

**Data-Driven Strategies for Addressing High-Utilizers and Systemic Inefficiencies in
Charlottesville's Criminal Justice System**
(Technical Paper)

Jail Design as a Reflection of Systemic Inequities: Gender, Race, and Mental Health
(STS Paper)

A Thesis Prospectus
In STS 4500
Presented to
The Faculty of the
School of Engineering and Applied Science
University of Virginia
In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science in Systems and Information Engineering

By
Olivia Bernard

December 9th, 2024

Technical Team Members:

Zakaria Afi
Sudarshan Atmavilas
Sarah Bedal
Mohini Gupta
Caroline Lee

On my honor as a University student, I have neither given nor received unauthorized aid on this
assignment as defined by Honor-Guidelines for Thesis-Related Assignments.

ADVISORS

Peter Alonzi, School of Data Science
Micheal Smith, Department of Systems and Information Engineering
Preston White, Department of Systems and Information Engineering

Dr. Coleen Carrigan, Department of Engineering and Society

Research Question: *How has the initial design of jails neglected the needs of marginalized groups, and how is this still evident in jails today, such as women, people of color, and those with mental illness, and how might reforming these environments improve outcomes for both incarcerated individuals and society as a whole?*

I. Introduction

The design of jails in the United States has long reflected a one-size-fits-all approach that fails to account for the diverse needs of those it confines, particularly marginalized groups such as women, people of color, and those with mental health conditions. Initially structured with a focus on punishment and containment, these spaces were not designed with the lived experiences of these groups in mind, often resulting in environments that exacerbate vulnerabilities rather than support rehabilitation.

Recent research highlights the importance of carceral infrastructure, revealing how poorly designed environments can exacerbate vulnerabilities: “The conditions represented in these accounts demonstrate the injustice and inhumanity of the US criminal system,” which, when combined with environmental challenges, often reaches “the threshold of cruel and unusual punishment” (Barron et al., 2024, p. 2439). That is to say, the built environment of jails, elements such as isolation, surveillance, spatial arrangements, access to natural light and air, and privacy and safety, conveys society’s outdated values on punishment versus rehabilitation and has profound implications for mental and physical health and rehabilitative outcomes.

When jails fail to serve the rehabilitative and safety needs of marginalized populations, they contribute to conditions that harm public health and safety, as it inhibits successful reintegration and perpetuates cycles of recidivism. As taxpayers fund these facilities, society at

large becomes a stakeholder in the consequences of ineffective carceral design. Misallocated state resources and environments that lack this space of rehabilitation contribute to mental health deterioration, increased recidivism, and weakened public safety. The injustice and inefficiency in this approach demand scrutiny. They not only impact the lives of incarcerated individuals but also strain community resources and perpetuate cycles of disadvantage. By examining how jail design serves or fails these groups, through the lens of marginalized groups versus acting powers, this research highlights the urgent need for reforms that align carceral environments with rehabilitative goals, ultimately fostering a justice system that benefits all.

II. Technical Research Project: Data-Driven Strategies for Addressing High-Utilizers and Systemic Inefficiencies in Charlottesville's Criminal Justice System

With over 1 in 4 jail admissions involving repeat bookings annually, high-utilizers, often individuals facing homelessness, mental health challenges, or systemic inequities, demonstrate the urgent need for data-driven interventions to reduce recidivism and improve the efficiency of the justice system (Widra et al., 2024). High-utilizers can be defined as chronic, low-level offenders whose crimes are not serious enough to warrant a prolonged sentence in either jail or prison and are individuals that frequently interact with justice or health-care systems, and disproportionately strain community resources (Castillo, 2021). Recognizing these challenges, my technical research project focuses on analyzing the common characteristics and behavioral patterns of high-utilizers in Charlottesville, Virginia, to identify resource-driven and targeted solutions.

This effort aligns with Charlottesville/Albemarle's designation, in 2009, as one of seven pilot sites for the National Institute of Corrections' Evidence-Based Decision Making Initiative.

To advance this initiative, the county formed an Evidence-Based Decision Making Team (EBDM) to reduce criminal justice costs, lower rearrest rates, and foster greater community trust in the justice system (The Center for Effective Public Policy, 2015). Collaborating with the EBDM team and organizations such as the Albemarle-Charlottesville Regional Jail (ACRJ), Offender Aid and Restoration (OAR), Region Ten, crisis aversion teams, and law enforcement agencies, including Charlottesville and University Police, our project leverages data analysis to evaluate policy effectiveness, identify high-utilizers, and uncover the systemic factors driving their frequent interactions with law enforcement.

To ensure ethical data handling, our team completed IRB protocol and CITI certification for prisoner research, enabling secure access to inmate data through a virtual machine. The data includes ACRJ bookings, COMPAS recidivism scores, mental health screenings and arrest records from Charlottesville and University police. The primary variable fields of interest include booking date, release date, jacket number, statute description, severity of offense, address of crime, home address (if applicable) and demographics, such as race, ethnicity, and age. Research investigating incarceration patterns among young adults in New York City has demonstrated these variables are critical for analyzing systematic disparities and behavioral trends of high-utilizers and offering insights into who is most at risk and why (Chan et al., 2020).

Our research explores the overlap between high-utilizers and factors like homelessness, mental health issues, and recidivism. We aim to determine the proportion facing chronic homelessness or mental health challenges by using clustering techniques inspired by Harding and Roman's (2016) work in Chicago. Identifying subgroups within Charlottesville's justice system will reveal patterns driving recidivism and resource strain, guiding tailored interventions for each group.

In designing our data collection, we evaluated the benefits of agency data versus inmate self-reports. Roberts and Wells (2010) identified significant discrepancies in self-reported criminal justice system users, particularly underreporting of arrests, highlighting the challenges of relying on inmate recall. Given these findings and IRB limitations, we chose to prioritize official agency data for more accurate tracking of justice system interactions, while recognizing the contextual value of self-reports.

We will incorporate statistical and machine learning (ML) techniques to evaluate the effectiveness of existing interventions and policies. ML has shown high accuracy in recidivism research and risks, offering reliable predictions and nuanced insights into criminal behavior. Using ML models such as logistic regression (predicts probability of binary outcomes) and random forests (uses patterns to predict single outcomes), we aim to analyze behavioral trends like frequent emergency room visits or repeat minor offenses (Travaini et al., 2022). For example, a histogram of jail bookings for repeat offenders, combined with ML-predicted risk factors, could visually highlight systemic patterns driving these interactions. By leveraging these advanced methods, we aim to provide local agencies with evidence-based insights into program successes, highlight areas needing improvement and guide policy decisions, including grant applications for effective interventions.

The quantitative research and modeling of our methodology complements the qualitative by providing context for high-utilizers' needs through a system-focused approach. Touring the ACRJ with Superintendent Kumer and observing inmates' daily tasks offered firsthand insight into challenges faced by inmates, their families, staff, and other stakeholders. Additionally, a "Hearing Voices" simulation by crisis intervention specialist Tom von Hemert recreated the experience of someone with schizophrenia navigating law enforcement and booking,

highlighting the impact of judgmental and impatient staff interactions. The widely used experience fosters empowerment and acceptance by normalizing voice-hearing, emphasizing the need for empathy and understanding among law enforcement, medical providers, and civilians (Corstens et al., 2014). This exercise revealed how compassionate interactions can lead to more effective outcomes and informed our planning for ride-alongs with Charlottesville Police to better understand crime response and pre-incarceration procedures, specifically for high-utilizers that are affected by mental illness.

By integrating quantitative analysis, machine learning techniques, and qualitative insights, our research seeks to uncover the systemic factors driving high-utilizer patterns in Charlottesville's justice system. This comprehensive approach aims to inform stakeholders, like the EBDM team, of targeted interventions, improve resource allocation, and foster more effective, compassionate strategies to reduce recidivism and support vulnerable populations.

III. STS Project: Jail Design as a Reflection of Systemic Inequities: Gender, Race, and Mental Health

During my investigation into Charlottesville's criminal justice system, my visit to the ACRJ left a strong impression. While its purpose was to observe the physical layout, it evoked emotions ranging from discomfort to curiosity about the intent behind its design. Richard E. Wener's *The Environmental Psychology of Prisons and Jail* (2012) revealed that jails are not just spaces for confinement but environments reflecting society's philosophy on justice, punishment, and rehabilitation. Architectural choices mirror societal attitudes toward incarceration and continue to shape inmate experiences, particularly for women, people of color, and those suffering from mental illness.

Leveraging frameworks from Jane Margolis et al.'s *Stuck in the Shallow End* (2008) and Josef Barla's "Technologies of antiblackness: Black matter, racial bias, and the haunting past of the spirometer" (2023), this paper will examine how race, gender, and mental illness shape the built environment of jails within long-standing systems of inequality. These systems isolate incarcerated individuals, hinder reintegration, and increase recidivism. Margolis and Barla contextualize barriers to access in built environments, such as segregated pools and racial bias in medical devices, highlighting the "haunting" of Black lives in the present. In my paper, I will seek to adopt an intersectional approach to show how jails' physical designs perpetuate systemic disparities, normalize exclusion, and "haunt" inmates' experiences.

My visit to ACRJ prompted me to examine the evolution of jail design, focusing on cell structure, isolation, surveillance, spatial arrangements, and safety. I questioned the absence of green or outdoor spaces and how the built environment impacts mental health, especially for inmates with pre-existing conditions. This raised broader questions about how design choices affect safety, trauma, and recidivism, driving my goal to analyze these aspects critically. I am to contribute to discussions on aligning future jail designs with rehabilitative goals, mental health support, and reintegration. Further, I will ground my research in Albemarle County and the City of Charlottesville, exploring how broader demographic realities are reflected in the jail's built environment.

Women

In the past few decades, the female incarcerated population has surged, rising over 585% from 1980 to 2022, reaching around 180,000 women. Kristen M. Budd roots this surge in the combination of factors which disproportionately affect women, including stricter drug sentencing

laws, expanded law enforcement efforts, and increases in post-conviction barriers to reentry (Budd, 2024). Despite rising rates of female incarceration, jail environments remain largely unsuitable for women, often failing to address gender-specific needs. Many elements of prison life, from programming to physical spaces, are based on models developed for male inmates. For example, prisons typically lack essential health services for women, such as trauma-informed care; these programs are critical given the high prevalence of abuse histories among female inmates (Covington and Bloom, 2000). In my analysis, I will explore a 2018 case study by Kimberly Collicia-Cox and Gennifer Furst to examine how jails, historically designed for men, fall short in supporting female inmates, particularly regarding programs aimed at building parenting skills in a supportive setting, which is especially crucial given that a large proportion of incarcerated women are mothers who often face separation from their children.

People of Color

In contrast, I will also aim to understand the impact of jail design on people of color, a group that is historically overrepresented in the criminal justice system. I will examine its origins from the post-Civil War era to the present, using Michelle Alexander's *The New Jim Crow* (2020) as a foundational text. Alexander argues that the criminal justice system has long served as a mechanism for racial control, from Reconstruction-era convict leasing to the War on Drugs. Alexander considers the ways in which systemic racism and structural disinvestment in Black neighborhoods *create* racial disparities in the criminal justice system (which are then compounded by biases in arrests and trial process). As Carrie Pettus (2024) demonstrates, carceral environments often reflect and reinforce societal racial divisions, as racial antagonisms among those who control the built environment of the jail, including jail staff, can manifest in

discriminatory treatment and reinforce racial hierarchies. Using both Alexander and Davis to frame my analysis, I will consider the ways in which jail environments *affect* the jail experience for Black inmates, who are more vulnerable to violence, sexual abuse, solitary confinement, and inadequate healthcare due to the racial dynamics within carceral spaces (Pettus, 2024). I hope to research ways in which the jail environment can be altered to better suit the needs of inmates of color by exploring potential frameworks of colorblindness, meritocracy, and implicit bias through Margolis et al. and Barla.

Mental Health Conditions

The final lens of focus will be on individuals with pre-existing mental health conditions, or those diagnosed while incarcerated. These individuals often struggle in jails that prioritize containment over care. I will study the history of mental health in the carceral system and adequate treatment options using Dvoskin, Iv, and Silva's paper, *A Brief History of the Criminalization of Mental Illness* (2020), to address how early designs of jails lack the supportive features needed to address inmates' mental health needs. I will consider how the use of physical space and design in jails can inadvertently worsen psychological distress, especially already vulnerable populations. For instance, research by Bruce Western (2021) notes that solitary confinement can intensify trauma, increase stress, and even encourage aggressive behavior. Similarly, he found that constant surveillance, intended for safety, can heighten feelings of psychological confinement, while overcrowded conditions contribute to elevated stress levels and frequent interpersonal conflicts. Additionally, limited or nonexistent access to outdoor or green spaces deprives inmates of restorative experiences, further diminishing their mental health. This lack of mental health support within the jail environment not only impacts inmates'

well-being but also complicates their chances of rehabilitation and reintegration (Engstrom & van Ginneken, 2022).

IV. Conclusion

This research bridges the STS and technical problems by uncovering how the design and operations of jails perpetuate inequities, especially for women, people of color, and individuals with mental health conditions. Through an intersectional analysis, it highlights how systemic biases, embedded in carceral environments, undermine rehabilitation and reintegration efforts. Taxpayer-funded jails reflect societal values, yet their design and practices fail to meet the needs of marginalized groups, creating cycles of harm that affect both inmates and the broader community.

By analyzing high-utilizer patterns through data-driven methods, the technical research offers practical strategies to reduce recidivism and allocate resources more effectively. These findings complement the STS analysis, demonstrating how evidence-based reforms in jail architecture and operations can challenge entrenched social hierarchies and support inmate well-being. Ultimately, this research advocates for a justice system that fosters equity and rehabilitation, driving positive change for individuals and society as a whole.

V. Bibliography

Alexander, M. (2020). *The New Jim Crow: Mass Incarceration in the Age of Colorblindness* (10th Anniversary ed.). The New Press.

Barla, J. (2023). Technologies of antiblackness: Black matter, racial bias, and the haunting past of the spirometer. *Technology in Society*, 73, 102256.
<https://doi.org/10.1016/j.techsoc.2023.102256>

Budd, K. (2024). *Incarcerated Women and Girls*. The Sentencing Project.
<https://www.sentencingproject.org/app/uploads/2024/07/Incarcerated-Women-and-Girls-1.pdf>

Castillo, C. (2021). *High Utilizers Initiative | City of Boulder*. City of Boulder.
<https://bouldercolorado.gov/projects/high-utilizers-initiative>

Chan, P. Y., Kaba, F., Lim, S., Katyal, M., & MacDonald, R. (2020). Identifying demographic and health profiles of young adults with frequent jail incarceration in New York City during 2011–2017. *Annals of Epidemiology*, 46, 41-48.e1.
<https://doi.org/10.1016/j.annepidem.2020.04.006>

COLLICA-COX, K., & FURST, G. (2018). Implementing Successful Jail-Based Programming for Women: A Case Study of Planning Parenting, Prison & Pups – Waiting to ‘Let the Dogs In.’ *Journal of Prison Education and Reentry*, 2(5).
<https://files.eric.ed.gov/fulltext/EJ1206440.pdf>

Corstens, D., Longden, E., McCarthy-Jones, S., Waddingham, R., & Thomas, N. (2014).

Emerging Perspectives From the Hearing Voices Movement: Implications for Research and Practice. *Schizophrenia Bulletin*, 40(Suppl_4), S285–S294.

<https://doi.org/10.1093/schbul/sbu007>

Covington, S., & Bloom, B. (2000, November). *Gendered Justice: Programming for Women in Correctional Settings*. American Society of Criminology, San Francisco, California.

<https://centerforgenderandjustice.org/site/assets/files/1542/11.pdf>

Dvoskin, J. A., Iv, J. L. K., & Silva, M. (2020). A brief history of the criminalization of mental illness. *CNS Spectrums*, 25(5), 638–650. <https://doi.org/10.1017/S1092852920000103>

Engstrom, K., & van Ginneken, E. (2022). Ethical Prison Architecture: A Systematic Literature Review of Prison Design Features Related to Wellbeing. *SAGE Publications*, 25(3), 479–503.

<https://doi.org/10.1177/12063312221104211>

Harding, C., & Roman, C. (2017). Identifying Discrete Subgroups of Chronically Homeless

Frequent Utilizers of Jail and Public Mental Health Services. *SAGE Publications*, 44(4),

511–530. <https://doi.org/10.1177/0093854816680838>

Margolis, J., Estrella, R., Goode, J., Holme, J. J., & Nao, K. (2008). *Stuck in the Shallow End:*

Education, Race and Computing (Vol. 25). <https://www.jstor.org/stable/j.ctt1mtz830>

- Moran, D., & Jewkes, Y. (2015). Linking the carceral and the punitive state: A review of research on prison architecture, design, technology and the lived experience of carceral space. *Annales de Géographie*, 702703(2), 163–184. <https://doi.org/10.3917/ag.702.0163>
- Morin, K. M. (2016). The late-modern American jail: epistemologies of space and violence. *The Geographical Journal*, 182(1), 38–48. <https://doi.org/10.1111/geoj.12121>
- Nadel, M. R., & Mears, D. P. (2020). Building with no end in sight: the theory and effects of prison architecture. *Corrections*, 5(3), 188–205. <https://doi.org/10.1080/23774657.2018.1461036>
- Nevis Barron, B., Roudbari, S., Pezzullo, P., Dashti, S., & Liel, A. (2024). “Because we’re dying in here”: A study of environmental vulnerability and climate risks in incarceration infrastructure. *SAGE Publications*, 0. <https://doi.org/10.1177/25148486241289006>
- Pettus, C. (2024, May 16). *Achieving Racial Equity and Improving Culture in Jails Using a Community-Engaged Quality Improvement Process*. Safety and Justice Challenge. <https://safetyandjusticechallenge.org/blog/achieving-racial-equity-and-improving-culture-in-jails-using-a-community-engaged-quality-improvement-process/>
- Roberts, J., & Wells, W. (2010). The validity of criminal justice contacts reported by inmates: A comparison of self-reported data with official prison records. *Journal of Criminal Justice*, 38(5), 1031–1037. <https://doi.org/10.1016/j.jcrimjus.2010.07.005>

The Center for Effective Public Policy. (2015, December 27). *Charlottesville-Albemarle County, Virginia – EBDM – Evidence Based Decision Making*.

<https://ebdmoneless.org/charlottesville-albemarle-county-virginia/>

Travaini, G. V., Pacchioni, F., Bellumore, S., Bosia, M., & De Micco, F. (2022). Machine Learning and Criminal Justice: A Systematic Review of Advanced Methodology for Recidivism Risk Prediction. *International Journal of Environmental Research and Public Health*, 19(17), 10594. <https://doi.org/10.3390/ijerph191710594>

Wener, R. E. (Ed.). (2012). Overview: History of Correctional Design, Development, and Implementation of Direct Supervision as an Innovation. In *The Environmental Psychology of Prisons and Jails: Creating Humane Spaces in Secure Settings* (pp. 1–112). Cambridge University Press.
<https://www.cambridge.org/core/books/environmental-psychology-of-prisons-and-jails/overview/0AC822D0ADF30010403372B60FFEC06F>

Western, B. (2021). Inside the Box: Safety, Health, and Isolation in Prison. *Journal of Economic Perspectives*, 35(4), 97–122. <https://doi.org/10.1257/jep.35.4.97>

Widra, E., & Sawyer, W. (2024, November 27). *Who is jailed, how often, and why: Our Jail Data Initiative collaboration offers a fresh look at the misuse of local jails*. Prison Policy Initiative. https://www.prisonpolicy.org/blog/2024/11/27/jail_bookings/