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Prescriptive Faith: Carceral Health Beyond The Prison Walls

Shamar S. Smalls
shamar.smalls@yale.edu

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Prescriptive Faith: Carceral Health Beyond the Prison Walls

An in-depth analysis on the health risks (cardiovascular disease risk factors, anxiety disorders, and impaired daily activity) that solitary confinement and general incarceration imposes on formerly incarcerated New Haven residents—while exploring the viability of faith-based self-efficacy as a coping mechanism to health-related harms

Shamar Samuel Smalls
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Abstract :

Individuals who are exposed to the carceral system—specifically, solitary confinement are uniquely vulnerable to psychological and physical health conditions. However, the relationship between solitary confinement and physical health conditions are relatively underexamined, compared to mental health disorders. This analysis examines the potential for a risks' association between solitary confinement and cardiovascular disease risk factors. Additionally, this study examines the relationship between spirituality as a self-efficacious coping measure for health-related outcomes. A cross-sectional analysis of 302 survey participants with a prior history of incarceration in a housing study (New Haven, CT) with a prior history of incarceration from Fall 2017 – March 2018 was used to explore the relationship between solitary confinement and several health outcomes (cardiovascular disease risk factors, anxiety disorders symptoms, and impaired daily activity) to decipher the association between solitary confinement and self-reported health outcomes. 175 participants in total reported solitary confinement history; further, 60% of participants who reported a cardiovascular disease risk factor reported a history of solitary confinement—but, the association was statistically insignificant. However, among individuals with a history of general incarceration: the risks for self-reported 'impaired daily activity' increased with older age. Additionally, self-reported physical chronic conditions increased the relative risk of self-reported 'impaired daily activity'. Also, self-reported anxiety disorder symptoms increased the risks of self-reported impaired daily activity. Participants of a younger age; as well as, individuals who reported physical chronic conditions maintained increased risks of self-reported anxiety disorder symptoms. Notably, Black participants demonstrated a decreased risk of anxiety disorder symptoms within the sample population. Additionally, higher spirituality scores increased the risk of self-reported anxiety disorder symptoms. Moreover, higher spirituality scores were systematically located in the 'impaired daily activity' group, compared to participants who reported no such limitations. This analysis provides further evidence that carceral system exposure (particularly among low-income individuals) is associated with a notable prevalence of mental and physical chronic conditions—while exploring the potential for self-efficacious coping mechanisms (such as faith-based systems) to be further evaluated in research studies.

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INTRODUCTION

The Ties of Mass Incarceration

For the past 40 years, the United States allowed mass incarceration to take hold on marginalized populations. Uniquely, the United States is the world's leader in incarceration: currently a little over 2 million people reside in the nation's prisons and jails (Carson, 2020; Sundaresh et al 2020; and, Rich, Wakeman & Dickman, 2011). Particularly, the racial inequity of mass incarceration manifests as a distinct form of structural racism, perpetrated to predominately Black men and women (Alexander, 2010). Across the country, Black Americans are incarcerated nearly 5 times that of Non-Hispanic white Americans; and, Latinx individuals are incarcerated 1.3 times that of Non-Hispanic white individuals (Nellis, 2016; 2021).

The prison population began to grow during the 1970s—politicians fanned the flames of fear and used cleverly disguised racial rhetoric to promote punitive policies that increased the prison population. Historically, Nixon's declaration for the "War on Drugs" and the "tough on crime" justifications—coupled with the steady decline to the social safety net (Bennett, 2014; Alexander, 2010; and, Achoenfeld & Schoenfeld, 2007) altogether disrupted the upward social mobility of marginalized communities.

Consequently, mental and chronic health conditions are overrepresented among incarcerated individuals (Fazel & Baillargeon, 2011). The multitude of contributing factors: such as mass incarceration; job and food insecurity; housing instability; lack of health insurance; stigma; trauma; and interpersonal violence all shape the health of individuals subjected to the carceral system (Binswanger et al, 2007). Incarceration rates aside, chronic diseases are common among Black individuals; and, on average, Black individuals have a higher risk of morbidity and mortality for chronic diseases than any other group (Benjamins et al, 2021). Given the overrepresentation of

Black and brown individuals within the carceral system, and their proximity to poor health outcomes—there is cause to believe that the health status of individuals recently released from prison (and jail) is a pressing public health matter. As such, this area of research requires further exploration into the facets of the carceral system and chronic disease outcomes—distinct from infectious diseases, substance abuse, and mental health disorders.

The Carceral System: A Silent Ill

The carceral system is complex, because it encompasses a series of interlinking systems that act as extensions of corrective rehabilitation. Explicitly, halfway houses, parole, probation, predictive policing, juvenile detention centers, prison industrial complex, and forms of solitary confinement (Alexander, 2010) altogether create the carceral system in the United States. However, solitary confinement, which can be defined as 22-24 hours in isolation with little to no human contact, differs in its severity of deprivation and inhumanity (Kurki & Morris, 2001).

The health implications of solitary confinement are the subject of increasing attention in recent years. It should be noted that before the 1990s, "supermax" prisons were a rarity—however, over the past two decades the application of solitary confinement across U.S. prisons has dramatically increased (Browne, Cambier, Agha, 2011). Currently, at least 44 states and the federal government use supermax units, where incarcerated individuals are held in destitute isolation for extensive periods of time (i.e. months, years) (Cloud et al, 2015). Historically, the discussion surrounding the necessity for restrictive housing in correctional settings is twofold. Confinement practices are a protective measure: (a.) to sperate violent incarcerated people from the general population, (b.) separate at-risk individuals from the general population for their own safety (Browne, Cambier, Agha, 2011). Additionally, restrictive housing is a tool of "correction"—rather,

a punitive punishment for incarcerated people who do not abide the by the institutions' guidelines (Browne, Cambier, Agha, 2011).

However, advocacy organizations and legal scholars speculate that solitary confinement, in some instances, is a harsh response for either minor infractions or for no infraction at all (Kurki & Morris, 2001). For example, low-risk "nuisance" incarcerated persons are housed in solitary confinement because they have broken minor rules, reported grievances with correctional staff, or filed lawsuits (Kurki & Morris, 2001). On the other hand, a sizeable subsidiary of incarcerated persons placed in restrictive housing are either mentally ill or cognitively disabled (Cloud et al, 2015; Reiter et al, 2020). In some circumstances, minors are held in solitary confinement for their own safety from the general prison population (*Washington Coalition For The Just Treatment of Youth,* 2009). In other words, the notion that solitary confinement is a tool used solely to mitigate the offenses of violent incarcerated persons, or safeguard those who are most at-risk to violence— is categorically untrue. Perhaps, if the usage of solitary confinement was restricted to only violence-based offenses, the cells of "supermax" prisons would be less filled.

Notably, on any given day roughly 80,000 people nationwide are confined to isolation in prison, and this population includes a disproportionate number of minorities compared to the total prison population (Nolan & Amico, 2017; Strong et al, 2020). This bears no surprise, given that in systems of extreme power imbalances (i.e. carceral settings), those who are societally vulnerable (i.e. racial minorities; transgender communities; sexual minorities; mentally ill; and youths) will endure more violence compared to their dominant-group counterparts (i.e. white, cis, heterosexual incarcerated persons) (Rylko-Bauer & Farmer, 2016; Christie, 1997; Williams & Sternthal, 2010; Gee & Ford, 2011; and, Hatzenbuehler, 2016). Previous research studies concerning the long-term effects of solitary confinement demonstrate a clear institutional harm towards the health of

incarcerated persons regardless of social status. Explicitly, exposure to solitary confinement is linked to negative psychological conditions (severe and chronic depressive disorder, post-traumatic stress disorder (PTSD)) (Grassian, 2004); self-harm and suicidality (Haney, 2003; Grassian, 2004); hallucinations (Grassian, 2006); decreased brain function (Gendreau et al, 1972); and, hypertension (Williams et al, 2019).

An Emerging Movement

In 2011, the United Nations issued a decree denouncing the systemic usage of solitary confinement on incarcerated persons—citing the severe psychological and emerging physical harms as a human rights' violation (United Nations, 2011). In 2014, the United Nations released a report urging that the United States must reform its current use of solitary confinement, because by definitive standards it is tortuous (United Nations, 2014).

In the United States, the *American Civil Liberties Union* (ACLU) leads the *Stop Solitary Campaign*, in conjecture with other legislative and advocacy groups to abolish the use of solitary confinement across all U.S. jails and prisons (ACLU, 2014). The *Federal Anti-Solitary Taskforce* recently released a report (ACLU, 2014) calling for legislative, executive, and any authoritative action to end the "torture" of solitary confinement on federally incarcerated persons, U.S. Marshall services, and immigration detention centers. In Connecticut alone, a recent bill to remove solitary confinement (PROTECT Act) as a practice in Connecticut state prisons and jails passed the house and state senate; but, was vetoed by the Governor despite adequate support (Lyons, Connecticut Post). Such actions demonstrate an emerging movement to unequivocally address the validity and functionality of solitary confinement as a practice in correctional settings.

The Physical Pains of Solitary

Until recently, the literature that focused on health outcomes associated with solitary confinement were exclusive to the negative psychological manifestations (chronic depression, generalized anxiety, PTSD, suicidality, hallucinations, substance use as a coping mechanism) (Strong et al, 2020; Arrigo, Bersot, Sellers, 2011; Haney & Lynch, 1997; Grassian, 2006; Hagan et al, 2017). As a result, the *American Medical Association* called for the elimination of solitary confinement for individuals who are mentally ill, citing the exacerbation of existing chronic mental illness— further validating the mental health harms of the practice (*American Medical Association House of Delegates*, 2018).

The full impact of the health burden solitary confinement may impose, specifically the physical health impact, is progressively emerging as a necessary point of study. For example, recent research highlights how the living conditions (limited exercise, extreme isolation, diet) of solitary confinement are potential risk factors for cardiovascular diseases and hypertension (Williams et al, 2019). However, this area of research is relatively understudied; and, the causal pathway between solitary confinement and cardiovascular diseases (including risk factors) are still in need of further research. A recent literature review of incarcerated European women posited that advanced aging ("weathering") of the body, due to an increased stress load from omnipresent exposure to the carceral system was a contributor to the cause of cardiovascular diseases in the population (Grammatikopoulou et al, 2021). Another proposed pathway to heart disease acquisition among incarcerated persons, is the increased exposure or acquisition of communicable diseases (human immunodeficiency virus (HIV), opportunistic respiratory infections, hepatitis C) amongst the carceral population, which heighten an individual's vulnerability to cardiovascular disease threats (Grammatikopoulou et al, 2021; Moschetti et al, 2015; and, Bautista-Arredondo et

al, 2015). Thus, existing evidence suggests that solitary confinement conditions, in addition to the general carceral climate, exacerbate physical health conditions, ultimately, facilitating worse health outcomes—creating the case for a public health crisis.

Self-Efficacy: The Heart of the Matter

In addition to describing a potential ill within a given population, it is equally important to highlight positive mitigating factors and assets—such as measures of self-efficacy. Self-efficacy is a complicated facet of social cognitive theory (Bandura, 1997), as such there are myriad definitive parameters. However, in this instance, self-efficacy can be characterized as the ability for an individual to actualize; in other words, it is the ability to assert a sense of power and control over obstacles, as a means to take charge over one's health. Chronic disease management self-efficacy acts as a positive mediator to the adverse social and political stressors that facilitate worse health outcomes. While incarcerated individuals may exhibit self-efficacious behaviors, it may be difficult for self-efficacious behaviors to be fully realized within a prison. The prison environment constrains self-efficacy—rather, it is an antithetical conundrum for an individual, because prisons require individuals to relinquish their agency.

The prison environment is persistently and extensively stressful due to the constant threat of violence; the need to maintain high awareness; overcrowding; constant surveillance; social network strain; decrease in recreational and educational services; gang activity; frustrations with the judicial process; conflict with correctional staff; and, an inability to access health services (Porter, 2019; Zamble et al, 1988; and, Massoglia & Pridemore, 2015).

Further, numerous studies show that an increased allostatic load (the cumulation of chronic stress within the body) and overload are associated with poorer health outcomes (McEwen, 2012;

McEwen & Stellar, 1993; Guidi et al, 2021). More specifically, increased allostatic load and overload are linked to increased risk for cardiovascular disease—particularly, ischemic heart disease, coronary heart disease, and peripheral arterial disease (Gillespie et al, 2019; Sabbah et al, 2008; Nelson et al, 2007; and, Guidi et al, 2021).

Self-efficacious behaviors were prescribed as key starting points to construct interventions (and increase adherence) for heart disease management (Clark & Dodge, 1999). In an observational cohort study, researchers quantified the impact of self-efficacy changes (based on a questionnaire) over time on behavioral modifications: such as, physical activity, smoking behavior, alcohol consumption, and food choices (Sol et al, 2011). The study concluded that higher self-efficacy measures on the questionnaire were positively associated with increased physical activity and healthier food choices (Sol et al, 2011). Thus, current literature presents strong evidence that self-efficacy may be a valuable tool to mitigate cardiovascular disease risk factors among certain groups.

Self-Efficacy: Faith it Forward

However, self-efficacious behaviors are broad—and, as a singular entity pose difficulties for analytical studies because measures of self-efficacy may be person-specific. Furthermore, the validity of self-efficacy measures garner more internal validity with the measurement of biomarkers: for example, allostatic load, serum cholesterol levels, or systolic/diastolic blood pressure. Furthermore, it would be inept to generalize a particular self-motivating behavior from one population to another (i.e. geographical differences—New Haven residents to the New York City metropolitan area; or Black participants compared to white participants). In other words, not

only is it difficult to objectively measure self-efficacy, it is also difficult (if not inappropriate) to ever generalize such measures beyond the population in question.

Thus, recognizing the breadth of self-efficacy, researchers—such as Marcus et al (1992), developed a measure to assess confidence as means to overcome barriers to physical inactivity. Additionally, Sallis et al (1988) developed specific criterion for how one might evaluate self-efficacy within study participants. Explicitly, participants reported how confident they were based on their ability to: (1.) motivate themselves; (2.) continuously engage in healthy behaviors; and (3.), do so for at least a 6 months period. Notably, a randomized trial of southern middle-aged Black women assessed the viability of self-efficacy as a means to decrease the burden of hypertension, by way of inducing increased physical activity. The researchers concluded that self-efficacy (i.e. "confidence", "social support") has value as a health-promoting tool (i.e. continuing the healthy behavior over time); but, it was quintessential to identify a broader range of variables that correlate to self-efficacy (Martin et al, 2008). More importantly, self-efficacy variables need to be explicit and tested on a singular basis.

An individual's self-prescribed identity can act as a key indicator of how they practice self-efficacy in their daily lives—especially when faced with stressful situations (Bandura, 1997). A relatively understudied facet of self-identity is personal faith, or a modes of spirituality in an individual's daily life. Uniquely, the sterility of medical science is not designed to utilize the 'inward healing' of theological principles. As previously mentioned, health-focused areas of study may address self-efficacy in terms of dispositional factors, valued belief systems, and social support models (Valdecantos et al, 2021). However, research shows that there is a relationship between spiritual intelligence and self-efficacy (Rahmanian et al, 2018). Specifically, researchers posit that spirituality (a broad term which encompasses religious beliefs independent of religious

group) can occupy a decision-making role for the betterment of one's overall health (Rahmanian et al, 2018).

A Spiritual Suppressant

German sociologist and economic theorist, Karl Marx (1843) understood religion to be "the opium of the masses"—asserting that religious beliefs can (and will) disconnect marginal populations from their reality, disallowing them the wherewithal to engage in the business of progressive politics. Marx characterized religion as a tool of the oppressor to disillusion the oppressed about the true (unadulterated) nature of their social condition. However, structurally disadvantaged groups (women, racial minorities, sexual minorities, low-income) are very politically engaged. Formerly incarcerated persons face additional barriers to political engagement: in this context, systemic voter disenfranchisement is an extension of the carceral system in the United States (Uggen & Manza, 2002; Miles, 2004). But the assertion remains: structurally disadvantaged groups look to spiritual beliefs, as a means to cope with the disproportionate hardship and marginalization they face (Dill, 2017). But, by no means are members of disenfranchised groups ignorant to their current (and projected) position within the social hierarchy (Locke, 1987; Smooth, 2011; and, McGregor et al, 2019). Perhaps, there is cause for speculation that religion acts as a suppressant, rather than an opiate, amongst the masses.

For example, Christianity's place within the Black community throughout the tides of centuries-old oppression is convoluted. Slaveholders used evangelical biblical teachings to justify slavery to the enslaved Africans—often restricting their access to religion, by omitting and misrepresenting teachings of spiritual equality (Smith, 1972). It cannot be negated that Christianity was proslavery—much of the American Christian identity was wrapped up in a proslavery

theology (Burell, 2021; Smith, 1972), to justify the economic aspirations of the bourgeoise (while enshrining white proletariats with a distinction from a presumed lower class of people).

Despite contentious roots, religious gospel was embraced by Black communities, so that they may endure the horrors of beatings and rapes, separations and lynching(s), along with separate and unequal politics (Bailey & Snedker, 2011). In this example, for some individuals, Christian religious beliefs have been a source of comfort in times of great trials. Simply put, for some Black communities, spirituality has moonlighted as a source of self-efficacy for at least 400 years.

The New Haven Case

To our knowledge, this analysis is the first of its kind to explore the relationship between solitary confinement, cardiovascular disease risk factors, and quality of life among a population of New Haven, CT residents released from prison or jail. Moreover, because the experience between chronic conditions and younger adults is both underexplored and unclear, this analysis explicitly reviews the health of younger populations (in addition to all ages). Furthermore, the presence of chronic conditions is correlated with depressive symptoms and substance use disorders (Fishbain, Cutler & Hubert, 1997; Hser et al, 2017; and, Bronson, Stroop, Zimmer & Berzofsky, 2017)— both of which, disproportionately impact individuals who have a previous history of incarceration compared to the general population. Therefore, this analysis also explores the relationship between solitary confinement and anxiety disorders' symptoms, among a population of New Haven, CT residents released from prison or jail. Thus, the relationship between mental health disorders and physical chronic condition comorbidities is examined.

Finally, this analysis explicitly evaluates the role of spirituality as a mitigating factor of the health outcomes in question that reach beyond a diagnosis (anxiety disorders symptoms, quality

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of life). Anthropological studies identified spirituality as a coping mechanism for African Americans weathering chronic stress induced by institutionalized racism (Greer & Cavalhieri, 2019; and, Dill, 2017). Given the racial demographic of the source population is more than 50% Black, predominately men, and were subjected to the misgivings of mass incarceration (a form of systemic racism)—there is sufficient rationale for exploring spirituality (independent of religious group identification) as a self-efficacy variable, that may attenuate a possible relationship between disease prevalence (or quality of life) and solitary confinement.

HYPOTHESIS:

Primary:

Solitary confinement exposure during participants' most recent incarceration will be associated with self-reported cardiovascular disease risk factors, relative to individuals who were not exposed to solitary confinement during their most recent incarceration.

Secondary:

Solitary confinement exposure will be associated with self-reported anxiety disorder symptoms and quality of life for people who have been incarcerated. Further, it is hypothesized that an interaction between spirituality (as a mode of self-efficacy) and solitary confinement exists, and will modify self-reported anxiety disorder symptoms in the sample population.

METHODS

Study, Design, & Setting

The data utilized in this analysis derived from the Justice, Housing and Health Study (JustHouHS), which was conducted in New Haven, CT. The purpose of this larger study was to examine the intersectionality between housing, mass incarceration, and health among low-income New Haven residents. For the purpose of the JustHouHS study: low-income New Haven residents were defined as individuals who were homeless, received food or housing assistance within the past year, Medicaid health insurance, or resided in a census tract area where more than 20% of residents live below the poverty line. Explicitly, given this study's particular focus on the social and health effects of mass incarceration, the sample was stratified to include 200 individuals released from prison or jail within one year from the date of screening.

The City of New Haven has approximately 130,000 residents (U.S. Census Bureau, 2019)—and, 400 participants were recruited for the study, and survey data was collected from September 2017 to June 2021. The JustHouHS study was a survey, conducted longitudinally, where participants took a baseline survey between September 2017-March 2018; and, then returned to take a follow-up survey every six months (allowing for a total of five surveys). Additionally, a subset population (N = 54) completed qualitative interviews every six months.

The eligibility criteria of participants were as follows: 18 years of age or older, a resident of the city of New Haven, no household members already enrolled in the study, and low income. While, at least half of the enrolled participants met the additional criterion for a recent release from prison or jail. The date of participants' release and subsequent controlling charge was verified, using publicly available sentencing information on Connecticut's judicial branch website. Participants were recruited using publicly displayed flyers, outreach to local service providers,

community meetings and snowball sampling. Participants were screened by telephone during the enrollment period (September 2017 to March 2018); as a result, 145 of the 616 individuals screened were not eligible for the study. Additionally, 71 individuals chose not to enroll.

The survey used a total of 523 questions in baseline, 443 in follow up one, 470 in follow up two, 477 in follow up three, and 485 in follow up four. The surveys were computer-based, administered from a centrally located office in New Haven, CT—and, the Qualtrics estimated times to completion were 1.8 hours for baseline and roughly 1.5 hours for follow-ups. However, to reduce potential loss to follow up, the survey was made available via a link that could be accessed on a smart phone or personal computer. Also, participants could choose to take the survey over the phone with a member of the research team.

The survey included questions on: demographics, social communal engagement, economic indicators, criminal justice history, mass surveillance, housing, sexual relationships, substance use, family history, health, HIV/AIDS knowledge with risk related behaviors, trauma, spiritual beliefs, and opinions concerning the police (and broader carceral system). The survey followed 'skip logic': meaning, some questions were not asked of all participants, based on their previous answers.

Thus, all answers to survey questions are self-reported without cross-validation. However, respondents' birthdates were used to ascertain participant had become incarcerated via weekly web scrapes of the *Connecticut Department of Corrections* website. The web checks provided an independent, verifiable record of incarceration and parole experiences of the participants. Moreover, the web checks allowed for differentiations between participants that were lost to follow up from those that could not take one or more follow up surveys due to incarceration. When a

participant was found to be incarcerated, research staff sent reminders about upcoming appointments to the participant at the prison facility where they were located.

Respondents received $50 in compensation for each survey and interview they completed. The retention rates for the survey varied: where follow-up one had 80% retention, follow-up two had 77% retention, follow-up three had 78% retention, follow-up four had 77% retention, and follow-up five had 65% retention. However, 64.75% of all participants completed all 5 surveys.

Analysis: Source Population

For the purpose of this examination, survey responses were restricted to baseline measures (September 2017-March 2018) to achieve a robust analysis of the source population. For this analysis, the study population (initially 400 participants) was restricted to participants (men and women) who reported to having a history of incarceration (N=302 participants). The survey sections of interest to this analysis included: demographics, criminal justice history, health status, and spiritual beliefs.

Exposure Variable: Solitary Confinement

The primary independent variable (exposure) was solitary confinement. It is a dichotomous variable, to which respondents either responded 'yes' or 'no', to ever being placed in solitary confinement during their most recent incarceration.

Health Outcome Measures: CVD Risk Factors

Given that this analysis focus exclusively on the JustHouHS baseline survey measures, it then operates as a cross-sectional measure of relative risks. The primary health outcome of interest was a dichotomous composite outcome. Explicitly, a diagnosis of cardiovascular disease risk factors (CVDRF) defined as self-reported hypertension, obesity, and diabetes mellitus (independent of type 1 or type 2) were analyzed together for three reasons.

First, hypertension, obesity, and diabetes are closely related on the risk set of cardiovascular disease—clinically, it is characteristically common that an individual can simultaneously experience two or three of the specified health conditions (Buddeke et al, 2019; Kendir et al, 2019). According to the *Connecticut Department of Public Health* (CT DPH) (2015), cardiovascular disease was surveilled as the leading cause of death for Connecticut residents. Furthermore, Black men and women had higher age-adjusted mortality rates from heart diseases, compared to their white and Hispanic counterparts (CT DPH, 2015). Black individuals comprise roughly 33.6% of the New Haven, CT population (U.S. Census Bureau, 2019). Moreover, the selection of low-income residents with carceral system exposure, creates a unique health analysis for a vulnerable population that may yield clinical significance for the region. Second, hypertension, obesity, and diabetes (specifically type 2) are modifiable cardiovascular disease risk factors. Thus, there lies an opportunity to devise targeted preventative and intervention methods (within the carceral system, and upon reentry) to decrease CVDRF incidence and burden on the population of analysis. Third, the composite outcome acted as a means to maximize the number of observations for statistical efficiency to detect an effect.

Health Outcome Measures: Anxiety Disorders

A second health outcome of interest was a composite anxiety disorder outcome: defined as self-reported generalized anxiety, obsessive-compulsive (OCD), and post-traumatic-stress disorder (PTSD). In addition to a asking respondents, 'had you ever been diagnosed'—participants were also prompted to the question, *'had you experience symptoms in the last six months'* question to gain a fuller understanding of the immediate health burden on the population. This variable was dichotomous. This analysis of anxiety disorders explicitly focuses on symptoms of anxiety that were experienced within the last 6 months of the survey. The composite for anxiety disorders increased the number of observations, thereby increasing an ability to detect an effect.

Health Outcome Measures: Quality of Life

The third health outcome of interest, 'impaired daily activity', which derived from the survey question: *do you have any problems with your physical health that limit your work or daily activities?* This outcome of interest was dichotomous; but, it is not a definitive health outcome. Rather, it is a quality of life metric that is tied to physical health. This survey question, unlike CVDRF and anxiety disorders, is independent of a diagnosis question. Impaired daily activity sought to analyze the quality of life among the source population, as it relates to their health experience.

Variable Measurement

Additional covariates were: race/ethnicity, marital status, age, sex, and physical chronic conditions. Race/ethnicity was a categorical variable—categorized for Non-Hispanic white (reference), Non-Hispanic Black, and 'Other'. Alternative survey variations that accounted for

Native-American race, Hispanic/Latinx, and Asian could have potentially led to fine categorization that would have too few observations for health outcomes. The sex variable was dichotomous for female. Marital status was categorical: never married (reference), currently married, divorced or separated, and widowed were the groups.

Smoking and alcohol consumption were used in the model given the precedent that these behaviors has as risk factors of cardiovascular disease. Smoking status was a binary variable ('yes/no'). It was adopted from the survey question that asked participants: *"how soon after waking do you smoke your first cigarette?"* This question allowed for smoking status to reflect current smoking habits at the time of survey. Alcohol consumption was a continuous variable, measured in days (out of past 30 days) at which the participant reported to consuming alcohol. Thus, the highest measurement was 30, and the lowest was 0 days within the past month.

Age (years) was categorical: participants were stratified as 20-29, 30-39, 40-49, 50-59, and 60-70. The younger ages, 20-29 and 30-39 were used as the reference for CVDRF and impaired daily activity outcome models; because, physical health conditions tend to manifest at older ages. However, the anxiety disorders outcome sought to detect a potential effect amongst younger groups. Age categorization was chosen to assess the extent that carceral system exposure has on the health of younger age-groups, in addition to older groups. The younger age categories provided an opportunity to detect and describe explicit differences between younger and older groups, that may not be as apparent if age was continuous.

Physical chronic conditions (independent of CVDRF) were defined as: asthma, epilepsy, cardiovascular disease, arthritis, chronic obstructive pulmonary disease (COPD), chronic pain, cancer, and physical disability. Physical chronic conditions underwent two distinct operationalizations. Descriptive statistics and the CVDRF regression model categorized chronic

conditions as either 0, 1, or ≥2 chronic physical conditions. However, anxiety disorders and impaired daily activity models used dichotomized chronic conditions—either participants reported 'yes' or 'no' to having any physical chronic condition. Explicitly, the anxiety disorder regression model used the binary chronic condition variable without hypertension. Instead, hypertension was analyzed as a singular independent variable (binary) given the bidirectional associations between anxiety disorders and hypertension in previous cross-sectional studies (Player & Peterson, 2011).

Spirituality Operationalization

The spirituality variable was operationalized from participant composite responses based on the following Likert scale where 1 was strongly disagree and 4 was strongly agree. The participant Likert-scale responses were in reference to 10 questions that were asked in the survey. The statements were:

i.   My religious faith/spirituality is extremely important to me.

ii.   I pray daily.

iii.   I look to my faith/spirituality as a source of inspiration.

iv.   I look to my faith/spirituality as providing meaning and purpose in my life.

v.   I consider myself active in my faith/spiritual community.

vi.   My faith/spirituality is an important part of who I am as a person.

vii.   My relationship with God is extremely important to me.

viii. I enjoy being around others who share my faith/spirituality.

ix.   I look to my faith/spirituality as a source of comfort.

x.   My faith/spirituality impacts many of my decisions.

Each participants' sum score for spirituality was measured, ranging from the lowest possible value of 10 points to the highest possible value of 40 points. As a result, participants' spirituality score was measured as a continuous variable. While the effect that variables such as 'age' may have on the acquisition or prevalence of disease in a given population is well-researched; the relationship between self-reported spirituality and anxiety symptoms is less clear. Thus, utilizing spirituality as a continuous variable, allowed for a more robust examination of any affect it may have on self-reported symptoms of anxiety among survey participants. Furthermore, spirituality as a continuous variable allowed for easier comparisons of spirituality scores amongst both health interests (anxiety disorders, and impaired daily activity) and interactions with solitary confinement in this analysis.

Statistical Analyses

In the analysis, a cross-sectional application of the survey baseline measures (Fall 2017 – March 2018) was applied; thus, measures of risk were limited to relative risk measurements comparing the exposed (solitary confinement) and unexposed (general carceral population) groups. A modified Poisson regression model applying the GENMOD procedure was used for dichotomous outcome variables assuming a binomial distribution. The stepwise methodology was applied to each modified Poisson regression to capture the most parsimonious model. Additional covariates, such as age, race, marital status, chronic conditions, smoking, alcohol consumption days, and sex were used in each modified Poisson adjusted regression model to control for possible confounding. However, both health outcomes (anxiety disorders, and quality of life) were applied to differing regression models as a covariate. Additionally, fisher's-exact (sample size < 500) analyses for

associations between variables were implemented, and p-values were reported. The significance level of effect was at the 0.05 alpha level. All statistical analyses used SAS v. 9.4 software ® (2020).

The analyses for the spirituality variable required nonparametric methods, due to a UNIVARIATE analysis that demonstrated the survey data to be non-normal with a Shapiro-Wilks criteria (p-value *< 0.0001).* Therefore, a T-TEST or ANOVA analysis would draw inappropriate conclusions given the survey data's limitations. However, the mean spirituality score for each health outcome of interest was calculated, as a means to provide evidence for: (a.) possible inordinate differences between the perspective groups, and (b.) insight as into which group had the systematically higher or lower spirituality score. The Wilcoxon Rank Sum test and the Wilcoxon median test were used to test for differences in the spirituality factor between the two groups for each health outcome. The null hypothesis for the Wilcoxon rank sum test: states there is no difference in location for the spirituality scores among respondents with the binary health outcome of interest (CVDR, anxiety disorders, impaired daily activity) and respondents without the health outcome of interest. Whereas the Wilcoxon median tests analyze differences in location above the median for spirituality scores between the two groups of each binary health outcome.

Thus, at best the WILCOXON test can only demonstrate whether there are statistically significant differences in location in participants' spirituality scores for those with the health outcome of interest, and those without the health outcome. The results of each Wilcoxon test for the health outcomes of interest informed applications to the modified Poisson regression models for measures of risk—independent from the solitary confinement and spirituality interaction applied to the anxiety disorders modified Poisson regression model. The continuous spirituality

variable was used as a model covariate and a possible interaction term for other covariates that proved statistically significant at the alpha 0.05 level.

RESULTS

Table 1. **Frequencies of Self-Reported Characteristics for Sample Population**

Characteristic	N (%)
Sex	
Female	66 (22.0)
Male	236 (78.0)
Race/ethnicity	
White	81 (27.0)
Black	193 (64.0)
Other	28 (9.0)
Age (years)	
20-29	33 (11.0)
30-39	66 (22.0)
40-49	93 (31.0)
50-59	79 (26.0)
60-70	31 (10.0)
Marital Status	
Never married	169 (56.0)
Married	24 (8.0)
Separated or divorced	75 (25.0)
Widowed	34 (11.0)
Smoking Status	
Yes	193 (64.0)
No	109 (36.0)
Alcohol Consumption Days [a]	3.5±7.16
Impaired Daily Activity	
Yes	102 (34.0)
No	200 (66.0)
Solitary Confinement [b]	
Yes	175 (58.0)
No	121 (40.0)
Anxiety Disorders [c]	
Yes	103 (34.0)
No	199 (66.0)
CVD Risk Factors [d]	
Yes	119 (39.0)
No	183 (61.0)
Physical chronic conditions (total) [e]	
0	154 (51.0)
1	84 (28.0)
≥2	64 (21.0)

Table 1.

Among the 302 participants included for analysis, males (78%) were overrepresented within the population compared to females (22%). Additionally, Black participants comprised 64% of the population, while 27% of participants identified as white, and 9% of participants were categorized into the 'Other' race category. The majority of study participants fell within the middle-adulthood range. Specifically, 31% of participants were between 40-49 years of age; then, 26% of participants were between 50-59 years of age; and, 22% of participants fell between 30-39 years of age. Whereas, 11% of participants were 20-29 years of age, and only 10% of participants were 60-70 years of age. Interestingly, 65% of participants reported to never being married—while 25% were separated or divorced. Also, 11% of participants were widowed, and only 8% of participants reported to being currently married at the point of survey.

The sample population was predominately composed of current smokers (64%), compared to participants that reported to not smoking cigarettes at the point of study (36%). Furthermore, the drinking habits of the sample population were relatively low—specifically, within the past 30 days of the survey, participants reported to consuming alcohol 3.5 days, on average. However, it should be noted that the data concerning alcohol consumption is not normal *(Shapiro-Wilk Test: < 0.0001);* as such, values concerning the average amount of days for alcohol consumption (within the past month) must be cautiously examined. Nevertheless, 201 (67%) participants reported to 0

days of consuming alcohol (within the past month); whereas the highest proceeding frequency was 14 participants (4.64%).

Altogether, 28% of study participants reporting to having one diagnosed chronic condition; and, 21% of participants reporting to have two or more physical chronic conditions. Altogether, 49% of participants were diagnosed with a physical chronic condition, compared to 51% of participants who reported to not have any physical chronic condition diagnosis.

For solitary confinement, the primary predictor variable, 58% of participants reported to experiencing solitary confinement during their most recent incarceration stay. As the primary outcome of interest, cardiovascular disease risk factors were reported amongst 34% of participants at the time in which they completed the survey. Additionally, 34% of individuals reported to experiencing anxiety disorder symptoms (with a self-reported anxiety disorder diagnosis) within the last six months of the time at which the survey was completed.

Table 2. **Descriptive differences in mean spirituality (continuous) for Binary Outcomes**

Characteristic	Spirituality Scale[†]
Solitary Confinement	
No	**29.3**±8.9
Yes	**30.0**±9.1
Impaired Daily Activity	
No	**28.9**±9.0
Yes	**31.1**±9.1
Anxiety Disorders [a]	
No	**29.5**±9.0
Yes	**28.8**±9.4
CVD Risk Factors	
No	**29.4**±9.3
Yes	**29.9± 8.7**

[a] *Generalized anxiety, OCD, and PTSD comprise anxiety disorders (symptoms in past 6 months)*
[†] *[mean spirituality score ±SD], 10 (minimum) – 40 (maximum)*

Table 2.

An analysis to compare the differences in the mean spirituality between the binary [no/yes] groups was inappropriate, given the non-normality of the distribution surrounding the spirituality variable. Thus, p-values (associated with a T-Test & Anova) at the alpha 0.05 significance level were not reported. But it is important to view descriptive characteristics of the spirituality scores amongst survey participants of differing groups.

Participants who reported solitary confinement exposure during their most recent incarceration stay had a marginally higher mean spirituality score (30.0±9.1), compared to

individuals who reported no solitary confinement exposure (29.3±8.9). Interestingly, individuals who did not report to having anxiety disorder symptoms in the last six months had a higher mean spirituality (29.5±9.0) score than individuals who reported to anxiety disorder symptoms (28.8±9.4). The mean spirituality score for individuals who reported to having a CVDRF (29.9± 8.7) and without a CVDRF (29.4±9.3) is nearly the same between the two groups.

However, impaired daily activity (by way of physical health) demonstrated an increased difference between mean spirituality scores of the two groups. Specifically, individuals who reported to having impaired daily activity due to their physical health demonstrated a higher mean spirituality (31.1±9.1) score, compared to individuals who did not report impaired daily activity (28.9±9.0).

Nevertheless, it is important to highlight that amongst all binary variables, the mean spirituality scores are relatively high—given that 40.0 is the maximum score, and 10.0 is the minimum score a participant could report.

Table 3. **Impaired Daily Activity Mean Rank Analysis**

Characteristic	Mean Rank Score	p
Impaired Daily Activity		0.0233
No	142.87±709.80	
Yes	166.87±709.80	

Table 3.

The differences for meaningful shifts in the location of the mean rank score (assigned by the Wilcoxon test), between individuals who reported impaired daily activity and those who did not report impaired daily activity was statistically significant (0.0233). Explicitly, individuals who responded 'yes' to impaired daily activity had a higher mean rank score (166.87±709.80) than individuals who responded 'no' to impaired daily activity (142.87±709.80). Thus, the statistically significant p-value (0.0233) indicates that the location of spirituality scores is not the same for two populations (of unequal numbers). Instead, the data suggests that there are significant differences in the location of spirituality scores amongst individuals who reported impaired daily activity and participants who did not report impaired daily activity.

Table 4. **Impaired Daily Activity Median Score Analysis**

Characteristic	Median Score[†]	p
Impaired Daily Activity		0.0447
No	0.4600±3.79	
Yes	0.5730±3.79	

† Number of scores above the median

Table 4.

The differences in the location above the median for spirituality scores amongst the two groups (participants who reported impaired daily activity vs. without reported impaired daily activity) were statistically significant (0.0447). Individuals who reported impaired daily activity had a

slightly higher median score (0.5730±3.79), compared to individuals who reported no impaired daily activity (0.4600±3.79). Given the evidence, it can be cautiously inferred that there are statistically significant differences in the location above the median for spiritualty scores amongst participants with and without reported impaired daily activity.

Given the Wilcoxon test analyses ability to demonstrate statistically significant differences in the locational shifts in spiritualty scores—the directionality of those differences require further independent examinations due to the limitations of the nonparametric methods. As such, univariate analyses on the impaired daily activity variable, modeled for individuals who responded 'yes' to having impaired daily activity (due to their physical health) was negatively skewed. Specifically, the estimated skewness was -1.007—resulting from spirituality scores being heavily concentrated on the right side (higher spirituality scores) of the distribution.

Table 5.
Unadjusted Associations for Cardiovascular Disease Risk Factors *(hypertension, obesity,*
and diabetes)

Characteristic	N	n (%) with Cardiovascular Disease Risk Factors * [n = 119]	p[†]
Race/ethnicity			0.5941
White	81	30 (25.0)	
Black	193	80 (67.0)	
Other	28	9 (8.0)	
Age (years)			<.0001
20-29	33	0 (0.0)	
30-39	66	11 (9.0)	
40-49	93	40 (34.0)	
50-59	79	49 (41.0)	
60-70	31	19 (16.0)	
Sex			0.1578
Female	66	31 (26.0)	
Male	236	88 (74.0)	
Marital Status			0.0785
Never married	169	57 (48.0)	
Married	24	11 (9.0)	
Separated or divorced	75	38 (32.0)	
Widowed	34	13 (11.0)	
Smoking Status			0.6258
Yes	193	74 (62.0)	
No	109	45 (38.0)	
Solitary Confinement			0.8088
Yes	175	70 (60.0)	
No	121	46 (40.0)	
Impaired Daily Activity			0.0008
Yes	102	54 (45.0)	
No	200	65 (55.0)	
Anxiety Disorders [a]			0.6195
Yes	103	43 (36.0)	
No	199	76 (64.0)	
Physical chronic conditions [b]			0.0001
0	172	57 (48.0)	
1	82	30 (25.0)	
≥2	48	32 (27.0)	

Table 5.

Cardiovascular disease risk factors were most prevalent amongst Black participants (67%). Also, 25% of white participants reported CVD risk factors; and, only 8% of participants classified under the 'Other' race category reported to a cardiovascular disease risk factor diagnosis.

The prevalence of CVD risk factors amongst age group was statistically significant *(p <.0001)*—ages [50-59] had the highest prevalence of CVDRF at 41%. Additionally, relationship between CVD risk factors and impaired daily activity was statistically significant *(p = 0.0008):* explicitly, 55% of participants with impaired daily activity did not report to any CVD risk factor. Notably, the burden of cardiovascular disease risk factors was higher among those who reported two or more physical chronic conditions (27%), compared to those who reported one chronic condition (25%). Altogether, individuals who reported any physical chronic condition (independent of any CVDRF) comprised 52% of CVDRF, compared to those without a physical chronic condition (48%); and, the differences between the groups were statistically significant *(p = 0.0001).*

Moreover, CVD risk factors were most prevalent amongst males (74%) than females (26%). Participants who were never married comprised the highest prevalence (48%) of CVD risk factors; whereas, participants who reported to separation or divorce comprise the second largest proportion (32%) of CVD risk factors. Among the participants who reported to smoking cigarettes (at the time of survey), 62% of them also reported a diagnosed cardiovascular disease risk factor; but, it was statistically insignificant *(p = 0.6258).* A Wilcoxon ranked sum test (not pictured) was conducted for alcohol consumption days (given the non-normality); and, the two-sided p-value for

significant differences in location of alcohol consumption days for those with (and without) CVDRF was insignificant *(p = 0.3882).*

Among individuals who reported solitary confinement exposure, 60% of those participants reported a cardiovascular disease risk factor. Individuals without a history of solitary confinement comprised 40% of cardiovascular disease risk factors. Lastly, 36% of participants who reported to having anxiety disorder symptoms (within the last six months) also reported a cardiovascular disease risk factor.

Table 6.
Adjusted Relative Risks estimates associated with Cardiovascular Disease Risk Factors
(hypertension, obesity, and diabetes mellitus)
[Multivariable Modified Poisson Regression Model] (N= 302)

Characteristic	Adjusted RR (95% CI)	p[†]
Age (years)		
20-39	1.00	---
40-49	4.33 (2.22, 8.45)	<.0001
50-59	6.30 (3.28, 12.10)	<.0001
60-70	6.19 (3.06, 12.54)	<.0001
Solitary Confinement		
No	1.00	---
Yes	1.09 (0.84, 1.41)	0.5300
Smoking Status		
No	1.00	---
Yes	0.98 (0.76, 1.27)	0.8918
Alcohol Consumption Days	0.99 (0.97, 1.01)	0.3232
Physical chronic conditions		
0	1.00	---
1	0.96 (0.69, 1.35)	0.8329
≥2	1.52 (1.15, 2.00)	0.0028

† P-value for modified Poisson regression

Table 6.

There was a clear association between increased age of the participants and the risk of reporting cardiovascular disease risk factors that was statistically significant *(p <.0001)* at all age groups relative to 20-39 aged participants. The risk of participants who were 40-49 years-old of reporting a cardiovascular disease risk factor was 4.33 times the risk[CI: 2.22-8.45] of participants who were ages 20-39. The risk of participants who were ages 50-59 years of reporting a cardiovascular disease risk factor was 6.30 times the risk [CI: 3.28-12.10] of participants who were 20-39 years-old of reporting cardiovascular disease risk factors. While participants between 60-70 years of age were 6.19 times more likely [CI:3.06-12.54] of reporting a CVD risk factor, compared to individuals who were 20-39 years-old. Notably, the confidence intervals for each age group is quite wide: the standard error ranged from 1.48 – 2.01, indicating that the risk measurement is not precise. However, the RR estimate undeniably indicates an increased risk for self-reported CVDRF, for older ages (compared to those 20-39 years) in the sample.

Participants who reported one physical chronic condition (independent of CVD risk factors) were 0.96 times more likely [CI: 0.69 – 1.35] to report CVDRF, compared to participants who reported zero physician chronic conditions. However, individuals who reported to being diagnosed with two or more physical chronic conditions had 1.52 times the risk [CI: 1.15-2.00] of reporting CVDRF, compared to those who had zero physical chronic conditions—and, the estimate was statistically significant *(p = 0.0028).* The smoking status of participants was statistically insignificant *(p = 0.8918),* with an estimate of 0.98 [CI: 0.76 – 1.27]. Additionally, alcohol consumption days was insignificant (0.8918) for evaluating risks associated with anxiety disorder symptoms' (in the past six months).

Among participants who reported exposure to solitary confinement during their most recent incarceration experience, individuals with a history of solitary confinement were 1.09 times more likely [CI: 0.84-1.41] to report a cardiovascular disease risk factor compared to those without solitary confinement exposure. Thus, highlighting a statistically insignificant relationship (p = 0.5300) between solitary confinement and self-reported prevalence of cardiovascular disease risk factors among this sample population.

Table 7. **Solitary confinement x Cardiovascular Disease Risk Factors**

Characteristic	n (%) Solitary Confinement [n = 175]
CVD Risk Factor	
No [n = 180]	105 (58.0)
Yes [n = 116]	70 (60.0)

Notably, *table 7* depicts the distribution of CVD risk factors among the solitary confinement variable more explicit to gain a detailed understanding of the relationship between the two variables. Specifically, 58% of people who reported 'no' to having been diagnosed with a CVD risk factor also reported solitary confinement status during their incarceration stay. While, 60% of those reported 'yes' to having been diagnosed with a CVD risk factor also had exposure to solitary confinement during their incarceration stay. Thus, as it relates to differences across the health

outcome (CVD risk factors) among those with and without a history of solitary confinement—the

two groups have very comparable exposures of solitary confinement.

Table 8.
Adjusted Relative Risk estimates associated with Anxiety Disorders *(generalized anxiety disorder, obsessive-compulsive disorders, and post-traumatic stress disorder symptoms, within the past six months)*
[Multivariable modified Poisson Regression Model] (N= 302)

Characteristic	Adjusted RR (95% CI)	p[†]
Age (years)		
20-29	1.00	---
30-39	2.09 (1.04, 4.19)	0.0374
40-49	1.55 (0.76, 3.17)	0.2280
50-59	1.22 (0.57, 2.62)	0.6111
60-70	1.03 (0.39, 2.75)	0.9532
Race		
White	1.00	---
Black	0.48 (0.34, 0.66)	<.0001
Other	0.67 (0.38, 1.58)	0.1498
Solitary Confinement		
No	1.00	---
Yes	**2.89 (0.91, 9.20)**	**0.0730**
Smoking Status		
No	1.00	---
Yes	1.20 (0.85, 1.70)	0.3008
Alcohol Consumption Days [a]	1.00 (0.98, 1.02)	0.7252
Spirituality Score	**1.04 (1.01, 1.07)**	**0.0244**
Hypertension		
No	1.00	---
Yes	1.26 (0.92, 1.73)	0.1493
Physical chronic condition[†]		
No	1.00	---
Yes	1.36 (1.01, 1.83)	0.0429

[a] Days alcohol was consumed, within the past 30 days

Table 8.

Individuals who were ages 30-39 were 2.09 times [CI: 1.04-4.19] more likely to report having anxiety disorder symptoms (within the past six months), compared to those who were 20-29 years old—and, this estimate was statistically significant (*p = 0.0374*). However, individuals who were older acquired statistically insignificant relative risk estimates for anxiety disorders, compared to participants who were 20-29 years of age. More specifically, participants 40-49 years were 1.55 times the risk [CI: 0.76-3.17]; individuals 50-59 had 1.22 times the risk [CI: 0.57-2.62]; and, those 60-70 years-old had a relative risk estimate of 1.03 [CI: 0.39-2.75] of anxiety disorders (symptoms within the last six months), compared to participants aged 20-29 years.

Black participants had an overall decreased risk of reported anxiety disorders among the population, and their risk was statistically significant *(<.0001)*. Explicitly, Black participants had 0.48 times the risk [CI: 0.34-0.66] of reporting anxiety disorder symptoms, compared to white participants. Yet, 'Other' race category participants yielded a statistically insignificant relative risk estimate of 0.67 [CI: 0.38-1.58] for reporting anxiety disorders symptoms, compared to their white counterparts.

Participants who reported solitary confinement were 2.89 times more likely [CI: 0.91-9.20] to report anxiety disorder symptoms, compared to individuals who did not report solitary confinement during their most recent incarceration stay. Smoking status among anxiety disorders was statistically insignificant *(p = 0.0730)*. Participants who smoked cigarettes were 1.20 times more likely [CI: 0.85-1.70], than participants who did not smoke cigarettes of reporting an anxiety disorder symptom (within the past six months). Additionally, alcohol consumption was a statistically insignificant covariate for predicting the anxiety disorder risks *(p = 0.7252)*.

Further, the spirituality scores (10 – 40) of participants were marginally significant, given the confidence interval [1.01-1.07] *(p = 0.0244)*. Explicitly, individuals with reported higher scores of spirituality were 1.04 times more likely to report anxiety disorder symptoms within the past six months, compared to participants who reported lower spirituality scores. However, it must be noted that an interaction term between solitary confinement and spirituality scores was applied to the model that assessed the risks associated with anxiety disorder symptoms (within the past six months). The interaction term between solitary confinement and spirituality scores was 0.96 [CI: 0.93-1.01], with a p-value of 0.0541. The interaction term remained in the model, due to the interaction being a variable of interest from the *apriori*-established hypothesis.

Given the unique relationship between hypertension and anxiety disorder symptoms, hypertension was independently analyzed from other physical chronic conditions. Individuals who reported a diagnosis of hypertension was 1.27 times more likely [CI: 0.92-1.74] to report anxiety disorder symptoms, compared to those who did not report a history of hypertension. However, individuals who reported to having any physical chronic condition (except for hypertension) were 1.41 times more likely [CI: 1.04-1.91] to report to experiencing anxiety disorder symptoms, compared to those who reported zero physical chronic conditions—with statistical significance of *0.0253*.

Table 9.
Adjusted Relative Risks estimates associated with Impaired Daily Activity *(by a means of physical health)*
[Multivariable modified Poisson Regression Model] (N= 302)

Characteristic	Adjusted RR (95% CI)	p[†]
Age (years)		
20-39	1.00	---
40-49	1.73 (1.07, 2.78)	0.0239
50-59	1.76 (1.05, 2.97)	0.0321
60-70	1.97 (1.12, 3.49)	0.0195
Solitary Confinement		
No	1.00	---
Yes	0.89 (0.66, 1.20)	0.4383
Smoking Status		
No	1.00	---
Yes	1.05 (0.77, 1.45)	0.7720
Alcohol Consumption Days [a]	1.02 (1.01, 1.03)	0.0041
Spirituality Score (SS)	1.01 (0.99, 1.03)	0.1947
Hypertension		
No	1.00	---
Yes	1.20 (0.89, 1.63)	0.2358
Anxiety Disorders [b]		
No	1.00	---
Yes	1.43 (1.06, 1.93)	0.0177
Physical chronic condition[†]		
No	1.00	---
Yes	2.03 (1.41, 2.93)	0.0001

[a] *Days alcohol was consumed, within the past 30 days*
[b] *Generalized anxiety, OCD, and PTSD comprise anxiety disorders (symptoms in past 6 months)*
† *Physical chronic condition excludes hypertension*

Table 9.

Across all age groups, increasing age (years) was associated with statistically significant increased risks for reporting impaired daily activity. Individuals who were ages 40-49 years had 1.73 times the risk [CI: 1.07-2.78], than those ages 20-39 years of reporting impaired daily activity (due to their physical health). Additionally, individuals who were 50-59 and 60-70 years were 1.76 [CI: 1.05-2.97] and 1.97 [1.12-3.49] times more likely to report impaired daily activity, compared to participants who were 20-39 years, respectively.

The participants' smoking status yielded a statistically insignificant risk measurement (1.05). However, the alcohol consumption days of participants was statistically significant ($p = 0.0041$). Individuals who reported higher alcohol consumption days were 1.05 times more likely to report to experiencing impaired daily activity. However, it must be noted that at best, the days of alcohol consumption is very weak risk association measurement. Additionally, the spirituality scores of participants was statistically insignificant (*p = 0.1947*), with a measured risk of 1.01 [CI: 0.99-1.03].

Also, participants who reported to hypertension had an estimated 1.20 times the risk [CI: 0.89-1.63] of reporting impaired daily activity, compared to participants without a history of hypertension; yet, the risk measurement was statistically insignificant (*p = 0.2358*). However, participants who reported to having anxiety disorder symptoms (within the past six months) had 1.43 times the risk [CI: 1.06 – 1.93] of reporting impaired daily activity, compared to those who did not have a reported anxiety disorder (symptom) (*p = 0.0177*). Participants who reported to having at least one physical chronic condition (independent of hypertension) were 2.03 times more likely [CI: 0.0001] to report to impaired daily activity, compared to individuals with zero chronic conditions.

Additional analyses of a spirituality and anxiety disorders symptom interaction term was applied to the model (given the results from the Wilcoxon Rank Sum test); but, was removed due to its negative affect on the model's overall fit. The interaction term between spirituality scores and anxiety disorders yielded a risk of 0.97 [CI: 0.94-1.01]—and, the reported p-value was 0.1868. Thus, in the effort to achieve the most parsimonious model, in addition to decreasing further extrapolations of the anxiety disorder variable, the interaction term was removed. For the sake of further exploration between solitary confinement and spirituality scores—the interaction term between the two variables was applied to the modified Poisson regression. The solitary confinement and spirituality interaction relative risk estimate was 0.98 [CI: 0.95-1.02], with an insignificant p-value of 0.3369. The term was not included in the final analysis.

DISCUSSION

Solitary Confinement & Cardiovascular Disease Risk Factors

According to fisher's exact analysis, there was not an association between solitary confinement and cardiovascular disease risk factors (hypertension, diabetes, and obesity) (CVDRF). The p-value of 0.8088 (two-tailed fisher's exact test) was statistically insignificant at the alpha 0.05 significance level. Additionally, the crude relative risk estimate of CVDRF and solitary confinement was 1.05 [0.79-1.41] (p = 0.7320); whereas, the adjusted relative risk estimate was 1.09 [CI: 0.84-1.41] (p = 0.5300). The statistical insignificance of both the (relatively weak) estimates may be attributable to the dispersion of solitary confinement amongst those who reported CVDRF and participants who did not report CVDRF. Explicitly, 58% of participants who reported not having a diagnosed CVD risk factor also reported solitary confinement—and, 60% of individuals who reported a diagnosed CVD risk factor also reported a solitary confinement experience during their most recent incarceration stay. In other words, the exposure burden was common in this population and was very

similar between both populations (reported solitary confinement experience vs. general incarceration population only); and as such, it may be difficult to extract a reliable risk measure that assesses for differences in cardiovascular disease prevalence between two similarly exposed groups. Additionally, the small sample size (N = 296) and power inefficiencies likely increased type II error—limiting the ability to adequately measure the true risks of solitary confinement on cardiovascular disease risk factors among the source population.

Nevertheless, it should be noted (despite statistical insignificance) that participants exposed to solitary confinement comprised 60% of the self-reported CVD risk factors' population. Furthermore, coupled with the 58% of participants (only exposed to the general carceral population) who also self-reported either hypertension, diabetes, or obesity—demonstrates that there is a considerable burden of cardiovascular disease risk factors among this particular carceral population in the Greater New Haven area between September 2017 – March 2018. Moreover, given that the population is low-income individuals, with history of incarceration—their access to adequate medical care is potentially limited. Thus, it is imperative that community-action health plans be set in place for this population to bypass barriers to healthcare. Explicitly, targeted-interventions to prevent (or attenuate) the modifiable risk factors for ex-incarcerated people (in the Greater New Haven area) to prevent the acquisition of heart diseases. Perhaps, such interventions would benefit from an earlier initiation—that is within the prison (or jail) industrial complex.

Anxiety Disorder Symptoms (within the past six months)

Newly Released & Still Confined

Similarly, as with the CVDRF outcome—solitary confinement as a risk aggravator (or mitigator) was statistically insignificant for anxiety disorder symptoms within the past six months. However,

the estimated relative risk (2.89) is larger than the CVDRF (1.05) risk measure—but, the confidence interval is noticeably wide [0.91-9.20] signaling a potential issue with estimate's standard error. The standard error was 1.71—showing that the solitary confinement relative risk estimate may not be reliable estimate (independent of statistical significance) of the sample population. However, the relationship between psychosocial stressors and solitary confinement was well established by previous studies. More specifically, relationships between anxiety disorders; increased suicidality; and major depressive disorders risks is heightened among individuals who are exposed to solitary confinement (for extensive time periods). The complex relationship (i.e. directionality) between raised blood pressure and anxiousness is why hypertension was used as an independent risk factor for self-reported anxiety disorder symptoms. However, the regression showed self-reported hypertension to be an insufficient predictor of self-reported anxiety disorder symptoms in the sample population.

But, among this population of New Haven residents exposed to solitary confinement, during the period between September 2017 – March 2018, the relationship between anxiety disorder symptoms (within the past six months) is weak and insignificant. This insignificance of the primary exposure (solitary confinement) relationship may be attributable to the measurement of anxiety disorder symptoms within the general sample population. First and foremost, the survey data is self-reported, exposing the data to recall and social desirability bias. At the time of the survey, participants may not have remembered the totality of the anxiety disorder symptoms felt during the previous six months. Or, given that the data is self-reported, participants (without clinician interference) may misinterpret any anxiety disorder symptoms. Additionally, by definitional standards the population is an at-risk group when it comes to accessing quality medical

care upon their exit from prison (or jail)—perhaps, participants of the survey are unknowingly living with anxiety disorders.

A Curious Buffer: Blackness

Interestingly, Black participants had an overall decreased risk (0.48, *p < 0.0001*) of reporting anxiety disorder symptoms compared to white participants—highlighting the Black (African American) race as a the sole (statistically significant) protective factor within the population. The source population disproportionately identified as Black (64%); furthermore, 61% of participants who were Black also self-reported an experience with solitary confinement. A post-hoc fisher's exact analysis (and solitary confinement interaction with Black race) for an association between Black participants and solitary confinement was insignificant. This result may be consistent with the disproportionate frequency of Black participants within the sample population, relative to the two different racial groups (white, Other).

Nevertheless, the notion that Black individuals were less likely to self-report an anxiety disorder symptom (within the past six months), despite constituting the dominant racial demographic is an interesting phenomenon. The confines of race supersedes biological determinism—instead, race encompasses a social and cultural experience that permeates every facet of a singular person's existence. As mentioned, Black participants were overrepresented in the sample population, and within the solitary confinement population—Further, the strong evidence that solitary confinement is an aggravator of psychological stressors, may cause for speculation that the a decreased willingness to report (in addition to a natural decreased risk in the sample) might partly explain this effect. For example, a proposed reason for the net decrease in

self-reported anxiety disorders symptoms for Black participants, may be attributable to mental health stigma within broader Black communities.

The Triad: Age, Physical Health, and Social Ills

Notably, only participants who were ages 30-39 years had a significant increase in risks of reported anxiety disorders, compared to individuals who were ages 20-29. Younger participants within the sample were more likely to report to dealing with anxiety disorder symptoms within the last six months (during September 2017 – March 2018). One theory for this effect can be centers on public discourse influences surrounding mental health services. The gradual medicalization of mood disorders (and behavioral disorders), as a means to reduce stigma, increase awareness, and encourage care-seeking behavior may have resonated with younger adults in the sample (during September 2017 – March 2018) than their older counterparts. For example, it is possible that negative preconceived notions on disclosure of anxiety disorders eclipsed the willingness for older adults (older men in particular) to disclose any issues with mental duress.

Yet, the increased relative risk (1.36) of self-reported physical chronic conditions (hypertension excluded), and the likelihood of self-reported anxiety disorder symptoms is a cause for less speculation. This result is consistent with the evidence of comorbidities between physical and mental chronic conditions. In other words, it is not difficult to perceive that individuals faced with physical pain or bodily ailment, may have heightened risks of psychological stress that manifests as anxiety disorder symptoms. Moreover, the intersectionality of physical, mental, and social pain could be a contributing factor to the reported measures of anxiety disorder symptoms. Characteristically, the 'social pain' to which is referred can be equated with *criminal record stigma*: the structural (i.e. voting rights, job insecurity, housing disqualifications), interpersonal

(i.e. microaggressions), and symbolic (i.e. internalized stigma). In other words, the complexity between comorbidities of mental and physical chronic conditions it out of the scope of this examination—but, relative risk measures demonstrate the need for further research concerning this matter.

Impaired Daily Activity

Impaired daily activity as an outcome was a metric used to quantitatively asses the quality of life (contingent on their health status) for participants in the survey. As expected, participants who reported at least one physical chronic condition (independent) had a significantly higher risk (2.03 times), compared to individuals who did not report a condition to report impaired daily activity (by way of physical health). Hypertension was analyzed separately from other physical chronic conditions, because the overall burden of self-reported hypertension (33% of the sample) was higher than other physical chronic conditions. However, the relationship between hypertension and impaired daily activity was insignificant. Physical chronic conditions contained self-reported conditions such as epilepsy, cancer, and physical disabilities—thus, this result is consistent with what is understood about physically taxing chronic conditions.

The risk estimates for ages demonstrate an increase in relative risk for impaired daily activity as age groups (years) increase, compared to individuals who were 20-39 years in the sample population. Specifically, individuals who were between the ages of 60-70 years maintained the highest RR estimate of 1.97—nearly double the risks of individuals who are 20-39 years. This result is also consistent with expectations—given the diagnosis (risks) of physical chronic conditions increase as individuals become older. In other words, older adults are more likely to

encounter issues with their physical health, that will hinder their ability to work or perform daily tasks, relative to younger adults.

Despite its expectancy, this result is of a great public health concern, considering the increase in the aging demographic for incarcerated people in the United States. Older adults with a history of incarceration are a uniquely vulnerable population, and older adults of color encapsulate a conglomerate of additional vulnerabilities. Upon their release, individuals face myriad barriers to proper societal reintegration: precarious employment, housing instability, further surveillance (i.e. parole, halfway houses), chronic stress, and the reestablishment of social networks to name a few. All of which negatively impact their health; and, ultimately limiting their ability to gain upward social morbidity to get ahead, and lead healthier lives. It has been postulated, that older adults with a history of incarceration are uniquely vulnerable to the acquisition of chronic diseases (compared to the general non-carceral population), because of the additive 'weathering' to the their bodies at the hand of the carceral system (Williams et al, 2012; Greene et al, 2018).

Most interestingly, individuals who self-reported anxiety disorder symptoms (within six months of the survey) had moderate RR estimate of 1.43 of reporting impaired daily activity. Based on the survey data, participants who also reported difficulties performing daily tasks and completing their work activities (due to their physical health), also reported to experiencing symptoms of anxiety disorders (generalized anxiety, OCD, PTSD)—relative to participants who did not report symptoms of anxiety. This result raises a question: *are participants experiencing psychological distress, because they are unable to complete their tasks?* Or, *are feelings of psychological distress magnifying participants' physical condition symptoms*—thus, impeding on their daily activity? The estimate highlights a heighted risk; but, the causal pathway of the RR

estimate is still unclear. However, what remains clear, is amongst this sample carceral population, there lies a relationship between recent anxiety disorder symptoms and physical health—which then has the potential to hinder daily activity.

Spirituality

Anxiety Disorder Symptoms: A Spiritual Soother

According to the modified Poisson regression, individuals who had higher spirituality scores (range: 10-40) had a statistically significant 4% increase in risk, relative to individuals with lower spirituality scores as it relates to reported anxiety disorder symptoms (within six months of the survey). The hypothesized mechanism was: *higher spirituality scores would yield a decreased relative risk estimate for self-reported anxiety disorder symptoms among the sample population.* Now, this phenomenon is particularly interesting because the risk estimate was observed in the opposite direction. Meaning, people who reported a presence of anxiety disorder symptoms were more likely (albeit only 4%) to have a higher spirituality score. Thus, this observations calls into question the nature of self-efficacy—specifically, the reliance on behavioral (and identity-based) methods as a means to cope with psychosocial distress. For this examination, behavioral and identity-based systems are faith-based belief systems that participants may have subconsciously (or consciously) implemented to cope with anxiety disorders (generalized anxiety, OCD, and PTSD).

Impaired Daily Activity: Leaning Into Faith

Furthermore, this trend between acquired health outcomes and higher spirituality scores was observed across impaired daily activity (by way of physical health). The mean value of impaired

daily activity was 31.1 (±9.1), compared to 28.9 (±9.0). Thus, providing a descriptive foundation: that individuals who reported that their physical health activity impedes on their ability to perform daily tasks, had higher mean spirituality value. But, the non-normality of the data calls for a more precise explanation concerning the distribution of spirituality scores that does not rely on normal data metrics.

As stated, the Wilcoxon rank sum test (mean) demonstrated there were significant differences in the locational shifts of spirituality scores between those who were (and were not) impaired *(p = 0.0233)*. In addition to, the impaired daily activity group's ability to produce a higher mean rank score (166.87±709.80) than the self-reported non-impaired group (142.87±709.80), also provides evidence for the impaired group having systematically higher spirituality score distribution than the non-impaired. Moreover, the distribution was negatively skewed (-1.007)— demonstrating that spirituality scores for the impaired daily activity leaned towards the right side (higher spirituality score end). Altogether, the totality of the statistical evidence reasonable suggest that individuals who reported impaired daily activity had a higher spirituality score distribution relative to individuals who self-reported as 'non-impaired'.

Therefore, again, the question of self-efficacy as a tool of reliance, rather than a simple mitigator of harms is of merit. More specifically, the usage of faith-based beliefs, religious practices, and behaviors demonstrate a tendency for participants to '*lean into their faith*' when faced with adverse health-related circumstances. According to survey data, New Haven residents (from September 2017- March 2018) with a history of incarceration tended to report higher instances of faith-based practices and beliefs, when they also reported anxiety disorder symptoms (within the past six months) and instances of impaired daily activity (due to their physical health).

The evidence highlights a need to further explore the role religious institutions and faith-based interventions as coping mechanisms for adverse health-related circumstances.

Spirituality Variable Limitations

However, a few specific limitations with the spirituality measurement should be addressed. The modified Poisson regression for anxiety disorder symptoms rendered the spirituality interaction with solitary to be insignificant ($p = 0.0541$). Statistical protocols would call for the removal of the interaction, due to its insignificance in the model. However, the interaction term was established *apriori*—meaning, it was a key variable of interest. For this reason alone, the interaction remained in the model, and the covariate estimates were reported.

A post-hoc analysis of the anxiety disorder symptoms model, without the interaction term then rendered the spirituality score variable statistically insignificant. But, all other parameters (*Black race; physical chronic conditions; ages 30-39 years*) that were significant in the interaction term model remained statistically significant in the new model without the interaction term. In retrospect, this jeopardizes the overall goodness of fit concerning the modified Poisson regression model.

The second limitation concerning spirituality measurement within the sample was the non-normality of the data. A t-test or anova to test for differences in the mean between the binary outcome variables was preferred; but, it would be an inappropriate measurement. The Wilcoxon rank sum test (for the mean and median) must be interpreted with caution. The nonparametric test merely concludes there are significant differences in the location of spirituality scores in the distribution, or significant differences in the above the median for spirituality scores between the two groups, respectively. In other words, at best, the data concludes that the locational shift in the

mean and mean ranks of spirituality scores (for impaired daily activity vs. non-impaired daily activity) is not equal to zero.

Despite the aforementioned limitations, there is sufficient evidence to conclude that further research concerning spirituality as a self-efficacy coping skill for health-related adversity, amongst formerly incarcerated populations is in need of further research. Faith-based interventions (particularly for Black populations) are not new to epidemiologic studies. However, the application of faith-based interventions as a potential coping mechanism among formerly (and currently) incarcerated populations is underexamined. At best, this analysis demonstrates the merit in creating more robust faith-based questionaries; interventions; and measurement instruments to assess the veracity of spirituality (self-efficacy) as a potential risks mitigator (and coping skill) for psychosocial distress, and adverse health circumstances among the carceral population.

Overall Strengths & Limitations

The usage of the Fisher's Exact Test and modified Poisson regression was applied given the small sample size (N < 500), limited power, and potential increase in type II error. Specifically, the modified Poisson regression has more statistical power than the log binomial test—resulting in wider confidence intervals, and a more stringent threshold for statistical significance. Statistical adjustments for smoking and alcohol were applied to account for confounding because both are recorded risk factors for cardiovascular disease. However, across the CVDRF variable—65% of participants reported to smoking cigarettes did not report CVDRF, and 62% of participants who reported CVDRF also smoked cigarettes. Thus, further statistical adjustments for smoking may have been an overadjustment.

The biggest limitation was the self-reported survey data—inviting recall and social desirability bias among the participants. Also, the small sample size of the population may have eclipsed the ability to detect significant differences between the primary exposure and health outcome variables. Moreover, the population is geographically isolated to the small state of Connecticut. In other words, isolation practices (i.e. solitary confinement) may be more limited in Connecticut, as compared with our institutions in the country. In addition to, the survey analysis was cross-sectional (September 2017 – March 2018); and, as such only the risks of disease prevalence could be assessed, not causality. Also, alcohol consumption and spirituality scores could benefit from more robust measurement instruments to ensure that the sample population is adequately represented. In the future, longitudinal analyses that use diagnosable biomarkers, corroborated medical records—with, randomized intervention groups that implement faith-based efficacy tools, targeted towards individuals with a history of incarceration and solitary confinement will be better equip to assess causality and directionality of the aforementioned factors.

CONCLUSION

In conclusion, a history of solitary confinement was not associated with cardiovascular disease risk factors amongst the New Haven residents who were recently released from prison or jail in the prior year. Solitary confinement history did not increase the risks of self-reported anxiety disorder symptoms (within the past six months of survey) and impaired daily activity (by way of physical health).

However, solitary confinement is an exacerbator of harm within the carceral system—and while the limitations of this data cannot explicitly place solitary confinement as a predictor of self-reported cardiovascular disease risk factors (anxiety disorder symptoms, and impaired daily

activity) or demonstrates strong associations –there still lies the fact that people who are exposed the carceral system are vulnerable to health harms. More importantly, their socioeconomic status within the social hierarchy may preclude them form receiving the necessary treatments (for physical and mental health) they are due to lead fuller and healthier lives. The risks of anxiety disorder symptoms (particularly amongst a younger age demographic) and physical chronic conditions morbidities were prevalent amongst the sample population. More pointedly, quantitative spirituality assessments showed faith-based belief systems (including identity and religious institutions) to be of merit when evaluating the ability for self-efficacy tools to moonlight as coping mechanisms for individuals who experience adverse-health circumstances.

It is the expectation that this analysis can serve as a source of information to inform future health and legal policies regarding solitary confinement; more saliently, chronic disease management for the general carceral population in New Haven, CT (and the broader carceral populations in Connecticut given that New Haven is the second largest metropolitan area in the state). In the future, it is the expectation that this research can be applied to larger randomized administrative cohorts, to decipher whether solitary confinement is an a risk factor for physical health conditions. The prospect of epidemiological studies that highlight the inhumanity and health depravity linked to solitary confinement, can prompt lawmakers to call for the reduction of restrictive housing in prisons or jails. Moreover, designated health services and resources for solitary confinement exposure can be designed to better the quality of life for ex-incarcerated people. Lastly, this analysis may be used to inform future self-efficacy-based interventions (explicitly faith-based efficacy measures) in conjecture with health (and social) support services, to meet the health needs of individuals recently released from prison or jail in the Greater New Haven area.

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