

All page/line/reference numbers refer to the tracked revised manuscript.

**Reviewers Comments:**

**Reviewer #1 (Remarks to the Author):**

**All my comments have been correctly addressed. I acknowledge the large amount of work done by the original and new authors. No additional changes are needed. I congratulate the authors for this interesting article.**

We thank the Reviewer for the thoughtful and constructive comments.

**Reviewer #2 (Remarks to the Author):**

The authors' response to the original inquiry about the importance of location-specific factors in shaping heat-related outcomes in prisons is satisfactory. They have acknowledged the significance of geographic location, especially focusing on the Southern United States, where the risk of dangerous heat conditions in carceral facilities is particularly high.

In the expanded discussion, the authors highlight that the majority of these facilities have seen a rapid increase in hot and humid days since the 1980s. This increase is attributed not only to anthropogenic climate change but also to land-cover and land-use changes, including the urban heat island effect exacerbated by the materials used in constructing these facilities. This point effectively underscores the multifaceted nature of the problem, where environmental factors are compounded by infrastructure choices.

Moreover, the authors draw attention to the interplay between geographic disparities and state-level criminal justice policies. They note that Southern states, which have some of the highest incarceration rates, often do not have mandatory indoor temperature requirements, thereby increasing the risk of heat-related issues. This adds depth to the understanding of how different states' approaches to prison management can affect inmate welfare, particularly in relation to climate conditions. The mention of specific states like Texas, Florida, Arizona, and Louisiana as the most exposed to hazardous heat days provides concrete examples that reinforce the argument.

We thank the Reviewer for the thoughtful and constructive suggestions. We have responded point-by-point to the Reviewer's questions and comments below.

**The lack of universal air conditioning in these states' prisons highlights a critical area of concern and vulnerability, especially given the increasing frequency and intensity of heatwaves - but is this true and validated?**

We agree with the Reviewer that it is a challenge to understand whether each prison and jail has air conditioning. Further direct research needed, ideally with each prison in our study (for example, by making a Freedom of Information Act (FOIA) request for every jail and prison). However, it is likely that there are many prisons and jails without air conditioning if they are not required to install air conditioning units, particularly given that 44 states do not universally provide air conditioning in carceral facilities, as well some prisons and jails which lack maintenance and upkeep of existing cooling infrastructure, as stated in the revised manuscript (P. 7, Lines 322-326):

*Further work is critical to ~~both~~ comprehensively characterize the vulnerability of the United States incarcerated population to heat, as well as how heat impacts ~~their health, health, to build reliable and validated datasets of cooling mechanisms in prisons and jails, to directly measure indoor temperatures in prisons and jails, and~~ to deploy adaptation measures to mitigate the worst impacts of climate-related stressors.*

We also agree that our paper highlights a critical area of concern and vulnerability for the incarcerated population, and we propose that the overall message of the manuscript is

successful in providing a firm foundation establishing a strong area of concern (as is the scope of a Brief Communication) to perform more detailed analyses in the near future.

**The concern and the elephant in the room is the lack of information on indoor environments and personal exposures in the study. To be, this is a crucial limitation in interpreting the findings. Despite the use of advanced exposure assessment techniques, the absence of specific data on indoor temperatures, particularly in prisons, casts uncertainty on the conclusions drawn about the actual conditions experienced by inmates.**

While data measuring indoor temperatures, particularly in prisons and jails, in the United States is scarce, a study from Denmark found temperatures in prison cells to be 4-5°C above those outdoors in summer, while another study of indoor heat in Harlem found similar results. We have added this information and references to the revised Supplementary Information due to space constraints of the Brief Commentary:

*While data measuring indoor temperatures in prisons and jails in the United States is scarce, a study from Denmark found temperatures in prison cells to be 4-5°C above those outdoors in summer.<sup>5</sup> This is approximately what was also found in the Harlem Heat Project in New York City, a study of indoor domestic temperatures in domestic settings in Harlem, which is an area of New York with many residents who suffer cooling hardship.<sup>6</sup>*

Related to the above point by the Reviewer, we have added that more research is needed to directly measure indoor temperatures in prisons and jails in the United States in the revised manuscript (P. 7, Lines 322-326):

*Further work is critical to ~~both~~ comprehensively characterize the vulnerability of the United States incarcerated population to heat, as well as how heat impacts ~~their health~~, health, to build reliable and validated datasets of cooling mechanisms in prisons and jails, to directly measure indoor temperatures in prisons and jails, and to deploy adaptation measures to mitigate the worst impacts of climate-related stressors.*

**Indoor environments, especially in settings like prisons, can significantly differ from outdoor ambient conditions. Factors such as building materials, ventilation, and the presence or absence of air conditioning or shades play a critical role in determining the indoor climate. Without data on these aspects, any conclusions about temperature exposure are primarily based on external environmental conditions, which may not accurately reflect the actual exposure experienced by individuals indoors.**

We recognise that temperatures which incarcerated people experience indoors is determined by many factors. Nevertheless, there are many emerging stories of incarcerated people dying in prisons and jails (e.g., <https://www.nytimes.com/2023/06/29/us/texas-prisons-heat.html>), which no doubt highlights how this is a major issue and will continue to be under climate change. The advantage of our analysis is it takes a top-down approach to lay foundation for further research, which we state clearly as needing to be done in the revised manuscript (PP. 6-7, Lines 304-327):

Our work highlights how incarcerated populations in the ~~United States~~US are systematically exposed to potentially hazardous heat with the greatest exposure and rates of increase concentrated in state-run institutions. Federal, state, and local laws mandating safe temperature ranges, enhanced social and physical infrastructure, and health system interventions could mitigate the effect of ~~heat exposure on this underserved and overburdened group.~~hazardous heat. Underlying this is the need for a fundamental overhaul to the perception and treatment of incarcerated people in environmental public health policy and regulatory action. Further work is critical to ~~both~~ comprehensively characterize the vulnerability of the United States incarcerated population to heat, as well as how heat impacts ~~their health,~~health, to build reliable and validated datasets of cooling mechanisms in prisons and jails, to directly measure indoor temperatures in prisons and jails, and to deploy adaptation measures to mitigate the worst impacts of climate-related stressors. Doing so is critical to environmental justice, particularly for incarcerated people with limited social and political agency.

**This limitation is important in understanding the health risks associated with heat exposure in prisons. Suppose the indoor conditions are markedly different from the outdoor temperatures (either cooler due to air conditioning or hotter due to poor ventilation and overcrowding). In that case, the study's findings might not fully capture the true extent of the risk or lack thereof. Surely, there are adaptation or acclimation measures for inmates and staff? The availability and quality of outdoor spaces for inmates can vary, and in some high-security settings, access to outdoor areas is highly restricted -- how does this factor?**

As we have stated above, while data measuring indoor temperatures in prisons and jails in the United States is scarce, a study from Denmark found temperatures in prison cells to be 4-5°C above those outdoors in summer. In general, this is approximately what was found in the Harlem Heat Project in New York City, a study of indoor domestic temperatures in Harlem. We have added this information and references to the revised Supplementary Information due to space constraints of the Brief Commentary:

*While data measuring indoor temperatures in prisons and jails in the United States is scarce, a study from Denmark found temperatures in prison cells to be 4-5°C above those outdoors in summer.<sup>5</sup> This is approximately what was also found in the Harlem Heat Project in New York City, a study of indoor domestic temperatures in domestic settings in Harlem, which is an area of New York with many residents who suffer cooling hardship.<sup>6</sup>*

The Reviewer is correct that many incarcerated people get very limited outdoor time. This will likely factor in increasing their vulnerability if indoor environments are not adequately cooled.

The format of the submission is Brief Communication and therefore we are very restricted in words. Nevertheless, we have substantially added where possible that more research is needed in the revised manuscript (P. 7, Lines 322-326):

Further work is critical to ~~both~~ comprehensively characterize the vulnerability of the United States incarcerated population to heat, as well as how heat impacts ~~their health,~~health, to build reliable and validated datasets of cooling mechanisms in prisons and jails, to directly

*measure indoor temperatures in prisons and jails, and to deploy adaptation measures to mitigate the worst impacts of climate-related stressors.*

**Lastly, we need a comparison group. Clarifying the characteristics of non-prison or non-institutionalized comparison groups would provide a clearer context for understanding the relative risk faced by the incarcerated population compared to non incarcerated population.**

We have added statistics in the revised Supplementary Information regarding comparisons between incarcerated and non-incarcerated groups in the United States as Supplementary Tables 1 and 2, copied below for convenience (next page and page after):

We refer to Supplementary Tables 1 and 2 in the revised manuscript (P. 4, Lines 214-216):

*Statistics comparing the characteristics of incarcerated and non-incarcerated people are found in Supplementary Tables 1 and 2.*

**Supplementary Table 1.** Race, sex, and some SES variables for state incarcerated populations compared to U.S. general population.

Variable	State incarcerated population	U.S. general population (18+)	Source
Race			<p>Beyond the count: A deep dive into state prison populations from the Prison Policy Initiative, 2022.  <a href="https://nicic.gov/weblink/beyond-count-deep-dive-state-prison-populations-2022">https://nicic.gov/weblink/beyond-count-deep-dive-state-prison-populations-2022</a></p> <p>-data are from Bureau of Justice Statistics' 2016 Survey of Prison Inmates</p> <p>-data are not regularly collected; most recent year available</p>
White	32%	62%	
Black	34%	12%	
Hispanic	21%	17%	
Sex			
Men	93%	49%	
Women	7%	51%	
Unemployment rate (pre-incarceration)	14.8%	4.7%	
Percent homeless (pre-incarceration)	4.9%	0.2%	
Percent with less than high school education	White: 52% Black: 68% Hispanic: 69%	Overall: 12%	
Percent with annual income of < \$22,500 (pre-incarceration)	57%	23%	<p>Prisons of poverty: Uncovering the pre-incarceration incomes of the imprisoned, 2015  <a href="https://www.prisonpolicy.org/reports/income.html">https://www.prisonpolicy.org/reports/income.html</a></p>

Note: the Prison Policy Initiative Reports are all based on Bureau of Justice Statistics

**Supplementary Table 2.** Race of incarcerated population compared to state population for CA, TX, AZ.

State	State incarcerated population	State general population	Source	Year
<b>California</b>			California's Prison Population Fact Sheet from Public Policy Institute of California, 2017 <a href="https://www.ppic.org/publication/californias-prison-population/">https://www.ppic.org/publication/californias-prison-population/</a>	2017
Black men	28.5%	5.6%		
Black women	25.9%	5.7%		
Incarceration rate for black men	4,236 / 100,000			
Incarceration rate for white men	422 / 100,000			
<b>Texas</b>			Texas state profile from Prison Policy Initiative, 2023 <a href="https://www.prisonpolicy.org/profiles/TX.html">https://www.prisonpolicy.org/profiles/TX.html</a>	2021
Black	33% prisons, 28% jails	12%		
White	34% prisons, 40% jails	41%		
Hispanic	33% prisons, 31% jails	40%		
<b>Arizona</b>			Incarceration trends in Arizona from Prison Policy Initiative, 2023 <a href="https://www.prisonpolicy.org/profiles/AZ.html">https://www.prisonpolicy.org/profiles/AZ.html</a>	2021
Black	15% prisons, 16% jails	4%		
White	38% prisons, 55% jails	53%		
Hispanic	39% prisons, 20% jails	32%		
NA/AN	6% prisons, 8% jails	4%		

**Reviewer #3 (Remarks to the Author):**

**The authors have greatly improved their already strong manuscript in response to Reviewer comments, with several additional sensitivity analyses and important clarifications to the text. I recommend this manuscript for publication and believe it will have a meaningful impact on epidemiologic research on the health of incarcerated populations as well as informing actions to address extreme heat exposure.**

We thank the Reviewer for the thoughtful and constructive comments.