

Solitary confinement placement and post-release mortality risk among formerly incarcerated individuals: a population-based study



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Summary

Background With more than 10 million people incarcerated worldwide, some of whom will have experienced solitary confinement, a better understanding of health and mortality after release is needed. The aim of this study was to assess the relationship between placement in solitary confinement and mortality in the 5 years following release among formerly incarcerated individuals.

Methods In this population-based study we used data from Danish administrative registers and administrative dataset from the Danish Prison and Probation Service. We linked information on all Danish individuals who had been incarcerated for more than 7 days during 2006–11, with information on mortality for the 60 months following release. We used Cox proportional hazards models to estimate the association between being placed in solitary confinement and mortality (death and cause of death) among formerly incarcerated Danish individuals, controlling for several possible confounders (prison security level, release year, sentence length, reason for conviction, age at admission, sex, ethnic minority background, and education level) and using a reference group of incarcerated Danish individuals who had been sanctioned for in-prison infractions but not placed in solitary confinement in some models.

Findings Our study included 13776 individuals, which translated to 812374 person-months of exposure to the risk of mortality up to Dec 31, 2016. Formerly incarcerated Danish individuals who spent time in solitary confinement had higher overall mortality 5 years after release (4.5%) than did those who had not spent time in solitary confinement (2.8%; $p < 0.0001$). After adjusting for possible confounders, our results suggested an association between solitary confinement and elevated mortality due to non-natural causes (hazard ratio 2.342, 95% CI 1.527–3.592). We did not identify a significant association with natural causes.

Interpretation The results from these analyses indicate that solitary confinement placement might be a key moderator of the association between a history of incarceration and post-release outcomes. Our findings suggest that incarcerated individuals ever placed in solitary confinement are a vulnerable population in need of interventions.

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Introduction

Although researchers, practitioners, and lawyers have objected to solitary confinement on ethical grounds for decades,^{1–5} the continuing high proportions of incarcerated individuals sent to solitary confinement suggest that solitary confinement might not be solely an ethical issue but a pragmatic one as well, especially for the process of re-entry into society of formerly incarcerated individuals.^{6–8} Although most research on solitary confinement has focused on the often devastating psychological consequences of being placed in solitary confinement,^{9–16} some research has now shown that it also has an effect on the post-release employment rates and recidivism risks of formerly incarcerated individuals, making solitary confinement an issue for reinsertion in society as well.¹⁷

Global estimates of the prevalence of solitary confinement are not available; however, as more than

10 million people are incarcerated worldwide on any given day (around 2.1 million in the USA and more than 1.5 million in Europe, including half a million in Russia alone), solitary confinement potentially affects millions of people too.⁸ Estimates from the USA suggest that around 450000 people had spent time in solitary confinement during the previous 12 months in 2012, making this experience common in the prison population.⁶

In this Article, we investigate whether solitary confinement could also be considered a public health issue (beyond mental health) by testing the relationship between solitary confinement and mortality in the 5 years following release in formerly incarcerated individuals in Denmark using a linked administrative dataset. The aim of this study is to contribute not only to research on the consequences of solitary confinement but also to two other bodies of literature. First, and most directly, to add

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Research in context

Evidence before this study

We searched Scopus and Medline for articles published in English between Jan 1, 2000, and Dec 1, 2019, using combinations of the search terms “solitary confinement”, “restrictive housing”, and “conditions of confinement” and each of these terms: “mortality”, “death”, and “health”. Most studies were published within the past 5 years. We excluded a few studies because they were irrelevant (not about the search words on inspection), and we excluded studies that focused on the special case of solitary confinement on death row.

Two studies linked solitary confinement to post-release mortality. One study found increased mortality associated with solitary confinement. However, the study focused on the mortality of male convicts who were shipped to Tasmania in the 1840s, so it was not relevant to present links between solitary confinement and post-release mortality. The second study also found increased mortality associated with solitary confinement. This study focused on people released from prison in North Carolina, USA, and found high mortality rates associated with having been in solitary confinement in that context.

The association was especially strong for death from suicide, homicide, and opioid overdose shortly after release from prison. Another study focused on the link between imprisonment more broadly and post-release mortality. Some studies focused on the link between solitary confinement and in-prison outcomes, such as suicide ideation, self-harm, violent misconduct, and psychosocial vulnerability. A few studies focused on the prevalence of solitary confinement for different populations.

Much more published research exists on the broader link between solitary confinement and health, especially mental health. This research generally documented damaging associations, suggesting that solitary confinement impairs mental health, and leads to, for example, post-traumatic stress disorder symptoms. Finally, some studies focused on human rights and the ethics of using solitary confinement as a correctional tool, and on how the use of solitary confinement can be reduced.

Added value of this study

Our study used high-quality, recent data, covering the full population of prisoners admitted to and released from prison in Denmark during 2006–11. The administrative nature of the data added value to existing research along three dimensions. First, we were able to accurately track people in the death register up to 5 years after release and obtain information on causes of death as per the International Classification of Diseases. Second, we merged individual-level information from other registers onto the main data, allowing us to add a range of important control variables. Third, by merging onto our main data a previously unexploited dataset from the Danish Prison and Probation Service on all disciplinary actions during confinement, we were able to control for other disciplinary actions that prisoners experienced during confinement, a potentially very important confounder. With these data, we were able to evaluate the association between solitary confinement and mortality.

Implications of all the available evidence

Available evidence suggests that solitary confinement is problematic along many dimensions, both ethical and related to health. The results of our study added to knowledge by documenting a strong link between solitary confinement and mortality, especially mortality related to risk behaviours such as accidents, suicide, and violence. Although our study does not directly test the mechanisms behind this association it is possible that, given the existing evidence, the association could be driven by solitary confinement’s adverse effects on mental health. Taken together, these findings suggest that researchers and correctional professionals should strive to more clearly document both the costs and the benefits of solitary confinement to understand whether and when this punishment in correctional facilities does more harm than good.

knowledge to the literature on the relationship between imprisonment, release, and mortality,^{17–23} and second, to understand how conditions of confinement might moderate the consequences of incarceration for population health.²⁴

Methods

Study design

This cohort study included people that served a prison sentence in Denmark, for whatever reason and lasting at least 7 days, that both started and ended during 2006–11. This decision restricted our analyses to focus only on sentences that were shorter than 5 years; yet, because as little as 3% of sentences in Denmark were longer than 4 years during our data period, this decision was unlikely to be consequential. The advantage of this data restriction

was that it allowed us to make all observations throughout the follow-up period. To avoid autocorrelation, we focused on each person’s first prison sentence during the data window, and because we also observed mortality during new prison sentences, we did not adjust the follow-up period for re-incarceration. Some individuals died, emigrated, or otherwise went missing in the data (ie, we no longer observed them in the population register) before the 5-year follow-up period was completed. Informed consent to participate from the study participants was not needed for this register-based study, in accordance with the legislation that governs Statistics Denmark.

To compare mortality among the prisoners in our cohort study to mortality in the general population, we also obtained the 5-year mortality rate of a randomly drawn sample from the full population of non-incarcerated

individuals in Denmark with similar observation years, age, and sex distribution.

Procedures

To consider the association between being placed in solitary confinement during imprisonment and mortality after release, we relied on two sources of administrative data. The first source was Danish administrative registers (not publicly available). The registers were full population data (and thus had virtually no attrition) that consisted of administrative records from various collecting agencies, such as criminal justice agencies and other Danish agencies. Statistics Denmark collected these data and made them available for research, with the appropriate safeguards in place for ensuring confidentiality. An advantage of these data was that the administrative records were linkable at the individual level since all residents of Denmark had a unique identification number.²⁵ We could therefore include an array of background information about the population (ie, sex, date of birth, ethnic background, education level). We also included information from the death register (dates and causes of death).

The second administrative dataset was made available to us by the Danish Prison and Probation Service and recorded which incarcerated individuals were subjected to disciplinary actions during confinement, including individual level information on whether someone was placed in solitary confinement while serving a prison sentence.

Our key predictor variable was whether a person was placed in solitary confinement during 2006–11. We assigned this variable a value of 1 if the individual had been placed in solitary confinement at any given time or 0 if they had not. This variable allowed us to observe whether mortality differed among formerly incarcerated individuals who spent time in solitary confinement and those who did not.

The main outcome of this study was mortality in the 5 years following release from a correctional facility. For each month after a person was released from prison, we constructed a dummy variable taking the value 1 if the person had died during that month and 0 otherwise. The outcome was right censored at 60 months after release (or when people had emigrated). We obtained the mortality information from the death register, which recorded all deaths in Denmark under the Danish Board of Health Data (Sundhedsdatastyrelsen). The death register was an appended mortality database, and the version we accessed included all deaths up to Dec 31, 2016. We censored everyone at 60 months from release, however, so the data window for mortality was Jan 12, 2006, to Dec 31, 2016.

The death register had information on date of death, which allowed us to determine the timing of death relative to prison release. We also merged our data with information on cause of death, which was recorded

using the International Classification of Diseases tenth revision (ICD-10) in the DODSAASG register on causes of death that were also recorded by the Danish Board of Health Data. We used three broad categories: any cause of death (all ICD-10 codes, to capture total mortality), non-natural causes of death (ICD-10 codes V01-Y99 [accidents], X60-X84 [self-harm], and X85-Y09 [violence]), and natural causes of death (inverse of non-natural deaths).

Our models included many covariates potentially linked with both the risk of placement in solitary confinement (contingent upon being placed in a correctional facility) and mortality. The administrative dataset from the Danish Prison and Probation Service provided information on admission date, release date (we measured mortality from date of release but used release-year dummies as control variables to take general time trends into account); sentence length; the crime type for which the person served a prison sentence (violent crimes, property crimes, and the residual other crimes). From the [Danish administrative population register](#) we obtained date of birth (used to calculate the demeaned age of each person when they were admitted into prison), sex (this variable was assigned a value of 1 if female, 0 if male), and whether the person had ethnic minority background (this variable was assigned a value of 1 if yes, 0 if no). From the education register we assessed each person's highest education level at the time of admission into prison (we assigned this variable a value of 1 if it was basic schooling [ie, tenth grade or less], 0 if it was a higher level of education).

We also included information on other conditions of confinement (which were also available in the data from the Danish Prison and Probation Service), namely the security level of the facility in which the person was incarcerated (coded as a series of dummy variables: low-security prison; high-security facility; local jail), whether those who were not sent to solitary confinement were assigned other disciplinary actions (eg, fines, confiscation of contraband, etc; this parameter was assigned a value of 1 if yes, 0 if no), and, for individuals who were sent to solitary confinement, the total number of days spent in solitary (dummy coded 1–3 days, 4–7 days, or more than a week in descriptive statistics but entered continuously in the regression models). We collapsed multiple incidents of solitary confinement into a common measure of total days in solitary, which arguably introduced a risk of bias across repeat solitary confinement placement. Yet, 75% of incarcerated people who experienced solitary confinement only did so once, and 93% only did so once or twice; we therefore opted to use the simpler measure. Preliminary analyses that included extensive controls (eg, sibship size, more detailed offence categories, and information about each person's parents) did not relate substantially to solitary confinement, so we decided to use the above-described more parsimonious model.

For Statistics Denmark see <https://www.dst.dk/en>

For an overview of all Danish registers (in Danish) see <http://www.dst.dk/extranet/forskningvariabellister/Oversigt%20over%20registre.html>

For the Danish Prison and Probation Service see <https://www.kriminalforsorgen.dk/om-os/kriminalforsorgens-opgaver/international/>

	No solitary confinement (n=12 114)	Solitary confinement (n=1662)	t-test p value
Mortality by cause of death after 5 years			
Any	345 (2.8%)	75 (4.5%)	<0.0001
Natural	120 (1.0%)	22 (1.3%)	0.0289
Non-natural	225 (1.9%)	53 (3.2%)	0.0006
Conditions of confinement			
Time spent in solitary confinement			
<72 h	..	431 (25.9%)	..
72 h–1 week	..	712 (42.8%)	..
>1 week	..	519 (31.2%)	..
Facility security level			
Low	9129 (75.4%)	902 (54.3%)	<0.0001
High	2985 (24.6%)	760 (45.7%)	<0.0001
Disciplinary actions			
None	7058 (58.3%)
Other*	5056 (41.7%)
Solitary confinement	..	1662 (100.0%)	..
Background characteristics			
Year of release			
2006	1814 (15.0%)	148 (8.9%)	<0.0001
2007	2559 (21.1%)	340 (20.5%)	0.1123
2008	2130 (17.6%)	308 (18.5%)	0.8490
2009	1956 (16.1%)	298 (17.9%)	0.0848
2010	1907 (15.7%)	286 (17.2%)	0.0142
2011	1748 (14.4%)	282 (17.0%)	0.0001
Sentence length, years			
	3.000 (1.000–6.000)	9.000 (4.000–18.167)	<0.0001
Reason of conviction			
Violent crime	5710 (47.1%)	930 (56.0%)	<0.0001
Property crime	2053 (16.9%)	351 (21.1%)	0.0573
Other crime type	4351 (35.9%)	381 (22.9%)	<0.0001
Age at admission, years			
	26.127 (21.529–31.296)	23.896 (20.567–29.225)	<0.0001
Sex			
Female	510 (4.2%)	76 (4.6%)	0.8607
Male	11604 (95.8%)	1586 (95.4%)	0.8607
Has ethnic minority background			
	2625 (21.7%)	534 (32.1%)	<0.0001
Education level			
Basic schooling	9848 (81.3%)	1520 (91.5%)	<0.0001
More than basic schooling	2266 (18.7%)	142 (8.5%)	<0.0001

Data are n (%) or median (IQR). *Such as fines and the confiscation of contraband.

Table 1: Background characteristics and conditions of confinement, by solitary confinement status

Statistical analysis

To estimate the association between being placed in solitary confinement and mortality, we first plotted the cumulative mortality rate by the key predictor (solitary confinement) and by cause of death (any, non-natural, and natural) using the Kaplan-Meier estimator. We then estimated multivariate Cox proportional hazards models, successively including more controls, to measure the mortality hazard (hazard ratio [HR], 95% CI) during the 60-month follow-up period while adjusting for background characteristics and other conditions of confinement.

The fundamental statistical assumption of the Cox proportional hazard model is the proportionality assumption, which states that although hazard rates might differ among the comparison groups (this was indeed what we expected), they would do so at a constant ratio at any point during the follow-up period. We tested this assumption by regressing the scaled Schoenfeld residuals on the time variable and testing whether the corresponding slope coefficient was zero. After allowing the effect of age, sentence length, sex, educational achievement, and release year to vary across the follow-up period, we found no significant breaches to the assumption.

Because it was debatable whether people who served a prison sentence at the same facility could be viewed as statistically independent, we clustered SEs at the facility level.

All analyses were done using Stata version 15.

Role of the funding source

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. LHA had full access to all the data in the study and the corresponding author had final responsibility for the decision to submit for publication.

Results

Our study included 13 776 individuals who served a prison sentence in 2006–11. After excluding individuals who died, emigrated, or otherwise went missing in the data before the 5-year follow-up period was completed, our study included 812 374 person-month observations. 420 (3.0%) individuals died during the follow-up period, which is substantially higher than the mortality in a random sample from the full population of non-incarcerated individuals with similar observation years, age, and sex structure (37 [0.3%] of 13 504 individuals). Mortality varied between individuals who were sent and those who were not sent to solitary confinement during their time in prison (table 1). The overall mortality was significantly higher 5 years after release among individuals who had been in solitary confinement (75 [4.5%] of 1662) than among those who had not been in solitary confinement (345 [2.8%] of 12 114; p<0.0001). We found similar results for non-natural causes of death (53 [3.2%] individuals who had vs 225 [1.9%] individuals who had not been in solitary confinement; p=0.0006) and, albeit to a lesser degree, for naturally occurring deaths (22 [1.3%] individuals who had vs 120 [1.0%] individuals who had not been in solitary confinement; p=0.0289). In the comparison sample, these rates were much lower (26 [0.2%] of 13 504 individuals died of natural death and 11 [0.1%] of non-natural death).

Individuals who spent time in solitary confinement had longer average sentence lengths, were younger at admission, were convicted for violent crimes at a higher proportion, identified with ethnic minority backgrounds,

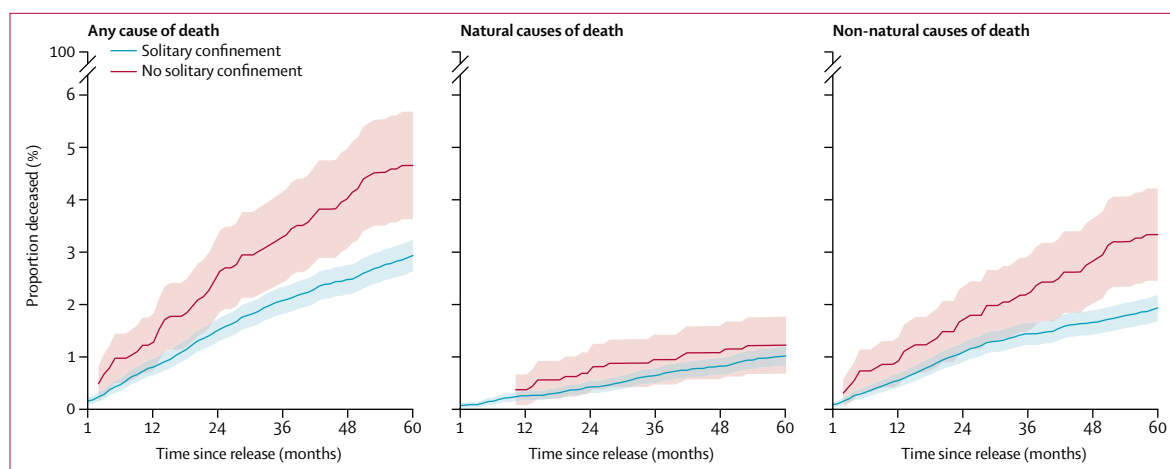


Figure: Cumulative proportion of individuals deceased, by month following release from prison, solitary or non-solitary confinement experience, and cause of death (n=13 776), 2006–11

Data are estimate (95% CI). Data were not adjusted for background characteristics. Number at risk were 13 755 individuals at 1 month, 13 663 individuals at 12 months, 13 562 individuals at 24 months, 13 479 individuals at 36 months, 13 420 at 48 months, and 13 356 individuals at 60 months.

	Any cause of death			Natural cause of death			Non-natural cause of death		
	Unadjusted model	Adjusted model*	Adjusted model†	Unadjusted model	Adjusted model*	Adjusted model†	Unadjusted model	Adjusted model*	Adjusted model†
Hazard ratio (95% CI)‡	1.599 (1.268–2.017)	1.680 (1.305–2.162)	1.972 (1.416–2.746)	1.340 (0.941–1.909)	1.506 (1.037–2.186)	1.471 (0.914–2.367)	1.728 (1.254–2.380)	1.748 (1.243–2.458)	2.342 (1.527–3.592)
p value	<0.0001	<0.0001	<0.0001	0.1047	0.0313	0.1120	0.0008	0.0013	<0.0001
Time at risk, person-months	812 374	812 374	812 374	822 210	822 210	822 210	816 921	816 921	816 921

All parameter estimates are available in the appendix (pp 1, 2). *Adjusted for background characteristics. †Adjusted for background characteristics and other conditions of confinement. ‡SEs (used to calculate the 95% CIs) were clustered at the facility level.

Table 2: Mortality up to 5 years after release, by cause of death (n=13 776)

did not acquire education beyond basic schooling, and served their sentences in a high-security facility (table 1). They were placed in solitary confinement for a variety of durations (median 5.0 days [IQR 3.0–10.0], mean 8.7 days [SD 13.2]), and two-thirds of those who had been in solitary confinement were there for a total of less than a week. Most individuals who were placed in solitary confinement would typically return to the general prison community within a few days (and often back into society within weeks or months because of the short sentences in Denmark). Around 40% of individuals who were not placed in solitary confinement underwent other disciplinary actions during incarceration. The differences in mortality during the 5 years after release from prison, for any cause of death and for non-natural causes of death manifested themselves very quickly (figure). Already during the first year after release, the differences in cause-specific mortality estimates grew. After 12 months, 20 (1.2%) of 1662 individuals placed in solitary confinement had died of any cause and 14 (0.8%) had died of non-natural causes of death, whereas 93 (0.8%) of 12 114 individuals not placed in solitary confinement had died of any cause and 62 (0.5%) had died of non-natural causes ($p=0.0648$ for all and $p=0.0877$

for non-natural causes). After 13 months the difference for any cause of death was statistically significant (1.3% solitary and 0.8% non-solitary, $p=0.0492$) and the difference for non-natural causes was statistically significant after 21 months (1.5% solitary and 0.9% non-solitary, $p=0.0390$). The pattern for naturally occurring deaths did not show any substantial differences between those who had been in solitary confinement and those who had not. Thus, most of the mortality gap between individuals who had been in solitary and those who had not was attributable to a small number of causes.

Table 2 presents the results from our statistical models of the association between mortality hazard and key predictor variable. The unadjusted models represent the raw associations and show that mortality hazards were higher among individuals who were placed in solitary confinement during incarceration than among individuals who were not given this disciplinary action (HR for death by any cause 1.599, 95% CI 1.268–2.017; $p<0.0001$). This overall difference was driven by non-natural deaths (1.728, 1.254–2.380; $p=0.0008$), whereas there was no discernible difference for naturally occurring deaths (1.340, 0.941–1.909; $p=0.1047$).

See Online for appendix

The other models we used adjusted the associations found with unadjusted models for background characteristics or for background characteristics and other conditions of confinement (table 2; appendix). The same overall pattern of results emerged, with the main difference between the unadjusted and adjusted results being that the association between placement in solitary confinement and mortality increased slightly when we took the compositional differences of the groups into account. Thus, direct comparison of individuals who were placed in solitary confinement versus individuals in the general prison community, without taking other differences between these groups into account, would have led to a slight underestimation of the effect of solitary confinement on mortality.

Discussion

Extensive evidence has shown that the mortality of formerly incarcerated individuals in the days, weeks, months, and even years following their release from correctional facilities is high.^{18–23} Many studies have also investigated the consequences of being placed in solitary confinement for mental health, especially among those placed in solitary confinement for long periods of time.^{9–16} In this Article, we evaluated the association between being placed in solitary confinement and mortality in the 5 years following release from a correctional facility in Denmark, including providing analyses by cause of death. As much as two-thirds of the people in our cohort who had spent time in solitary confinement did so for less than a week in total during the incarceration. We found that individuals who were placed in solitary confinement during incarceration died at high rates in the 5 years following release from a correctional facility and died from causes that are consistent with those that lead to excess mortality among formerly incarcerated individuals in the USA and Europe.^{18–23} In fact, the 5-year mortality among formerly incarcerated individuals who were placed in solitary confinement was almost ten times that in the general population (with similar sex and age composition). We also showed that even after adjusting for possible confounders, the association between solitary confinement placement, mortality, and non-natural mortality persisted. Indeed, the association between having been placed in solitary confinement and post-release mortality was stronger after adjusting for covariates, suggesting either that differential selection into solitary confinement was not driving this association or that there was some omitted variable—such as underlying mental health problems or addiction—that could have driven both associations. Although omitted variable bias could, of course, have been an unobserved driver of this association, given the strength and stability of this association, even if that were the case, formerly incarcerated individuals ever placed in solitary confinement are a vulnerable population in need of interventions.

Finally, our study showed that short periods in solitary confinement were linked to elevated post-release mortality

and that these elevated mortality rates were confined to non-natural causes. In other countries, such as the USA, in which extremely long periods (eg, years) in solitary confinement are common, solitary confinement would probably also be linked to elevated rates of mortality through natural causes as well (eg, through lack of exercise or exposure to sunlight).²⁴

Important as these results are for informing our understanding of how conditions of confinement in correctional facilities moderate the association between incarceration and health, our analyses still had five core limitations. First, because the data that were provided to us did not contain information on protective custody (ie, an incarcerated person requesting to be placed in solitary confinement, often due to safety concerns) our analyses focused on the effects of placement in disciplinary and administrative segregation. As such, we compared placement in disciplinary or administrative segregation (solitary confinement) to the control group of incarcerated people who received the standard conditions of confinement or who were in protective custody. Placement in disciplinary segregation occurs because of specific in-person infractions, whereas placement in administrative segregation occurs because of a more general assessment of the risk an incarcerated individual would pose in the prison community. Second, the analyses presented here were merely associational and a possible causal effect of solitary confinement placement on mortality could not be estimated because of the retrospective and observational nature of the study. The stringent interpretation of our main results was thus that the proportion of individuals placed in solitary confinement and mortality from non-natural causes was increased in incarcerated people with specific demographic characteristics (eg, younger individuals, individuals who served longer sentences). Third, some omitted variable (or set of variables, such as rapidly declining mental health, exposure to severe trauma through other sources within the facility, or within-facility drug or alcohol abuse), rather than solitary confinement, might have driven the association we found. Fourth, we focused only on a person's first prison sentence in our data window and we did not censor later periods of incarceration because our data contained mortality even during periods of incarceration. Research has shown, however, that solitary confinement might increase rates of reincarceration, which means that new prison sentences could affect our comparison groups differentially.¹⁷ Finally, although the analyses presented a compelling portrait of how solitary confinement shaped the health and mortality risk of formerly incarcerated individuals in Denmark, it was unclear how these results translated to other countries. Although there might be reasons to worry about the external validity of our results and, especially, how well our results generalise to the unusual conditions surrounding mass incarceration, previous research suggests that incarceration in Denmark and

other European countries has much the same consequences there as it does in the USA.^{26–29}

Our results offered important information of how one key modifiable condition of confinement potentially shaped the health and mortality risk of formerly incarcerated individuals. Our analyses focused on short stays in solitary confinement for individuals who were due to be released back into society within, often, just months; however, research on solitary confinement disproportionality focuses on long stays in solitary confinement among individuals who have long sentences (and might never be released from prison).¹² As such, our results have important implications both for departments of corrections and for public health professionals. For public health professionals, these results suggest that having knowledge about whether a formerly incarcerated person spent time in solitary confinement might be a salient predictor of added risk for mortality (and, possibly, other poor health outcomes). As such, it would be important for public health services to have information on incarceration and confinement, but only if there are methods for obtaining it in a sensitive and unobtrusive way. This Article provides those who work in departments of corrections with some insight into the costs of placement in solitary confinement, even for short times. As others have argued,¹⁶ neither the costs nor the benefits of placing incarcerated individuals in solitary confinement have been clearly laid out; however, solitary confinement as well as other forms of segregation, are very costly. Departments of corrections should thus seek to carefully catalogue both the costs and benefits of this practice in order to be certain that they are using solitary confinement efficiently.

Contributors

CW conceptualised the study, drafted the manuscript, and consulted on the analyses. LHA did the analyses and provided critical feedback on the initial draft of the manuscript.

Declaration of interests

We declare no competing interests.

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References

- Bastian B, Haslam N. Excluded from humanity: the dehumanizing effects of social ostracism. *J Exp Soc Psychol* 2010; **46**: 107–13.
- Cloud DH, Drucker E, Browne A, Parsons J. Public health and solitary confinement in the United States. *Am J Public Health* 2015; **105**: 18–26.
- Metzner JL, Fellner J. Solitary confinement and mental illness in US prisons: a challenge for medical ethics. *J Am Acad Psychiatry Law* 2010; **38**: 104–08.
- New York State Council of Churches. Resolution opposing the use of prolonged solitary confinement in the correctional facilities of New York State and New York City. Albany, NY: New York State Council Churches; 2014. <https://sites.google.com/site/nyscouncilofchurches/priorities/on-solitary-confinement> (accessed April 24, 2019).
- Obama B. Why we must rethink solitary confinement. *Washington Post*. Jan 25, 2016. https://www.washingtonpost.com/opinions/barack-obama-why-we-must-rethink-solitary-confinement/2016/01/25/29a361f2-c384-11e5-8965-0607e0e265ce_story.html?utm_term=.2367a0d39f64 (accessed July 15, 2019).
- Beck AJ. Use of restrictive housing in US prisons and jails, 2011–12—Special Report NCJ 240209. Washington, DC: Bureau of Justice Statistics, 2015.
- Rope O, Sheahan F. Global prison trends 2018. London and Bangkok: Penal Reform International and Thailand Institute for Justice; 2018. https://cdn.penalreform.org/wp-content/uploads/2018/04/PRI_Global-Prison-Trends-2018_EN_WEB.pdf (accessed July 30, 2019).
- Walmsley R. World prison population list, 12th edn. London: World Prison Brief, Institute for Criminal Policy Research, 2018. <http://www.prisonstudies.org/sites/default/files/resources/downloads/wpp12.pdf> (accessed April 23, 2019).
- Arrigo BA, Bullock JL. The psychological effects of solitary confinement on prisoners in supermax units: reviewing what we know and recommending what should change. *Int J Offender Ther Comp Criminol* 2008; **52**: 622–40.
- Cloyes K, Lovell D, Allen D, Rhodes L. Assessment of psychosocial impairment in a supermaximum security unit sample. *Crim Justice Behav* 2006; **33**: 760–81.
- Grassian S. Psychiatric effects of solitary confinement. *Wash Univ J Law Policy* 2006; **22**: 325–83.
- Haney C. Mental health issues in long-term solitary and “supermax” confinement. *Crime Delinq* 2003; **49**: 124–56.
- Haney C. Restricting the use of solitary confinement. *Ann Rev Criminol* 2018; **1**: 285–310.
- International Psychological Trauma Symposium. Istanbul statement on the use and effects of solitary confinement. Istanbul: International Psychological Trauma Symposium; 2007. http://solitaryconfinement.org/uploads/Istanbul_expert_statement_on_sc.pdf (accessed April 24, 2019).
- Kaba F, Lewis A, Glowa-Kollisch S, et al. Solitary confinement and risk of self-harm among jail inmates. *Am J Public Health* 2014; **104**: 442–47.
- Smith PS. The effects of solitary confinement on prison inmates: a brief history and review of the literature. *Crime Justice* 2006; **34**: 441–528.
- Wildeman C, Andersen LH. The long-term consequences of being placed in disciplinary segregation. *Criminol* (in press).
- Daza S, Palloni A, Jones J. The consequence of incarceration for mortality in the US. SocArXiv 2019; published online Feb 10. DOI:10.31235/osf.io/b8xe6 (preprint).
- Massoglia M, Pare PP, Schnittker J, Gagnon A. The relationship between incarceration and premature adult mortality: gender specific evidence. *Soc Sci Res* 2014; **46**: 142–54.
- Noonan MF, Rohloff H, Ginder S. Mortality in local jails and state prisons, 2000–2013—statistical tables. NCJ 248756. Washington, DC: Bureau of Justice Statistics, 2015. <https://www.bjs.gov/content/pub/pdf/mljisp0013st.pdf> (accessed April 24, 2019).
- Patterson EJ. Incarcerating death: mortality in US state correctional facilities, 1985–1998. *Demography* 2010; **47**: 587–607.
- Rosen DL, Schoenbach VJ, Wohl DA. All-cause and cause-specific mortality among men released from state prison, 1980–2005. *Am J Public Health* 2008; **98**: 2278–84.
- Rosen DL, Wohl DA, Schoenbach VJ. All-cause and cause-specific mortality among black and white North Carolina state prisoners, 1995–2005. *Ann Epidemiol* 2011; **21**: 719–26.
- Wildeman C, Goldman A, Turney K. Conditions of confinement in American prisons and jails. *Annu Rev Law Soc Sci* 2018; **14**: 29–47.
- Andersen LH. Chapter 2—Danish register data: flexible administrative data and their relevance for studies of intergenerational transmission. In: Eichelsheim VI, van de Weijer SGA, eds. Intergenerational continuity of criminal and antisocial behavior: an international overview of studies. London: Routledge, 2018.
- Andersen LH. How children’s educational outcomes and criminality vary by duration and frequency of paternal incarceration. *Ann Am Acad Pol Soc Sci* 2016; **665**: 149–70.
- Joukamaa M. The mortality of released Finnish prisoners; a 7 year follow-up study of the WATTU project. *Forensic Sci Int* 1998; **96**: 11–19.
- Nieuwebeerta P, Piquero AR. Mortality rates and causes of death of convicted Dutch criminals 25 years later. *J Res Crime Delinq* 2008; **45**: 256–86.
- Pratt D, Piper M, Appleby L, Webb R, Shaw J. Suicide in recently released prisoners: a population-based cohort study. *Lancet* 2006; **368**: 119–23.