An Environmental Justice and Policy Assessment of California Prisons: The Impact of Prisons on Community Health Disparity

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ABSTRACT

This paper investigates health outcomes in communities living near a prison controlling for demographic and environmental factors possibly affecting health outcomes, given that (1) the location of prisons are not random, (2) populations that live near prisons may be very different than populations not living near prisons, and (3) other factors such as environmental differences may differ between prison and non-prison locations. This study hypothesizes that cardiovascular disease rates in census tracts with prisons are higher than census tracts without prisons across California. Am ordinary least squares regression correlation of incidence of cardiovascular disease with an indicator whether the community has a nearby prison, has found a significant correlation which corresponds to a 9.6% higher incidence of cardiovascular disease . When controlling for demographic differences (race, age, etc.), I find a higher correlation which corresponds to 8.6%. Finally, a third multiple regression controlled for environmental variations (nearby landfills, treatment facilities, etc.) with a higher incidence of cardiovascular disease. Although not causal, my findings reveal a positive correlation indicating that individuals living near prisons have higher cardiovascular disease. Through an extensive literature review, I isolate accelerated aging, lack of quality health care, and failing environmental conditions in prisons as the three most reasonable factors for the increased health disparity rates. By integrating an environmental justice framework to address an institutional prison issue, the prison site represents a rallying point for community activism towards equity improvements in health care, labor conditions, policing regulations, hygiene standards, green technology, and more.

KEYWORDS

Prison Industrial Complex, Prison Reform, Environmental Health, Environmental Racism, Cardiovascular Disease

INTRODUCTION

I conduct a comparative cross-sectional analysis of census tracks with and without prisons throughout California to identify a prison's impact on their community's environmental-health outcomes. California's environment shares a highly dynamic history of environmental issues ranging from agricultural collapse, wildfire, and corporate pollution. In particular, the American prison system poses a considerable environmental justice concern. The state of California alone holds one of the largest prison systems in the world, holding more than 130,000 inmates (CDCR, 2014). Prisons are a major locus point of environmental concern that range from sanitation and water issues to the geographical placement of the prisons. As such, prisons in California are not only a source of pollution, but they are also subject to environmental discrimination. Though not determinative of all prisons, I will study that on average, whether census-tract communities with prison sites are significantly more likely to exhibit a positive correlation of suffering from environmental health diseases. I will apply an environmental justice theoretical framework and an institutional prison reformist analysis to make a case for prisons as a critical platform of environmental scrutiny. I will use a cross-sectional regression analysis as an econometric quantitative assessment that will test for census-tract-level environmental health correlations from the mere existence of a prison site.

BACKGROUND

EJ framework

The environmental justice (EJ) framework offers a theoretical explanation and political practice that attributes individual policy failures to larger community social determinants, such as race, class, or gender. According to the Environmental Protection Agency (EPA), environmental justice is defined as the "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (EPA 2019). Environmental justice is thus a question of ensuring equal protection of environmental health hazards and equal access to the political decision-making processes. From Martin Luther King Jr's push for environmental agendas in light of civil discrimination to Clinton's executive order to establish EJ programs, environmental justice movements and activism has a historical trajectory towards social progress (EPA 2019). An environmental justice paradigm centers community-based activism and negative state action as a necessary project to both generate comprehensive assessments and galvanize coalitions towards equality.

Currently, environmental justice is a relevant issue that plagues marginalized communities. EJ scholars have highlighted a great example of this in reference to the environmental crisis in Flint, Michigan where not just poor folk, but racialized black poor folk were detrimentally affected and almost disregarded by the lack of governmental response and institutional care (Pulido 2012). Given the legacy of slavery and structural racism, the problem of solving environmental issues is more than just a technical question, it is also a political and sociological question that requires a deeper level of communication and attention. Similarly, the scene of the 2016 Dakota Access Pipeline protests, also referred to as #NODAPL, reflects an escalation of settler environmental injustices characterized by corporate enclosures and the construction of oil pipelines on Sioux land (Tuck et al. 2014). Like the Sioux tribe, many other indigenous communities suffer from similar injustices and the lack of political representation. By connecting the problem to larger social determinants and advocating for fair treatment, environmental justice is a critical term that allows native communities such as the Meskwaki tribe to generate land-based resistance strategies involving abundant, global alliances to demand legal representation, reparations, and the removal of capital industries (Tuck et al. 2014).

Recent scholarship describes a historical pattern of how race operates as a significant variable for prison placement and planning. In particular, racialized communities tend to have the most congested prisons that are nearby landfills, chemical plants, waste facilities, and polluting factories (Bullard 2001). As such, prisons are not only more likely to be populated by racialized members, but also disproportionately exposed to environmental health impacts. One study that researches and conducts interviews at Mira Loma Detention Center and prisons in San Antonio finds that the policing, poor mistreatment of prisoners, and the lack of institutional care have caused higher reports of both physical and mental illness (Thompson 2018). Because prisons are highly racialized and dispersed throughout local communities, an environmental justice paradigm is necessary to strengthen decarceration efforts.

Prisons in California

California's demographic and geographical conditions make its prison system highly expansive and complex. California is a large and diverse population characterized by varying urban and rural cities, a high number of racial-ethnic minorities, and differentiated legal statutes. California also possesses an unusually higher rate of violent crime and sentencing laws compared to the national average (CDCR 2014). California currently incarcerates 130,000 inmates across 35 prisons, with facilities overcrowded, reaching more than 200% of their limited capacity (CDCR 2014) (Figure 1). Prisoners in California are highly racialized and diverse. In 2011, Hispanic inmates represented 39.8% of the population, African-American inmates 28.9%, white inmates 25.2%, and others 6.1% (CDCR 2011). California has a long history of policing and regulation paradigms that target and criminalize black and brown minorities at a disproportionate rate. As such, the higher numbers of inmates of color reflect a unique history of marginalization.

Figure 1: California Prisons. A map of major state prison institutions across California from the California Department of Corrections and Rehabilitations (CBCR)

Prisons in California also share a history of environmental discrimination. For example, e-waste recycling represents a common labor practice among prisoners that contributes to the unsustainability of prisons. Specifically, one study finds that 120 million pounds of e-waste was processed under multiple prison institutions that pay incarcerated folk for an average of $1 an hour to disassemble metal parts like cathode ray tubes (Tinson 2013). As a result, prisoners are exposed to heavy metals such as cadmium and lead in the form of fine dust. Finally, it reveals several court rulings that found prisoners suffering from excess heat or cold (Tinson 2013). Several exploitative practices intensify environmental conditions that raise major health concerns for prison inmates (Shen et al. 2018). Not only are prisoners subjected to dangerous environmental conditions, they are also lack adequate medical facilities and access to health care, further exacerbating the negative effects of said environmental conditions (Wilper and et al. 2009, Fazel and Baillargeon 2011, Prins and Story 2020). As such, prison inmates suffer a higher rate of disease and deaths caused by illnesses such as lung cancer and cardiovascular disease.

Given the harsh conditions of California's prison system, there have been a rise of governmental efforts for prison reforms. The 8^{th} amendment prohibits the government from imposing excessive bail, fines, or cruel and unusual punishments. Because prisoners were subject to overcrowding and unusually long exposure to failing infrastructural conditions, the Supreme Court ruled in 2011 that California's prison system violated the 8^{th} amendment (Newman and Scott 2012). Brown v Plata court case thus marked a major turn in the history of prison reform that forced public correctional institutions like the California Department of Corrections and Rehabilitation (CDCR) to redistribute inmates based on safe and mandated standards. More recently, Governor Gavin Newsom singed a series of 25 bills to support inmates by establishing systems to clear criminal records, reform unfair sentencing, and increase outside support for ex-convicts reentering their community (CA.GOV 2019). Only recently have environmental justice scholars and policymakers made a case of environmental discrimination as part of a major justification for continued prison reform.

METHODS

The experimental design was conducted by collecting health data and census-tract level, demographic data from the Office of Environmental Health Hazards Assessment (OEHHA) enviroscreen 3.0 data set. I also collected data on prison site locations and their census-tract from the Homeland Infrastructure Foundation Level Data (HILFD). To control for differences in environmental conditions and demographic characteristics, I chose regions with prisons and without prisons that are in adjacent census tracts across California. Census tracts are small, statistical subdivisions of a county that generally have a population size between 1200 and 8000 people. Census tracts thus possess relatively small boundaries and as such, their close proximity allows for the control and experimental site to meet the common trends assumption. I also collected reported cardiovascular disease (CVD) from the same OEHHA data sheet to measure the environmental-health impact. This is because multiple accredited health journals have identified cardiovascular disease as one of the most common results of prolonged exposure to environmental toxins such as pollution. I used the same OEHHA data set to collect information on income, race, age, and gender of the selected communities to control for confounding variables.

After downloading the various data sources, I have used STATA (Version SE14) to consolidate and merge the data sets. I first import the OEHHA data into my coding interface which I then remove non-relevant variables such as hazardous waste sites and water treatment facilities. I then merge the demographic information including but not limited to race, age, and income. Lastly, I merge my prison data. Because the prison data, at first, did not have corresponding census tracts, I used the census geocoder to manually generate the census tracts that corresponded to each prison site location.

After merging all my data sets together, I created several regressions of cardiovascular disease on prisons across census tracks in California. The model specification is as follows: $CVD= \beta 0+\beta 1*Prison+\beta k*Controls + \varepsilon$. The dependent variable, Prison, is measured by a set of binary code (1-0). 1 signifies a census track with a prison and 0 without a prison. The following variable, Controls, represents a string of multiple confounding variables that are controlled for. The confounding variables include both demographic differences such as poverty, race, and age, and environmental differences such as CES 3.0 scores, ozone scores, toxic release, pollution scores, and number of nearby clean-up sites. The last variable, ε, represents the error term. In my analysis, I first conducted a simple single regression of reported cardiovascular disease on prisons. Then, I constructed one multiple regression model that controls for demographic confounding variables. The second multiple regression model controls for both demographic and environmental confounding variables.

RESULTS

I matched 132 prisons to their respective census tracts and found that the average cardiovascular disease rate was 8.98 (Table1). In the remaining 7,826 census tracts without prisons, the average cardiovascular disease rate was 8.28 (Table 1). The census tracts with prisons reported 0.60 higher cardiovascular disease rates than census tracts without prisons. For census tracts with prisons, the minimum for cardiovascular disease rates was higher while the maximum was lower.

Table 1. Reported cardiovascular disease between prisons and non-prison census tracts. A descriptive summary statistic of the cardiovascular disease rates in census tracts without prisons and with prisons. The first row (Obs=7826) describes the census tracts without prisons. The second row (Obs=132) describes the census tracts with prisons.

Variable	Obs	Mean	Std.Dev.	Min	Max
Cardiovascular Disease (Non-Prison)	7826	8.284	2.943	1.04	21.26
Cardiovascular Disease (Prison)	132	8.982	3.311	3.77	18.34

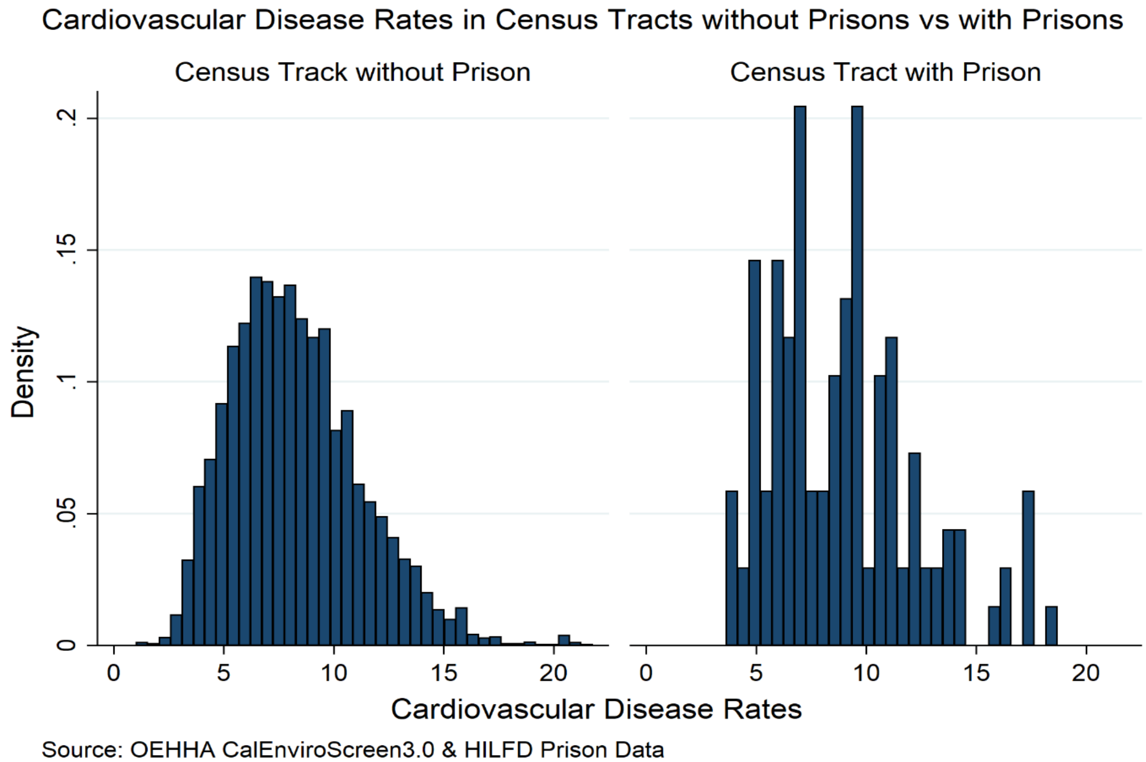

Figure 2. Reported cardiovascular disease rates by density. – A comparative histogram in the reported distribution of cardiovascular disease rates between census tracts with prisons and without prisons.

Model 1: single regression

Using a cross sectional analysis of 132 prisons in California, I found that cardiovascular disease rates are significantly higher in census tracts with prisons than in census tracts without prisons. In the simple regression of cardiovascular disease on prisons, prisons have a positive correlation coefficient of 0.843 with a t-stat of 3.52 (Table 2). In the logarithmic model, the CVD coefficient is 0.096 with a t-stat of 3.23 (Table 3). The R-squared value remains very low at 0.001 for both models, which means that there are a lot of unobserved determinants of cardiovascular disease I was not controlling for at all.

Model 2: multiple regression

Controlling for confounding demographic variables such as poverty, race, and age, I found that cardiovascular disease rates remain significantly higher in census tracts with prisons. In the first multiple regression model, the prisons coefficient increased to 0.791 with a t-stat of 3.62 and an increased R-squared value of 0.271 (Table 2). In the logarithmic model, the prison coefficient is 0.086 with a t-stat of 3.15 and an increased R-squared value of 0.274 (Table 3). All other confounding variables also held significant p-values. Ages 11to64 were omitted to avoid collinearity.

In addition to demographic data, I controlled for other confounding environmental variables such as pollution score and surrounding cleanup sites. I found that cardiovascular disease rates remain higher in census tracts with prisons. In the second multiple regression model, the prisons coefficient decreased to 0.627 with a t-stat of 3.65 and an increased R-squared value of 0.572 (Table 2). In the logarithmic model, the prison coefficient decreased to 0.067 with a t-stat of 3.17 and an increased R-squared value of 0.586 (Table 3). The environmental confounding variables such as CES pollution score and ozone also show significant t-statistics while others such as toxic release do not. Upon adding in environmental variables, the confounding demographic variables also changed significantly. Now, poverty is negative while people of ages less than 10 has lesser effect.

Table 2 – Simple regression of cardiovascular disease on prisons. Below lists the statistical results from the single regression model (1), multiple regression model controlling for demographic variables (2), and final multiple regression model controlling for both demographic and environmental variarables (3)

	(1) **CVD**	**(2)** **CVD**	**(3)** **CVD**
Prison	0.843** (3.52)	0.791** (3.62)	0.627** (3.65)
Poverty		0.0263** (12.71)	-0.0501** (-25.57)
Hispanic(%)		-0.217** (-7.39)	-0.331** (-14.18)
White(%)		-0.240** (-7.80)	-0.324** (-13.21)
AfricanAmerican(%)		-0.205** (-6.50)	-0.342** (-13.72)
NativeAmerican(%)		-0.117** (-3.10)	-0.225** (-7.64)
AsianAmerican(%)		-0.261** (-8.46)	-0.343** (-14.04)

Age<10		0.171**	0.0920**
		(17.72)	(11.80)
Age(11-64)		0	0
		(.)	(.)
Age>65		0.0391**	0.00781
		(7.42)	(1.88)
CES 3.0 Score			0.240**
			(61.99)
Ozone			83.17**
			(33.39)
Tox. Release			0.000000849
			(0.47)
Pollution Burden Score			-1.360**
			(-50.24)
Cleanup Sites			0.00215
			(1.43)
Constant	8.256**	27.07**	37.17**
	(247.01)	(9.22)	(16.08)
Observations	8071	7987	7955
R^2	0.002	0.271	0.572

t statistics in parentheses
* p<.05, ** p<.01

Table 3. **Logarithmic regression of cardiovascular disease on prisons.** Below lists the statistical results from the single regression model (1), multiple regression model controlling for demographic variables (2), and final multiple regression model controlling for both demographic and environmental variarables (3)

	(1) **CVD(Log)**	**(2)** **CVD(Log)**	**(3)** **CVD(Log)**
Prison	0.0963**	0.0857**	0.0667**
	(3.23)	(3.15)	(3.17)
Poverty		0.00257**	-0.00709**
		(9.96)	(-29.62)
Hispanic(%)		-0.0291**	-0.0448**
		(-7.98)	(-15.70)
White(%)		-0.0331**	-0.0448**
		(-8.63)	(-14.96)
AfricanAmerican(%)		-0.0282**	-0.0468**
		(-7.21)	(-15.35)
NativeAmerican(%)		-0.0155**	-0.0300**
		(-3.31)	(-8.34)

AsianAmerican(%)		-0.0351**	-0.0467**
		(-9.16)	(-15.66)
Age<10		0.0190**	0.00882**
		(15.78)	(9.26)
Age(11-64)		0	0
		(.)	(.)
Age>65		0.00429**	0.000293
		(6.54)	(0.58)
CES 3.0 Score			0.0303**
			(64.02)
Ozone			10.55**
			(34.66)
Tox. Release			0.000000258
			(1.18)
Pollution Burden Score			-0.167**
			(-50.48)
Cleanup Sites			0.0000979
			(0.53)
Constant	2.047**	4.714**	6.085**
	(492.58)	(12.90)	(21.53)
Observations	8057	7987	7955
R^2	0.001	0.274	0.586

t statistics in parentheses
* p<.05, ** p<.01

DISCUSSION

Prisons possess an important positive correlation to environmental health risks for their community. Using cardiovascular disease rates as our health outcome variable and the existence of prisons as our independent testing variable, I ran a single regression between prisons and higher cardiovascular rates and found a significant, positive correlation. For additional robustness, a second multivariate regression strengthened these results by controlling for confounding variables such as demographic characteristics (age, income, etc) and environmental conditions (nearby waste sites, clean-up sites, etc). While this study confirms many other expert studies that have established a pattern of higher cardiovascular disease among prison inmates, I was not able to explain why census tracts with prison sites might report higher cardiovascular disease rates. I controlled for factors that the literature found to be confounding factors, and still found a positive correlation of higher diseases near prisons. Whether the population differs in other aspects or behaviors that contribute to cardiovascular disease remains to be investigated. Additionally, another year of data is required to be able to control for other factors specific to each zip-code in a panel fixed effects structure.

Existing scholarship indicates that the top six contributors to higher cardiovascular disease rates among prison inmates are age, diet/nutrition, lack of quality health care, environmental conditions, experience of incarceration, and substance-use (Wang et al. 2017). Among the listed possible contributors, I will argue that accelerated aging, lack of quality health care services, and failing environmental conditions of the prison are the three most important factors to consider for the environmental health inequality in California prisons. I will then discuss several limitations to this study and its inability to establish a causation argument. Finally, I will conclude that more intensive efforts through the channels of both environmental justice and prison institutional reform are required to address the poor health conditions of the prison site.

Accelerated aging in prison

There is a large consensus that aging is a major factor for cardiovascular disease. Major health organizations such as the National Institutes of Health (NIH) and individual health studies indicate that elderly people of ages 65 and older are significantly more likely to experience heart attacks, strokes, and ultimately coronary heart disease (North and Sinclair 2012, Steenman and Lande 2017, NIH: National Institute on Aging 2018). Aging induces hyper-variation in heart and blood vessel activity. Though the number of heartbeats does not change significantly with age, the build-up of fatty deposits in the artery walls and the increased stiffness of the larger arteries, commonly known as arteriosclerosis, substantially hinder the body’s ability to maintain proper blood flow, oxygen delivery, and general cardiovascular activity (NIH: National Institute on Aging 2018). In addition to higher blood pressure and sensitivity to physical and mental stress, bodily resilience and recovery for older individuals are low. Within this elderly age group alone, cardiovascular disease thus remains the leading cause of death (North and Sinclair 2012).

Prison inmates in California undergo a process of accelerated aging that poses considerable risk of cardiovascular disease. Geriatrics represent a field of specialized medicine for the elderly, typically for ages of 65 years and above. Though they vary from state to state, prison inmates, however, are actually considered geriatric starting as young as 50 years old (Lemieux et al. 2002). The effects of aging expounds the vulnerability of prison inmates because prison conditions (e.g. lack of hygiene, intensive labor, and overcrowding) are not only more suitable for young individuals, but also contribute towards a higher burden of physical and mental stress (Aday 2003). In California, the percentage of male inmates aged 50 and older increased from 4.7% of the census in 1995 to 10.2% of the census in 2004 ("California Prisoners and Parolees 2004" 2005). These rising numbers are projected to increase such that by the year of 2022, geriatric prison inmates will constitute 16% of California's prison population (Stupp and Willmott 2005).

The extraordinary high number of older prison inmates can be attributed to several reasons: more older people are sentenced to prison, higher mandatory minimum sentencing laws, strict drug-related policies, and third strike legislations (Anno and et al. 2004, Williams and Abraldes 2007). In 2012, California passed Prop 36 which amended the third strike rule to only include "violent" and "serious crimes" rather than nonviolent drug-related felonies (Subramanian and Delaney 2014). Despite the recent amendments, however, several drug crimes are still considered as "serious felonies" which allows state courts to continue operations as usual (Doyle 2013). With the increased effects of accelerated aging among prison inmates and the increased number of geriatric prison inmates, age among prison inmates is unavoidably a major factor for the higher number of reported cardiovascular disease in their respective census tract.

Lack of quality health care

Current lack of access to quality health care is a major barrier towards better treatment for CVD risk factors in California prisons. Because the primary purpose for correctional facilities is not to provide health services, prison inmates are often treated with poor quality health care (Williams and Abraldes 2007, Wang et al. 2017). Though 80% of incarcerated members are reported to visit a physician at least once, challenging barriers to access such as high copay payments, varying security protocols, and lack of present health providers prevent many inmates from actually receiving treatment (Wilper and et al. 2009, Wang et al. 2017). Additionally, government programs such as Medicaid/Medicare options do not cover in-prison health care, and less than 1% of care is covered by other insurance.

While health care settings vary across individual prison sites, there are also barriers to quality health care such as the lack of adequate funding, qualified physicians, and oversight expertise in public health operations (Wang et al. 2017, Prins and Story 2020). Even when prisoners overcome the barriers to accessing health care, they often receive poor quality services and misdiagnoses, resulting in higher risks of illness including cardiovascular disease. Thus, the lack of access to quality health care is a highly concerning factor that helps to explain the higher cardiovascular disease rates in census tracts with prisons.

Failing environmental conditions

Environmental conditions characterize the chemical substrates in the atmosphere and water supply, the hygienic status of an infrastructure, and any nearby waste or treatment facilities. Along with the spread of disease and germs, pollution and gaseous toxins such as sulfur dioxide (SO2) and nitrogen oxide (NO) are major contributors for a higher risk of cardiovascular disease. In addition, expert studies report that particulate matters (PM2.5 & PM10) is significantly correlated with higher adverse effects (cardiovascular disease, stroke, and high blood pressure), on among the elderly, children, and those with pre-existing health conditions (Lee et al. 2014). Prisons in California are critical sites to investigate failing environmental conditions because they are not only afflicted by overcrowding and poor sanitation regulations, but they are also positioned in geographical areas that expose inmates to highly toxic areas (Shen et al. 2018, Pellow 2018).

The failing environmental conditions of prisons often exacerbate the risk of cardiovascular disease. Prisoners are more likely to suffer from pollution, exposure to toxins, and various particulate matters. First, prisons are institutionally constructed in vulnerable areas that bear the biggest burden of environmental degradation and climate change. Some prisons are placed in geographical areas that suffer from excessive heat or cold (Tinson 2013). More importantly, California prisons tend to have the most congested prisons nearby toxic landfills, chemical plants, waste facilities, and dirty factories (Shen et al. 2018, Pellow 2018). In the Central Valley of California, an agricultural hotspot, youth prisons consist of mostly Latinx members that are constantly surrounded by chemical pesticides, diesel emissions, and heavy farming waste (Braz and Gilmore 2006).

Cardiovascular disease rates are further induced by institutional neglect such as broken power supplies, lack of nutritional food, and general health hazards such as dirty water (Prins and Story 2020). Women prison sites, for example, contain a history of toxic land-use. The Mira Loma Detention Center, located near Los Angeles, California, has been planted on a former military base that utilized waste generators and underground fuel tanks (Thompson 2018). Because of the wear and tear effects of material aging, the pre-existing waste generators and fuel tanks have leaked hazardous substances such as polychlorinated biphenyls into the same groundwater and air that the prisoners consume. As a result, as many as 1,600 prisoners, mostly black and Latinx members in the Mira Loma Detention Center have been daily exposed to toxic material, significantly increasing their risk of respiratory illness and visceral poisoning (Thompson 2018). In addition to failing infrastructure, water-borne organisms such as cholera and bacillary dysentery can spread rapidly among prison meals and inevitably into the prisoners' body (Nembrini 2005). This not only causes a deplorable taste in food but poses serious health risks that contribute to a prison's mortality rates. In addition, some prisons have reported the use of wood and coal as a direct energy source to cook meals (Nembrini 2005). Although not a direct influence on food quality, wood and coal already release large amounts of smoke that can irritate lungs and trigger asthma attacks while also producing ash which underscores the unsanitary kitchen standards (Nembrini 2005, Tinson 2013).

Third, most California prison inmates are exploited as laborers, exposing them to dirty material. Multiple prison institutions pay incarcerated to disassemble e-waste like cathode ray tubes, exposing prisoners are to heavy scrap metals such as cadmium and lead (Tinson 2013). E-waste metals (copper, aluminum, silver, and gold) contain high concentrations of toxins such as lead, cadmium, mercury, arsenic, barium, coltan, chromium, flame retardants, and polyvinyl chloride (Conrad 2011). Lead dust alone is a major cause of lung cancer, respiratory disease, depression, kidney disease, and autoimmune suppression (Jaishankar et al. 2014). Cadmium accumulates in the kidneys, cadmium decimates the lungs, barium heavily restricts heart and brain activity, and flame retardants are known to cause thyroid and neurological impairments along with fetal toxicity (Conrad 2011, Jaishankar et al. 2014). In the recent 2018 California wildfires, the California Department of Corrections and Rehabilitation (CDCR) position inmates into volunteer firefighting positions that seriously exposed them to ash and heavy smoke characterized by fine particulates dangerous to the human lungs. Wildfires are composed of particulate matter such as

$PM_{10–2.5}$ (mass median aerodynamic diameter > 2.5 μm to < 10 μm; coarse) and $PM_{2.5}$ (mass median aerodynamic diameter < 2.5 μm; fine) (Wegesser et al. 2009). Wildfire PM have already been found responsible for multiple inmate death counts and on-going illnesses such as respiratory lung and heart disease (Wegesser et al. 2009, Neklason 2017). Indeed, it would be no surprise that cardiovascular disease rates are higher in census tracts with prisons precisely because of their institutional failure to secure better living conditions, higher hygiene standards, and equitable placement in location.

Policy implications

Considering the interconnectedness and dynamic nature of the prison industrial complex, a coalitional force for environmental justice is key. Though the American Civil Liberties Union (ACLU) has shed light on prison overcrowding and pressured the U.S. Supreme Court to reduce prisoners, there still lacks legal attention to the environmental degradation and dangers of the prison sites (Saed 2012). This is because it was only until recently that a few activists and scholars have done work to connect the atrocities of prison to environmental questions (Braz and Gilmore 2006, Saed 2012). If the prison institution struggle is also an environmental justice struggle, then there requires an integrated approach to tackle the prison site as a major source for other social injustices. It is arguable that the prison represents a focal point that can set a powerful precedent for future movements and governmental obligations such as providing basic health care as a human right.

In the past century, prison services have been characterized by general neglect and a lack of social services, particularly in health standards. Across the United States, prisons have been reporting an increasing rate of health complaints and injuries along with poor medical treatment. The government is legally obligated, even as it imprisons people, to provide decent health care as part of the constitution right to deny cruel and unusual treatment (Jacobi 2005). It is especially concerning that in California alone, the prison population has grown from 25,000 to 164,000 prisoners (556% increase) between 1980 and 2005 (Braz and Gilmore 2006). Considering that prisoners consume toxic food and water daily, there is a strong case to appeal to Civil Rights law, Clinton's executive order, and past Supreme Court cases. This establishes a key starting point for increased legal support for qualitatively better health care provisions that can go beyond the prison site and towards other disenfranchised communities.

This also implicates a nuanced philosophical approach towards decarceration. If dismantling prison sites implicates reforming health care, urban planning, and a swath of other interdisciplinary fields, then policymakers and scholars must not only remove the prison as a biophysical space, but a social and ideological web that mutates and spills over to all other political systems (Saed 2012, Pellow 2018). To fight prisons is to demand for environmental and health corrections, improved housing opportunities, food services, firefighting and policing regulation, hygiene management, urban planning, construction projects, green technology, and more.

Prisons provide the nexus rallying point for justice; however, it is important to tread politics on careful ground. While in theory environmental justice and decarceration may seem compatible and effective, an actualized practice might instead produce unintended consequences. Prison systems in England and Wales reveal that even with better green designs and social services, there are still problems with exposed toxic metals in newer technologies, labor exploitation manifested in different positions, and overcrowding of prison inmates (Jewkes and Moran 2015). Policy reformists in California have pushed for similar institutional "green care" initiatives characterized by renewable energy installations, 'green-collar' labor, and environmental renovations (Thigpen and et al. 2011). However, renovating prison buildings and life-style conditions runs itself into a paradox that found companies advertising their new refurbished prison package and gaining public support to accelerate corporate incarceration (Jewkes and Moran 2015). This represents a kind of greenwashing that not only utilizes green reform as a potential profit platform, but also maintains and legitimatizes the existence of prisons and the exploitation of prison inmates.

Nonetheless, an environmental justice (EJ) framework provides a promising solution to the ecological crisis of the prison industrial complex. Environmental justice is not only concerned with environmental impact analysis and health risk management, but rather seeks preventative measures and movements that incorporate all other social movements including "housing, land use, industrial planning, health care, and sanitation services" (Bullard 2001, Bonds 2013). Because modern day prisons share a racialized legacy of poor land use, zone planning, and social services such as health care and food, environmental justice captures the perfect framework to tackle the complex supply chains and interconnectedness of the prison industrial complex.

Limitations

The lack of panel data analysis represents a major limitation to this study. Without recorded data over time, this study is simply a cross-sectional study using census data in 2010 and prison data last updated in 2018 to explain a relationship between prisons and cardiovascular disease rates in a census tract. To establish a more definitive causation argument, future studies should conduct a diff-in-diff regression strategy or a matching strategy over time to investigate the true effects of a prison, before and after a prison opens. Out of the 408 total recorded prisons sites in California, I took out 99 juvenile level and 124 unavailable security level prisons along with 28 prisons that were missing census tract information. As such, the estimations are biased towards prisons not having an effect of higher cardiovascular disease rates.

CONCLUSION

Prisons in California have a significant positive correlation to higher cardiovascular disease rates in their respective census tracts. My final regression model indicates that prisons have a significant coefficient of 0.63 with a t-statistic of 3.65, which corresponds with a 6.7% higher incidence of cardiovascular disease. Although this study does not account for all differing characteristics or behaviors of the population and cannot demonstrate causality, it does reveal a positive correlation that motivates further research into why prisons might pose higher incidences of cardiovascular disease. This is no surprise because prisons have had a long history as solitary confinement for marginalized and stigmatized populations. Prisons have not only been institutionally neglected by public health officers and policy reformists, they have also been subject to environmental racism and mistreatment.

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REFERENCES

Aday, R. H. 2003. Aging Prisoners: Crisis in American Corrections. Praeger.

Anno, B. J., and et al. 2004. Correctional Health Care: Addressing the Needs of Elderly, Chronically Ill, and Terminally Ill Inmates. NICIC:157.

Bonds, A. 2013. Economic Development, Racialization, and Privilege: "Yes in My Backyard" Prison Politics and the Reinvention of Madras, Oregon. Annals of the Association of American Geographers 103:1389–1405.

Braz, R., and C. Gilmore. 2006. Joining Forces: Prisons and Environmental Justice in Recent California Organizing. Radical History Review 2006:95–111.

Bullard, R. D. 2001. Environmental Justice in the 21st Century: Race Still Matters. Phylon (1960-) 49:151–171.

California Prisoners and Parolees 2004. 2005. California Department of Corrections and Rehabilitation, Offender Information Services, Estimates and Statistical Analysis Section, Data Analysis Unit.

Conrad, S. M. 2011. A Restorative Environmental Justice for Prison E-Waste Recycling. Peace Review 23:348–355.

Doyle, C. 2013. Federal Mandatory Minimum Sentencing Statutes. Congressional Research Service.

Fazel, S., and J. Baillargeon. 2011. The health of prisoners. The Lancet 377:956–965.

Governor Newsom Signs Criminal Justice Bills to Support Reentry, Victims of Crime, and Sentencing Reform. 2019, October 8. . https://www.gov.ca.gov/2019/10/08/governor-newsom-signs-criminal-justice-bills-to-support-reentry-victims-of-crime-and-sentencing-reform/.

Jacobi, J. V. 2005. Prison Health, Public Health: Obligations and Opportunities. PUBLIC HEALTH 31:32.

Jaishankar, M., T. Tseten, N. Anbalagan, B. B. Mathew, and K. N. Beeregowda. 2014. Toxicity, mechanism and health effects of some heavy metals. Interdisciplinary Toxicology 7:60–72.

Jewkes, Y., and D. Moran. 2015. The paradox of the 'green' prison: Sustaining the environment or sustaining the penal complex? Theoretical Criminology 19:451–469.

Lee, B.-J., B. Kim, and K. Lee. 2014. Air Pollution Exposure and Cardiovascular Disease. Toxicological Research 30:71–75.

Lemieux, C. M., T. B. Dyeson, and B. Castiglione. 2002. Revisiting the Literature on Prisoners who are Older: Are we Wiser? The Prison Journal 82:440–458.

Neklason, A. 2017, December 7. California Is Running Out of Inmates to Fight Its Fires. https://www.theatlantic.com/politics/archive/2017/12/how-much-longer-will-inmates-fight-californias-wildfires/547628/.

Nembrini, P. G. 2005. Water, sanitation, hygiene and habitat in prisons. International Committee of the Red Cross:147.

Newman, W. J., and C. L. Scott. 2012. Brown v. Plata: prison overcrowding in California. The Journal of the American Academy of Psychiatry and the Law 40:547–552.

NIH: National Institute on Aging. 2018, June 1. Heart Health and Aging. https://www.nia.nih.gov/health/heart-health-and-aging.

North, B. J., and D. A. Sinclair. 2012. The Intersection Between Aging and Cardiovascular Disease. Circulation Research 110:1097–1108.

Pellow, D. N. 2018. Political Prisoners and Environmental Justice. Capitalism Nature Socialism 29:1–20.

Prins, S. J., and B. Story. 2020. Connecting the Dots Between Mass Incarceration, Health Inequity, and Climate Change. American Journal of Public Health 110:S35–S36.

Saed. 2012. Prison Abolition as an Ecosocialist Struggle. Capitalism Nature Socialism 23:1–5.

Shen, Y., D. Pellow, J. Vazin, S. Kime, M. Levine, S. McAlpine, and H. Ashby. 2018. Environmental Injustice Behind Bars: Toxic Imprisonment in America.

Steenman, M., and G. Lande. 2017. Cardiac aging and heart disease in humans. Biophysical Reviews 9:131–137.

Stupp, H. M., and D. J. Willmott. 2005. Dignity Denied: Price of Imprisoning Older Women in California. San Francisco: Legal Services for Prisoners with Children.

Subramanian, R., and R. Delaney. 2014. Playbook for Change? States Reconsider Mandatory Sentences. Federal Sentencing Reporter 26:198–211.

Thigpen, M., and et al. 2011. The Greening of Corrections: Creating A Sustainable System. U.S. Department of Justice: National Institute of Corrections.

Thompson, K. 2018. Prisons, Policing, and Pollution: Toward an Abolitionist Framework within Environmental Justice. Pomona Senior Theses.

Tinson, C. 2013. The Unsustainability of the Prison Industrial Complex. Population & Development Program.

Tuck, E., M. McKenzie, and K. McCoy. 2014. Land education: Indigenous, post-colonial, and decolonizing perspectives on place and environmental education research. Environmental Education Research 20:1–23.

Wang, E. A., N. Redmond, C. R. D. Himmelfarb, B. Pettit, M. Stern, J. Chen, S. Shero, E. Iturriaga, P. Sorlie, and A. V. D. Roux. 2017. Cardiovascular Disease in Incarcerated Populations. Journal of the American College of Cardiology 69:2967–2976.

Wegesser, T. C., K. E. Pinkerton, and J. A. Last. 2009. California Wildfires of 2008: Coarse and Fine Particulate Matter Toxicity. Environmental Health Perspectives 117:893–897.

Williams, B., and R. Abraldes. 2007. Growing Older: Challenges of Prison and Reentry for the Aging Population. Pages 56–72 *in* R. B. Greifinger, editor. Public Health Behind Bars: From Prisons to Communities. Springer, New York, NY.

Wilper, A. P., and et al. 2009. The Health and Health Care of US Prisoners: Results of a Nationwide Survey. American Journal Public Health 99:666–672.