations (Strodel et al. 2021). In addition, there is a gap in our understanding of ongoing vaccine efforts, with most vaccine reports covering early access to vaccines in the summer of 2021 and few since.

Despite finding 77 publications over the span of the past two years on COVID-19 epidemiology and management (four times more than have been published in the past two decades), there were several areas that warranted further research. Our review reveals that although the toll of disease among those who live and work in carceral facilities has been starkly documented with the inordinately high tallies of COVID-19 cases, in-hospital complications, and deaths, there is not a single published report on the experience of COVID-19 among incarcerated people: their self-reported health or long COVID, their experience of prolonged quarantines and lockdowns, or their experience of healthcare during COVID-19, including access to evidence-based COVID-19 therapeutics. Their voices are absent in our accounting of the pandemic and reinforce the black box of what is known about correctional healthcare systems and the quality of care.

There are certainly reasons to believe that prolonged isolation resulting from mitigation policies such as decreased out-of-cell time and little communal activity could have significantly impacted the mental health of incarcerated people and that this may impact health risks even after release. A recent study by Marquez et al. (2022) found that the percentage change in all-cause standardized mortality between 2019 and 2020 was higher for people incarcerated in Florida prisons (40%) than for the general population of Florida (19%), demonstrating excess mortality during COVID-19 for incarcerated people from all causes, not exclusively COVID-19. Studies in the general population have found that delayed mental health and medical treatment have contributed to excess death during the pandemic (Stokes et al. 2021). This hypothesis should also be tested within correctional systems.

There is also a paucity of data on the impact of the pandemic and related policies on incarcerated women, youth, and older adults and on the health of family members whose loved ones were incarcerated. There is emerging evidence of negative mental health impacts of having an incarcerated family member during COVID-19 (Testa & Fahmy 2021). But given that close to half of Americans report having had an immediate family member incarcerated (Enns et al. 2019), understanding the impact on people whose family members are incarcerated may identify new paths to improving population health.

Compared to the incarcerated population, there are very few data available relevant to staff movements, health, or engagement in mitigation strategies (e.g., testing, vaccines), even though data suggest that the source of outbreaks in prison and jail settings are often staff who bring in the virus after community exposure. In the few studies that focused on staff, they too had worse health outcomes with COVID-19. Thus, engaging correctional staff in sustainable mitigation efforts is

critical for their own health and that of their families and communities as well as incarcerated people. Most of the data on staff in the studies identified in this review relied on self-reported infections when staff data were available; often it was not. Strategies to effectively engage correctional staff in occupational health research and effective mitigation strategies, including frequent testing strategies and vaccination uptake, even without mandates, are lacking. Furthermore, this research also must acknowledge the inherent challenge of working in times of gross understaffing, staff burnout, and strain and the health-harming impacts of COVID-19 on the overall physical and mental health of staff.

Although this review revealed a host of effective strategies that can be deployed by carceral facilities to mitigate outbreaks, there were no studies that tested approaches to peeling back on pandemic strategies when outbreaks abated. There is presently no guidance on what the leading indicators of the cessation of an outbreak are or how a facility might systematically loosen restrictions while monitoring the impact of these sequential changes. This is fertile ground for future research from both institutional management and public health perspectives and from a humanistic standpoint, as people can only withstand so much isolation before the protective efficacy wanes and the deleterious impacts take hold.

Finally, this review found almost no experimental data on how to improve health outcomes in the carceral system. Studies that are ripe for funding include comparative effectiveness trials of strategies to improve vaccine uptake and studies on how best to support sustained decarceration with community supports (Hawks et al. 2022). There are also no studies in this review of the effectiveness of COVID-19 therapeutics in correctional systems. Access to these treatments, such as monoclonal antibodies and oral antivirals, may be important for narrowing the disparities in health outcomes that have been noted between incarcerated people and community-dwelling adults, especially in-hospital outcomes, and ought to be rigorously studied.

LIMITATIONS

Our review has several limitations. There are notable exclusions to our review because we limited our inclusion criteria to peer-reviewed papers. White papers published during the pandemic were not included in our review. Furthermore, our protocol only included studies in the United States, and there has been a significant number of papers published that originate in South America, Europe, and Australia on the role of COVID-19 in those unique carceral systems.

CONCLUSIONS

Our review identified and synthesized evidence on COVID-19 and correctional systems using a standardized scoping review technique. This pandemic has been studied like no other before, and we emerge with clear evidence that decarceration, serial and mass testing, vaccinations, and any efforts to dedensify living quarters are effective at preventing COVID-19 transmission. As the pandemic continues, these effective strategies must be funded and sustained and require leadership and legislation to prevent further outbreaks. Investments in correctional system data infrastructure will reap future rewards for public health preparedness. Areas that require urgent study are the experiences of incarcerated people and correctional staff, their access to resources and healthcare quality, and, especially, experimental trials that identify successful strategies for vaccine uptake in staff and community supports for decarceration.

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