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# Clustering of health burdens in solitary confinement: A mixed-methods approach

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ABSTRACT

Research on the mental health consequences of solitary confinement has contributed to restrictions on its use, particularly for people with serious mental illness. However, solitary confinement continues to isolate people with physical and mental health problems, even where its use has been restricted. This mixed-methods analysis seeks to evaluate the practice of solitary confinement on mental and physical health using data from a sample of 99 men in Pennsylvania. We first describe patterns of multimorbidity among men in solitary confinement using a latent class analysis to group individuals with shared demographic attributes and mental and physical health conditions. We then use thematic analysis to explore how men from each of these groups experienced and managed health concerns in solitary confinement. Our findings describe significant physical and mental health burdens and unmet healthcare needs. Over three-quarters of respondents reported a physical health diagnosis such as heart disease or diabetes, and over half reported a mental health diagnosis, including anxiety, depression, and schizophrenia. Those with pre-existing, often multiple, health issues struggled to maintain their health given restrictions to daily living, isolated idle time, and limited healthcare access in solitary confinement. These aspects of solitary confinement also challenged those who entered solitary in relatively good health. These findings demonstrate the struggle for self-advocacy in maintaining health and healthcare access under extreme conditions of confinement and point to the need to prevent the health harms of solitary confinement by further restricting its use.

## 1. Introduction

Although decades of research and legal testimony have documented serious health harms associated with solitary confinement, fewer empirical studies have sought to directly measure the conditions of solitary confinement that may shape both physical and mental health of incarcerated people (Smith, 2006; Williams et al., 2019a). Solitary confinement is a harsh form of imprisonment typically involving restriction in a prison cell for 23 h each day, with brief, tightly-controlled movements for showers, medical visits, or recreation (Garcia, Cain, & Cohen, 2016). Approximately 20 percent of those incarcerated in U.S. prisons are held in solitary confinement annually, half of whom for 30 days or more (Beck, 2015). During the COVID-19 pandemic, conditions of medical isolation and restricted movement were widespread and similar to solitary confinement (Johnson et al., 2021). Previous research on solitary confinement, however, has been limited in its ability to distinguish between the ways that health, and especially psychiatric, conditions increase the risk of being placed in solitary confinement from the direct health harms of this experience. This study uses a mixed methods approach to further understand how the conditions of solitary confinement shape mental and physical health and healthcare needs from the perspective of those who experience it, in order to inform policies that regulate its use.

### 1.1. Conditions of solitary confinement in U.S. Prisons

In solitary confinement units across the U.S., meals are highly regulated and often served through a slot in the cell door (Garcia, Cain, & Cohen, 2016). Recreation time out of the cell usually takes place in an outdoor cage or concrete exercise yard with no equipment (Resnik, VanCleave, & Bell, 2018; Reiter, 2016). Deprivations extend beyond the hours of lockdown and restricted movement, although conditions vary

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across facilities and states. A survey of state correctional systems found that all states reporting to the survey restrict visitation and phone calls, and many restrict prison education and programming (Resnik, VanCleave, & Bell, 2018). Medical visits often take place at the cell door, limiting the privacy and frequency of these meetings (Garcia, Cain, & Cohen, 2016). These conditions contrast with those in the general prison population, where incarcerated people have relatively greater access to basic supplies, food, medical services, exercise, rehabilitative programming, and meaningful social interaction (Reiter, 2016).

### 1.2. Mental and physical health of people in solitary confinement

The prevalance of mental and physical health issues among men in solitary confinement is higher relative to the rest of the incarcerated population and in comparison to the general U.S. population (Beck, 2015; Dellazizzo et al., 2020). Psychiatric symptomatology, traumatic brain injury, and substance use (including self-medication for health issues) can result in solitary confinement because of rule violations or perceived safety risk (Dellazizzo et al., 2020) or to separate "vulnerable" individuals from the rest of the imprisoned population. Moreover, solitary confinement is associated with increased risk of PTSD, self-harm and suicidal behavior (Kaba et al., 2014), and other adverse mental and cognitive health outcomes (Hagan et al., 2018; Luigi et al., 2020; Smith, 2006), elevated hypertension (Williams et al., 2019b), and higher post-release mortality (Ahalt et al., 2017; Brinkley-Rubinstein et al., 2019; Wildeman & Andersen, 2020).

Research on the mental health consequences of solitary confinement and international scientific consensus statements have contributed to policies that limit its use, particularly for people with serious mental illness (Haney et al., 2020; Resnik, VanCleave, & Bell, 2018; International Psychological Trauma Symposium, 2008). Pennsylvania prohibited the use of solitary confinement for those with serious mental illness or intellectual disabilities in 2015. However, two noted research gaps (Williams et al., 2019a) are in documenting how the restrictions, isolation, and other conditions of solitary confinement: (1) produce poor health among otherwise healthy individuals and (2) affect existing physical, in addition to mental, health issues (Strong et al., 2020). One complexity of studying the health of those in solitary confinement is the high degree of heterogeneity of this population, which includes people of all ages and health conditions. As such, an integrated approach that identifies the mechanisms through which solitary confinement might contribute to the development of new health problems and potentially worsen different types of pre-existing conditions is needed to better understand the relationship between solitary confinement and health.

There are thus two goals of this analysis. The first is to describe patterns of multimorbidity in the population of incarcerated men in solitary confinement in order to provide clinicians, researchers, and prison administrators with an understanding of how chronic medical conditions, substance use problems, and other mental and behavioral health concerns are patterned in this population (Nowotny et al., 2016). The second goal is to evaluate the practice of solitary confinement, particularly in light of the health burdens and healthcare needs of this population. While other research has examined the causal effects of solitary confinement, especially on mental health, our analysis seeks to understand how health conditions and access to healthcare were affected by solitary confinement from the perspective of those who experienced it (Guest & McLellan, 2003).

## 2. Methods

### 2.1. Study design

We use a mixed methods concurrent triangulation design to explore the kinds of health problems experienced by our sample of men in solitary confinement and how these health issues compounded the hardships of solitary confinement (Creswell & Creswell, 2017). This study was conducted in Pennsylvania Department of Corrections prisons, a large state system with similar prevalence and use of solitary confinement as compared to the national average and where there are policies prohibiting the use of solitary confinement of individuals with serious mental illness that were put in place as part of a settlement agreement from a lawsuit put forth by the Disability Rights Network of Pennsylvania (Resnik, VanCleave, & Bell, 2018; Disability Rights Network of Pennsylvania v. Wetzel., 2015). These policies allow those with serious mental illness to be placed in Diversionary Treatment Units when they have misconduct violations, but limit the amount of time these individuals can be held there. However, incarcerated people in Diversionary Treatment Units were not able to be included in our study, which only includes people in the Restricted Housing Units. Quantitative survey data and qualitative interview data were collected concurrently and then integrated in order to determine confirmation, expansion, and discordance across these two sources of data (Creswell & Creswell, 2017; Fetters et al., 2013).

### 2.2. Data collection

Between July and September 2017, eight interviewers collected demographic and health information on a sample of 99 incarcerated men held in solitary confinement at one prison, State Correctional Institution Graterford. The prison was a maximum security men's prison with a general population of about 3600 people. Solitary confinement cells were in two buildings that had different kinds of cells: one had enclosed spaces with heavy metal doors that contained a wire-reinforced plexiglass strip and the other with metal bars and more open air. Interviews took place in rooms not used for housing and where prison staff were not within hearing range. Respondents were not shackled during interviews. There was a physical barrier between respondents and interviewers that permitted eye contact and allowed conversation without raised voices.

Respondents were interviewed within two months of their entry to solitary confinement (average: 15 days, IQR: 6–19 days), and most respondents reported previous experiences in solitary confinement (average: 7.3 prior occasions, IQR: 1–10). Prison staff gave the researchers a list of all people meeting this criterion, and researchers recruited respondents by going cell to cell and describing the study to eligible men on the unit. Researchers were not allowed to interview individuals awaiting the death penalty or who were classified by the prison administration as having serious mental illness, although results of the self-reported survey suggest a high burden of mental health problems in the study population. The overall response rate was high at 80 percent, and the sample was approximately 40 percent of all admissions to solitary confinement at the prison site. Interview topics included physical and mental health and well-being, self-reported diagnoses of health conditions, conditions of confinement, and social and family contact. Interviews were audio recorded and typically lasted between 60 and 90 min. This study was approved by the Columbia University and Boston University institutional review boards, and informed consent documents with respondent names and identifying information were kept separately from interview data on a secure, non-networked computer only accessible to study staff.

### 2.3. Statistical analysis

We used latent class analysis to identify subgroups of health conditions among our sample. We compared the fit of models with 2–6 latent classes with the following categorical variables: chronic physical health condition, mood disorder, ADD, psychotic disorder, injury in the past 3 months, chronic pain, received counseling in the past 3 months, received healthcare in the past 3 months, age (categorical), race/ethnicity, and educational attainment. Due to small sample size and several available variables, we condensed chronic disease to include high blood pressure/hypertension, asthma/chronic lung illness, diabetes/high blood pressure, hepatitis, HIV/AIDS, and high cholesterol. Similarly, mood disorders

included anxiety and depression; psychotic disorders included bipolar disorder, schizophrenia, and other psychotic disorder; and chronic pain included arthritis, headaches, stomachaches, or other source of chronic pain. Models with three classes had the best AIC and entropy.

We additionally validated the clusters generated by our latent class model using k-means clustering for the following continuous indices: physical health conditions, mental health conditions, and chronic pain, as well as number of injuries, ratings of self-rated mental and physical health, and age (Miaskowski et al., 2017; Papachristou et al., 2018). We compared the model fit for 2 through 6 clusters using the Dunn index. Latent class analyses were done in R with the poLCA package.

### 2.4. Qualitative analysis

Audio recordings of interviews were transcribed by a team of research assistants and verified by the second author to ensure correct transcription. We used NVivo to conduct a mixed methods thematic analysis (Creswell & Creswell, 2017) and first identified interview themes with codes developed inductively by the lead interviewers. The interviews were then coded by research assistants and then checked by the lead interviewers to ensure reliability, consistency, and coverage. We iteratively developed themes inductively from these initial codes through a process of analyzing transcripts and comparing and contrasting with quantitative results (Creswell & Creswell, 2017). We compared the themes and codes across the clusters generated by the quantitative analysis (Fetters et al., 2013; Guest & McLellan, 2003).

## 3. Results

There was a high degree of mental and physical health burdens among the sample of men held in solitary confinement. Indeed, over three quarters of respondents reported some kind of physical health diagnosis, and over half reported a mental health diagnosis. The healthcare needs of this population were also high: 31% wanted physical healthcare and 25% wanted mental health counseling. Among those who wanted physical healthcare, 61% received it, although only 28% received wanted mental healthcare.

Our final latent class model with three classes had adequate classification certainty (relative entropy = 0.86) and superior model fit to models that specified different numbers of classes (AIC: 1831.2, BIC: 1772.2, sample size-adjusted BIC: 1585.9). Importantly, the three-class model also aligned with theoretical distinctions between relatively healthy individuals and more mental health versus more physical health conditions. We describe the three classes as: relatively healthy (41.4%), higher burden of mental health outcomes (28.3%), and higher buden of physical health outcomes (30.3%).

### 3.1. Class 1: relatively healthy

The first class was composed of mostly people under age 40, 78.0% of whom were non-Hispanic Black. As compared with the other two classes, the prevalence of chronic disease, chronic pain, and mental health conditions was relatively low (Table 1). Many experiences and needs expressed by respondents in class 1 were common across all three classes (Table 2). Restrictions on the available food, water, and ability to exercise affected hunger, weight change, pain, and sleep for many respondents.

#### 3.1.1. Theme 1: restrictions to daily living

Regimented meal times and other restrictions to food availability made food in solitary confinement particularly challenging for many respondents, beyond issues they experienced with food in prison outside of solitary. In the survey data, 70% of respondents felt that they were not receiving adequate food portions while in solitary confinement. In interviews, many said that the food was low-quality, and for some this resulted in frequent stomachaches. When asked about stomach pain, one respondent, a Black man in his twenties (class 1), described the difference between the available food in solitary as compared with in the prison's general population where he had more access to food outside of designated meal times: “Yeah, I think it's because I be hungry. I'm so used to eating on population, and your body is not—not getting the food it used to get.” Another respondent, a Latino man in his thirties (class 1), also compared food in general population and solitary, with the added complication of needing a specialized diet: “I got acid reflux pain, gastritis. Right now, I'm—I haven't got my diet for days, and I'm trying to get it. And I don't know what's going on. It's hard to—even from the block, it was hard getting things. Imagine from down here [in solitary]. It's bad.” For both respondents, the inadequate food in solitary confinement had immediate physical consequences.

For some, the restrictions on food were especially difficult in

**Table 1**
Distribution of health outcomes in the study population across assigned class.

| Variable | Overall N = 99 | Class 1: Relatively Healthy N = 41 | Class 2: Mental Health N = 28 | Class 3: Physical Health N = 30 | P-value |
|---|---|---|---|---|---|
| Age | | | | | |
| 30 and under | 43 (43.4%) | 25 (61.0%) | 18 (64.3%) | 0 | <0.01 |
| 31 to 40 | 28 (28.3%) | 11 (26.8%) | 8 (28.6%) | 9 (30.0%) | |
| 41 to 50 | 15 (15.2%) | 5 (12.2%) | 2 (7.1%) | 8 (26.7%) | |
| 51+ | 13 (13.1%) | 0 | 0 | 13 (43.3%) | |
| Race | | | | | |
| Non-Hispanic White | 24 (24.2%) | 3 (7.3%) | 14 (50%) | 7 (23.3%) | <0.01 |
| Non-Hispanic Black | 49 (49.5%) | 32 (78.0%) | 5 (17.9%) | 12 (40.0%) | |
| Hispanic | 21 (21.2%) | 6 (14.6%) | 8 (28.6%) | 7 (23.3%) | |
| Other | 4 (4.0%) | 0 | 1 (3.6%) | 3 (10.0%) | |
| Missing | 1 (1.0%) | 0 | 0 | 1 (3.3%) | |
| Highest level of education | | | | | |
| Less than high school | 36 (36.4%) | 18 (43.9%) | 8 (28.6%) | 10 (33.3%) | 0.28 |
| High school degree | 19 (19.2%) | 10 (24.4%) | 7 (25.0%) | 2 (6.7%) | |
| GED | 18 (18.2%) | 5 (12.2%) | 5 (17.9%) | 8 (26.7%) | |
| Vocational | 3 (3.0%) | 0 | 2 (7.1%) | 1 (3.3%) | |
| Any college | 14 (14.1%) | 5 (12.2%) | 4 (14.3%) | 5 (16.7%) | |
| Missing | 9 (9.1%) | 3 (7.3%) | 2 (7.1%) | 4 (13.3%) | |
| Received medical care in RHU | 12 (12.1%) | 1 (2.4%) | 2 (7.1%) | 9 (30.0%) | <0.01 |
| Received counseling in RHU | 7 (7.1%) | 3 (7.3%) | 2 (7.1%) | 2 (6.7%) | <0.01 |
| Chronic disease | 44 (44.4%) | 9 (22.0%) | 10 (35.7%) | 25 (83.3%) | <0.01 |
| Chronic pain | 46 (46.5%) | 7 (17.1%) | 12 (42.9%) | 27 (90.0%) | <0.01 |
| Mood disorder | 42 (42.4%) | 5 (12.2%) | 27 (96.4%) | 10 (33.3%) | <0.01 |
| ADD/ADHD | 23 (23.2%) | 2 (4.9%) | 18 (64.3%) | 3 (10.0%) | <0.01 |
| Psychotic disorder | 21 (21.2%) | 0 | 17 (60.7%) | 4 (13.3%) | <0.01 |
| Substance use disorder | 53 (53.5%) | 10 (24.4%) | 22 (78.6%) | 21 (70.0%) | <0.01 |
| Did not receive medication | 25 (25.3%) | 8 (19.5%) | 9 (32.1%) | 8 (26.7%) | 0.48 |
| Thought about suicide, past 3 months | 6 (6.1%) | 1 (2.4%) | 4 (14.3%) | 1 (3.3%) | 0.10 |

**Table 2**
Summary of central themes across each of the three classes.

| Class | Theme 1: Restrictions to daily living | Theme 2: Isolated idle time | Theme 3: Healthcare access and medical mistrust |
|---|---|---|---|
| Class 1: Relatively healthy | Restrictions to food and exercise affected weight loss, sleep, and physical pain | Primary stressors included worrying about family, arrival and departure from solitary & prison. Isolation contributed to feeling depressed | Difficulties requesting healthcare, problems receiving medications, medical mistrust |
| Class 2: Higher burden of mental health outcomes | Similar to class 1, and lack of freedom of movement heightened psychiatric symptomatology | Pre-existing mental health conditions and prior trauma heightened panic attacks and depressive symptoms | Delays receiving care particularly mental health care, distrust of the psychiatric care system |
| Class 3: Higher burden of physical health outcomes | Difficulties accommodating dietary restrictions for chronic disease. Severe chronic pain exacerbated by restrictions to exercise and movement | Similar to class 1 | Required the most healthcare, but experienced delays and barriers accessing care; medical mistrust |

combination with limited ability to exercise while in solitary, and respondents linked these to changes in weight, sleep, and physical pain. One respondent, a Black man in his forties (class 1), emphasized restricted movement and lack of food saying, "You're locked in all the time, and your food feeding gets short—you're gonna lose some weight." Another man described his challenges sleeping because of pain from lack of physical movement: "There's nothing to do—you don't get to expel any energy … it makes you miserable … I mean, I got body aches. It's sore all around, but that's just … that's normal for being in the hole. Everything starts to hurt when you don't use it, you know?" (White man, twenties, class 1). Respondents who were relatively healthy experienced the intensified restrictions governing daily life in solitary confinement as particularly challenging for a variety of acute physical health issues.

### *3.1.2. Theme 2: isolated idle time*

In addition to physical health concerns, respondents described how the isolated idle time in solitary confinement contributed to rumination about incarceration-related stressors and had consequences for mental health. In the survey data, 63% of respondents reported that the experience of solitary was generally stressful. Interview data revealed the primary stressors of solitary included worrying about their families and feeling concerned about their arrival and departure from solitary as well as release from prison generally. Many described long stretches of idle time in solitary confinement spent thinking about these issues, and some said they caused panic attacks. For one respondent, a Latino man in his thirties (class 1), his legal case was a major source of stress, and he said, "It was about three weeks ago—I had like an anxiety attack because I was thinking about my case and if I could get probation … I guess it plays tricks on my mind." Another respondent shared that he experienced panic attacks as a result of "lack of things to do … So my mind starts racing, and once that happens, it's all downhill from there." (White man, 30s, class 1). About 41% of respondents reported having at least one panic attack in the past 3 months.

Many also described the ways that isolation contributed to feeling depressed in solitary confinement. A Latino man in his thirties (class 1) put it this way: "I'm depressed now. You know, it depends on the circumstances, I guess … well, the RHU [restricted housing unit]—I don't like being closed in. You know, I don't—there gotta be a better way …. 'cause I'm a social person and I like being around people and talking to people and—now this, depressing." This respondent reported no official diagnosis of depression but makes clear connections among isolation, seclusion, and restrictions of solitary life, and his depressive symptoms, and several respondents in this class of relatively healthy people discussed feeling depressed, even without a formal diagnosis.

### *3.1.3. Theme 3: healthcare access and medical mistrust*

Although a handful of respondents were satisfied with the degree of healthcare provided by staff, others across all three classes found it challenging to access healthcare while in solitary because of administrative delays related to being transferred from general population. While many also described delays in receiving healthcare in prison generally, delays in solitary were particularly challenging for those who felt ignored by staff and without means of recourse in this restricted context. In order to see a doctor, individuals would formally request an appointment with correctional staff on the unit, and this "sick call" would then get passed along to medical staff. Around 40% of respondents expressed frustration with accessing timely and adequate healthcare in solitary confinement specifically. One respondent, a Black man in his thirties (class 1) described his frustrations with administrative delays after being transferred to solitary. He currently had a hernia and had significant pain as a result. He reported that he put in a sick call every day but was told 'oh, you not in the system yet.''. He and others felt ignored by staff while in solitary and that they had to be especially persistent with staff in this context where they had no alternatives to meet their healthcare needs.

The transition from the general prison population to the solitary confinement unit also presented problems for receiving medications. Respondents frequently noted that they had to wait for their medications to be re-approved upon arrival in solitary, meaning that it sometimes took days or weeks spent on a waiting list before they received access to their regular prescriptions. Access to medications was a particular concern because medications were one of the only means through which some individuals received healthcare while in solitary. Around 25% of respondents reported missing medications while in solitary confinement. Some reported lateness in receiving medications and a few described inaccuracies in the medications they were given.

Furthermore, some respondents often felt that the medications they did receive—particularly over-the-counter options for pain management—were insufficient. Ibuprofen was the most commonly mentioned example. The respondent with hernia pain went on to say, "I was supposed to go to surgery today from the PV [Parole Violator] center. Since I came back to prison, they just giving me Motrin. So I have to go through whatever their system is to try to get surgery."

Although some respondents described receiving needed medications, others described how delayed and insufficient healthcare in solitary confinement engendered feelings of mistrust and skepticism directed at prison healthcare staff, including doctors, nurses, and psychologists. One respondent explained his distrust of the psychiatric staff's expertise, care, and motives:

> They [staff] don't understand, and I ended up getting … mad at them, because they—they wanted to act like they know, but they don't know nothing. I don't know what kind of psychiatrist they are, because they don't know nothing. All they say is—all she tried to offer me was meds. I don't want no meds. I've been there, done that … I'm not gonna let you kill me little by little. I know what they do with the meds. I know what they do with them. They don't want you to live, be all right. They don't want you to be sane. They want you to be insane. (Latino man, thirties, class 1)

Although few other respondents described malicious intent and distrust to this degree, his frustration and skepticism were shared by many. Indeed, while a sizable portion of respondents reported wanting to see a healthcare professional, many were also doubtful that the care they could receive would be effective.

### 3.2. Class 2: higher burden of mental health outcomes

Nearly all (96.4%) people in class 2 were diagnosed with a mood disorder (anxiety or depression), and the prevalence of psychotic disorders was also relatively high (61.5%) as was a diagnosis of ADD/ADHD (60.7%). Seventy eight percent of people in this class reported a substance use or addiction problem. Most (64.3%) of the second class was age 30 or younger, and, as compared with class 3, had lower levels of physical health problems (Table 1). Respondents in class 2 shared many of the experiences and perspectives as those in class 1, with differences in themes 2 and 3 described below.

#### 3.2.1. Theme 2: isolated idle time

Respondents in class 2 built upon the mental health concerns described by those in class 1 and, in particular, the ways in which their pre-existing mental health conditions made the stressors of solitary confinement more challenging. For example, those in class 2 discussed panic attacks at length the most frequently. In addition to the stressors shared by nearly everyone in solitary confinement, those in class 2 detailed instances of prior trauma as triggering panic attacks while in solitary. One respondent, a White man in his thirties (class 2), said that he often worries about his family, adding, "I guess 'cause my sister passed when—in 2010—when I was in jail, so I always got this fear of losing somebody on the outside." Another respondent, a multiracial man in his thirties (class 2), echoed this: "I'm worried about hearing something from my case, you know. I be worried about my family. I be worried about everything. I be having it [panic attacks] a lot 'cause my sister just died and I had a brother that just died, yeah, so I worry about that so much." For both of these respondents, their prior experiences with the death of a family member were also linked to the stresses of incarceration, and these feelings were heightened in the context of solitary confinement.

Men in class 2 described depressive symptoms in solitary confinement to a greater extent than those in class 1 (15% of class 1, 36% of class 2), and many in class 2 described how the isolation of solitary confinement worsened pre-existing problems with depression. One respondent, a Latino man in his thirties (class 2), described his intensified depression: "I've been more sad … I cry more; And I feel like a failure, like I've failed. This is like the bottom of the bottom, coming to this place … I feel like a failure. This place reminds you of that all the time. There's no one to really talk to, so you're really left to like talk—talk yourself down." In addition to separation from their families and other incarcerated people, others noted that the lack of freedom of movement in solitary worsened their depression. One respondent, a Latino man in his thirties (class 2), said, "I think it's only when I get close[d]. Like now, because in the population I don't feel that 'cause you go outside all the time … you can go to the yard. You can go to the gym, you know what I mean? But now, I'm in the hole, right, it's 23 to 1 and you only go outside one hour. So I started feeling like my depression, like close." This respondent describes depression in solitary confinement as almost inescapable because he is unable to change his surroundings or exercise.

Most significantly, while individuals in all three classes mentioned witnessing or hearing about suicide in solitary, it was most common for individuals in class 2 to discuss personal experiences with suicidal feelings either in solitary or in prison generally. Their isolation and idleness—along with prior trauma—were seen as intensifying these thoughts. One respondent described thinking about his father's suicide in solitary confinement: "He committed suicide in jail, in the hole, so like … it's like mentally … you're stuck in the hole. You're in the same situation he was in, and sometimes you sit back and think, what was his state of mind? What made him—like I wouldn't think of that normally if I wasn't in the hole with nothing to do all day" (White man, twenties, class 2). Others similarly described the impact of the conditions of solitary on thoughts about suicide. One respondent, a multiracial man in his thirties (class 2), described the auditory hallucinations that precipitated a previous suicide attempt while in solitary confinement: "It [solitary] can begin to … confuse you. Hallucination. Hallucinatory, stuff like that. It can be from hearing things … yeah, suicidal, it can make you suicidal." Both respondents describe solitary confinement as a setting that has previously been connected to suicide for them, because of their own and others' experiences there, and how being placed there again was understood to be part of a repeated traumatic exposure.

#### 3.2.2. Theme 3: healthcare access and medical mistrust

The delays in accessing healthcare that were shared across all classes particularly affected those in class 2 who sought mental health counseling (39% of class 2). One respondent, a White man in his twenties (class 2), had been in solitary for 15 day at the time of the interview and said that he had been requesting to see a mental healthcare professional since he had arrived. He said, "I've put in probably six request slips, I've talked to every CO [correctional officer] I see, and I've talked to [the unit manager] maybe twice." Another respondent, a White man in his thirties (class 2), felt discouraged from seeking medical care because it would limit his time out at yard, which is the single hour each day individuals in solitary can be outside of their cells: "Yeah, you put a sick call in, they'll come in the next day during yard. You have to stay in during yard, which is—you gotta choose between yard and a medical condition."

In addition to delays in receiving care, those in class 2 echoed medical distrust described by individuals in class 1. One respondent in class 2, a Black man in his twenties, said that he wanted to meet with a mental health professional, but the encounter ended up being too short to address his needs, no more than 5 min long. He described the situation: "All the officers are gonna do is tell psych to come talk to me, and all the psych is gonna do is put me in POC [psychiatric observation cell] if they feel like I'm gonna harm others. I want to talk with somebody. I don't want to go into the smock with no blanket or clothes." This respondent goes on to say, "Then they call me a master manipulator, but they are master manipulators," articulating how his distrust and skepticism are due to a system of care management where he feels he lacks autonomy in his medical care, which prevents him from seeking additional care.

### 3.3. Class 3: higher burden of physical health outcomes

The third class had a higher proportion of older (51+) men with chronic disease and chronic pain (Table 1). There was additionally a high prevalence of substance use or addiction issues (70%) in class 3, and 26% were placed in solitary because of drug-related rule violation. Two respondents in class 3 reported being placed in solitary because they were taking drugs to address chronic pain issues. This class was also more likely to receive medical care compared with the other two classes.

#### 3.3.1. Theme 1: restrictions to daily living

The higher prevalence of chronic disease in class 3 affected their experience of the restrictions on food and exercise in solitary confinement. Although they shared the same concerns related to conditions as those in the other two classes, these conditions were sometimes experienced as aggravating their symptoms or interfering with their disease management. For example, one respondent, a Black man in his sixties (class 3) with hypertension and diabetes described how he felt he did not have enough food, even though he received additional food to help manage his diabetes because "the food's just bad … there's so much of this stuff here that I just don't eat – it don't taste right". For him, managing his chronic conditions was a challenge because of the restricted food in solitary, despite efforts by the institution to meet these needs.

Just under half (46.5%) of all respondents reported experiencing chronic pain, including 90% of the respondents in class 3. Respondents typically linked back pain they experienced in solitary to insufficient

exercise, poor sleep quality, and uncomfortable bedding, or to exercising less frequently. In particular, some respondents described the mattresses as being especially thin and worn, making sleep difficult and intensifying the pain of preexisting back injuries. For those with chronic back pain these conditions were particularly detrimental. One respondent, a White man in his thirties (class 3) with chronic back pain, whose cell had an additional layer of plexiglass across it found it especially challenging to stay active: "I can't work out because of the glass—it's like suffocating." He then links this to his sleep and pain, "I stay up—but … when it's like two in the morning is like when it's cool. So I can do like a few hundred push-ups and sit down and not sweat as much … 'cause if you just lay in your bed 24/7, you're just—you're just deteriorating. And that's when the back pain comes." This respondent draws connections between how the restrictions on food and exercise are also related to the physical environment of solitary confinement at this facility.

#### 3.3.2. *Theme 3: healthcare access and medical mistrust*

More of those in class 3 described wanting medical care compared to the other two classes (class 3: 50%, class 1: 7%, class 2: 39%), and were more likely to receive it (Table 1). However, many still described delays in accessing care. One respondent, a White man in his fifties (class 3), expressed his frustrations with the series of barriers he faced trying to place a sick call:

> Can't put in a request—they don't have any. They always say, well, uh, you have to see—you know nurses come by three times a day here, but if you ask them for a sick call, you have to do it at nighttime. Then you ask the nighttime one who say, oh, write it on a piece of paper. You don't have a piece of paper. And only half the time you're gonna have a pen. I just got a pen yesterday.

In solitary confinement, restrictions on material goods such as pen and paper limit communication and requests to services in an already limited-service environment. Some respondents further explained that one key issue with the process was that healthcare needs exceeded the supply of healthcare services. When one respondent, a Latino man in his forties (class 3), told a correctional officer that he wanted to see a psychiatrist, he was told, "Yeah, but it's 4000 people here, and you're on the list." He also believed that his name was on the bottom of the list because he was currently in solitary.

As with the other two classes, respondents in class 3 frequently questioned the knowledge and qualifications of prison medical staff because of the perceived low quality of care. One respondent, a Latino man in his thirties (class 3), said, "I would like to see somebody professional. But … to be honest with you, over here [in solitary] they say they professional—I don't know where they got their license." Sometimes this mistrust was also reflected in concerns over the types of medications being distributed. For instance, a respondent, a Latino man in his forties (class 3), who mentioned that he had prescriptions for depression and anxiety medications expressed that he was not sure what kind of medication staff were giving him, and he worried that it could be harmful: "You know, one pill that they're giving me is yellow with a little heart-shaped thing. I don't have a heart problem. That's probably for a heart problem, and I don't even take it." In an environment of lowered service provision and high levels of mistrust, respondents described their experience of solitary confinement as one that ignores or even exacerbates health problems.

## 4. Discussion

Our study documents grave health concerns voiced by men held in solitary confinement, both from relatively healthy individuals as well as those struggling to manage chronic health conditions. Coupled with the widespread use of solitary confinement in U.S. prisons, these findings show how solitary confinement is one way in which incarceration acts as social determinant of health (Brinkley-Rubinstein & Cloud, 2020; Nosrati et al., 2021). Our analysis describes how the conditions of solitary confinement exacerbate both mental and physical health problems. While a large research literature has examined the mental health status of solitary confinement populations (Dellazizzo et al., 2020; Hagan et al., 2018; Kaba et al., 2014; Luigi et al., 2020; Williams et al., 2019a), few studies have examined physical health outcomes (Strong et al., 2020). The high degree of clustered multimorbidity shown in our latent class analysis is suggests that existing research examining on-average health effects of solitary confinement may underestimate the impacts for these subgroups with multiple mental and/or physical health problems. Indeed, in addition to the multiple mental or physical health problems experienced by classes 2 and 3, chronic pain and substance use issues were experienced by many in both groups. Moreover, our three themes identify additional pathways through which solitary confinement affects health: restrictions to daily living, isolated idle time, as well as healthcare access and medical mistrust.

The deprivation described by respondents in this study is supported by findings from a similar sample in Washington state prisons, which also documented weight change, pain, and problems with healthcare in solitary confinement (Strong et al., 2020). These results, along with findings from several other studies (Brinkley-Rubinstein et al., 2019; Smith, 2006; Wildeman & Andersen, 2020; Williams et al., 2019a), stand in contrast to two reviews of quantitative investigations of the health effects of solitary confinement that minimize the extent of health harms (Labrecque & Smith, 2018; Morgan et al., 2016). Although quantitative investigations of the health consequences of solitary confinement are important for identifying population-level effects, they face several methodologic challenges and often struggle to distinguish between pre-existing health concerns and the ways that the experience of solitary confinement produces health problems (Williams et al., 2019a). Qualitative and mixed-methods approaches can complement the quantitative literature by centering the perspectives of people in solitary confinement to illuminate mechanisms, heterogeneity, and understudied harms. Importantly, scientific disagreements on the effects of solitary confinement have consequences for policies that regulate the use of solitary confinement.

Several states, including Pennsylvania, have limited the use of solitary confinement for individuals with serious mental illness (Resnik, VanCleave, & Bell, 2018). However, classification of those with serious mental illness varies significantly by jurisdiction (Resnik, VanCleave, & Bell, 2018). The three classes in our study provide insight into the flaws of such approaches. The results from our first class make clear that these policy efforts do not address the significant mental and physical harms we identified among those who are "relatively healthy". Secondly, the results from class 2 show several self-reported mental health diagnoses and associated challenges in solitary confinement, even among those without administrative designation as having a serious mental illness. In addition, our results from class 3 show that such designations ignore the grave concerns of those with physical health problems in the context of solitary confinement.

There are some limitations to our analysis that should be considered. First, our cross-sectional sample was drawn from admissions to solitary during the study period, and therefore is not able to characterize some of the more long-term health experiences of that population. Similarly, although our response rate was high, at 80%, it only represented 40% of admissions during the study period because it did not include individuals awaiting the death penalty or those with serious mental illness, and should therefore not be considered a definitive documentation of the health consequences of solitary confinement. Second, although our analysis noted a few times when this was not the case, respondents may be more likely to express issues that need be addressed to interviewers, rather than things that are working well. On the other hand, several respondents, and particularly those in class 1, emphasized their psychological "toughness" or resiliency to the hardships of solitary confinement—which may have limited their willingness to share vulnerabilities with the interviewers (Bergen & Labonté, 2020). Relatedly,

our study's latent class analysis relied upon self-report of health conditions and needs, and differences in willingness to disclose personal information could also have affected how each class described the experience of solitary confinement. A third limitation is that our findings are restricted to Pennsylvania. In 2017, the year of our field work, Pennsylvania had the seventh largest prison system with an imprisonment rate and solitary confinement rate similar to the U.S. average (Bronson & Carson, 2019; Smith, 2006). These findings are intended to expand upon existing measures of material deprivation, health, and severe social isolation in an average prison system that regularly uses solitary confinement to punish or control incarcerated people, but examining these conditions in other jurisdictions is an important avenue for future research and intervention. A related generalizability concern is that although our latent class analysis provided important information on clustering of health conditions in this population, our sample of 99 individuals may not reflect the latent class structure in a larger population, and we were unable to detect smaller subgroups that could potentially have been identified with a larger sample.

Our study highlights persistent efforts respondents made to maintain their health and access healthcare, despite the challenges posed by these conditions. Numerous health and medical professional organizations have called for reforms to limit the use of solitary confinement and an end to the practice altogether (Ahalt et al., 2017). The Istanbul (International Psychological Trauma Symposium, 2008) and Santa Cruz (Haney et al., 2020) Statements suggest growing consensus across public health and medical professionals, as well as prison administrators that solitary confinement should be restricted to exceptional circumstances and only for short periods of time. The significant health concerns raised by respondents in this study underscore the need for policies that further restrict the use of solitary confinement, in addition to monitoring and oversight of prisons and jails to prevent the health harms of solitary confinement and improve healthcare standards and delivery in this context (Cloud et al., 2015).

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## CRediT roles

JLJ: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Validation, Writing- original draft, review & editing, NB: Conceptualization, Data curation, Formal analysis, Investigation, Validation, Writing- original draft, review & editing, Project administration, JTS: Investigation, Funding acquisition, Project administration, Supervision, Writing- original draft, review & editing, BW: Investigation, Funding acquisition, Project administration, Supervision, Writing-review & editing.

## Declaration of competing interest

The authors have reviewed the above manuscript and none has conflicts of interest to report.

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