Excessive Heat and Correctional Officer Turnover: Evidence from Texas

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Abstract

Correctional work is difficult and dangerous. It is also hot. Most U.S. states' prison systems lack universal air conditioning, resulting in sweltering conditions for incarcerated people and correctional staff. We examine the relationship between heat and correctional officer turnover using personnel records of 40,334 correctional staff employed by the Texas Department of Criminal Justice between 2010 and 2023. We show that before the COVID-19 pandemic, frontline correctional officers in prisons without air conditioning were overall approximately 10% more likely to depart in a given month. Increased departures were especially common among less-experienced frontline correctional officers who are likely less acclimated to the heat. Additional conservative tests provide some suggestive evidence that departures were more frequent during the summer months in facilities without air conditioning. The onset of COVID-19 increased overall turnover but attenuated the relationship between heat and departing, underscoring the new challenges to correctional work introduced by the pandemic.

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Prisons and jails across the U.S. are contending with an understaffing crisis. Hiring and retaining correctional officers has long been difficult (Lambert 2001), but rising incarceration rates and the COVID-19 pandemic have brought many prison systems to the tipping point. Between 2019 and 2022, the number of state-employed correctional officers declined by 10%, with states like Arkansas and Georgia experiencing declines of 20% and 29%, respectively (Heffernan and Li 2024). In some states, vacancy rates among correctional staff are as high as 50% despite widespread initiatives to attract new hires (Lieb 2023).

This is compounded by the fact that correctional work is dangerous and stressful. A survey of state correctional officers in California found that 70% of respondents had witnessed someone be seriously injured or killed at work, while 18% reported being seriously injured on the job (Lerman, Harney, and Sadin 2022). Correctional officers are at heightened risk of anxiety, Post-Traumatic Stress Disorder, burnout, job dissatisfaction, and COVID-19 infection (Cheeseman et al. 2011; Cullen et al. 1985; Finney et al. 2013; Lambert 2001; Schwartz et al. 2024; Ward et al. 2021). One study estimated that the suicide rate is 39% higher among correctional officers than the general public (Stack and Tsoudis 1997), and more recent research suggests that elevated suicide rates persist (Frost and Monteiro 2020; Lerman, Harney, and Sadin 2022).

Most existing studies emphasize how the psychological stresses associated with correctional work contribute to turnover (Cullen et al. 1985; Finney et al. 2013; Lambert 2001; Schwartz et al. 2024). Much less work has examined the underlying role of poor working conditions in prisons, which often contribute to the heightened levels of stress and burnout documented among correctional employees. We address this gap by examining the relationship between excessive heat—an increasingly relevant source of poor working conditions in U.S. prisons—and correctional officers' propensity to leave their jobs. Very few states' prison systems have universal air conditioning. As a result, many prisons are sweltering in the summer months, with some reaching indoor temperatures of over 130°F (Salhotra and Melhado 2024). These conditions have been likened to "torture chambers," "concrete coffins," and "sitting inside of a convection oven" (Lartey 2023; Salhotra and Melhado 2024). The poor conditions brought about by excessive heat have spurred numerous lawsuits and instigated a growing body of research documenting the negative effects of heat on rates of violence (Mukherjee and Sanders 2021) and incarcerated individuals' health (Skarha et al. 2022; Skarha et al. 2023).

Climate change is predicted to further increase the dangerous conditions associated with living and working in prisons without air conditioning. Dangerously high temperatures are especially common in Southern states like Texas and Florida where incarceration rates are also high Tuholske et al. (2024). Higher temperatures will exacerbate these already dangerous conditions. While southern states have often been the loci of legal and legislative battles to install air conditioning in prisons, rising temperatures will likely also impact prisons in other parts of the country. Individuals living and working in prisons in the Pacific Northwest, Midwest, and New England, for example, are less accustomed to hazardous heat levels, potentially increasing the dangers of rising temperatures in facilities without effective heat mitigation.

Excessive heat poses at best a nuisance to correctional staff—and, at worst, a major health hazard. The head of the Louisiana Department of Public Safety and Corrections recently noted that officers in prisons without air conditioning were changing their clothes up to three times per shift (O'Donoghue 2022). More seriously, between 2012 and 2013, 147 state correctional employees in Texas reported illness or injury due to heat (Martin 2013). Incarcerated people in the state have also reported seeing correctional workers faint on account of heat (*Deadly Heat in U.S. (Texas) Prisons* 2024). Yet, despite numerous anecdotal accounts of heat's impact on correctional staff and concerns over prison understaffing, our study is the first to examine how excessive heat influences correctional officer turnover.

We evaluate the impact of excessive heat on correctional officers employed by the Texas Department of Criminal Justice (TDCJ). Texas's prison system is an ideal setting for evaluating heat's role in fostering poor working conditions for correctional officers. The TDCJ operates the largest state prison system in the country. In December 2024, the agency had over 135,000 individuals in its custody across nearly 100 facilities. Despite Texas prisons being exposed to high levels of extreme heat in the summer months (Tuholske et al. 2024), only

30 of the 105 TDCJ facilities that have been in use at some point between 2010 and 2023 have fully air-conditioned housing areas. Twenty-three facilities lack any air conditioning in their housing areas, with the remaining prisons having partial, often minimal, coverage. As a result, conditions within many TDCJ prisons are brutal in the summer months. A federal judge in 2025 called the lack of air conditioning in TDCJ prisons "plainly unconstitutional," while a different federal judge wrote in a 2018 injunction that incarcerated people in Texas "face a substantial risk of serious harm from the sweltering Texas heat" (McCullough 2017; Salhotra 2025). Union officials in the state have called excessively hot Texas prisons "death traps" and likened working in units without air conditioning to "going up and down stairs at a football stadium in the heat of the day, while wearing a coat" (Dang 2022; Martin 2013).

We test whether these conditions are associated with an increased propensity to depart the TDCJ workforce using individual-level personnel data and facility-level air-conditioning data. The personnel records consist of monthly snapshots of all TDCJ staff employed in security positions across the state from January 2010 to January 2023. The records are rich, noting employees' names, race, sex, ages, job titles, salaries, hire dates, and employing facilities. In order to determine whether correctional officers work in air-conditioned facilities, we rely on data from the Texas Prisons Community Advocates (TPCA), a nonprofit advocacy organization. The facility-level air-conditioning data, which the TPCA received via public-records requests to the TDCJ, note whether each prison's housing areas have full, partial, or no air conditioning.[1]

Controlling for a variety of employee-, facility-, and state-level covariates,[2] we show that before the onset of the COVID-19 pandemic, frontline correctional officers were approximately 10% more likely to leave their jobs in a given month if they worked at a prison

1. Due to ongoing litigation regarding air conditioning in TDCJ facilities, we were unable to obtain this information directly from the TDCJ.

2. As described in the Methods section, we control for employees' race, age, squared age, monthly salary, and sex. We also include facility controls for the monthly unemployment rate of the county containing the prison, the percent change in the number of correctional employees working at the prison over the prior six months, the age of the facility, the number of security staff working at the facility in the given month, the number of people incarcerated in the facility in the given month, whether the facility only houses individuals who require minimal security, whether the facility is located in an urban zip code, and monthly production of oil and natural gas in the county containing the facility. Finally, we include monthly fixed effects and fixed effects for employees' years of experience.

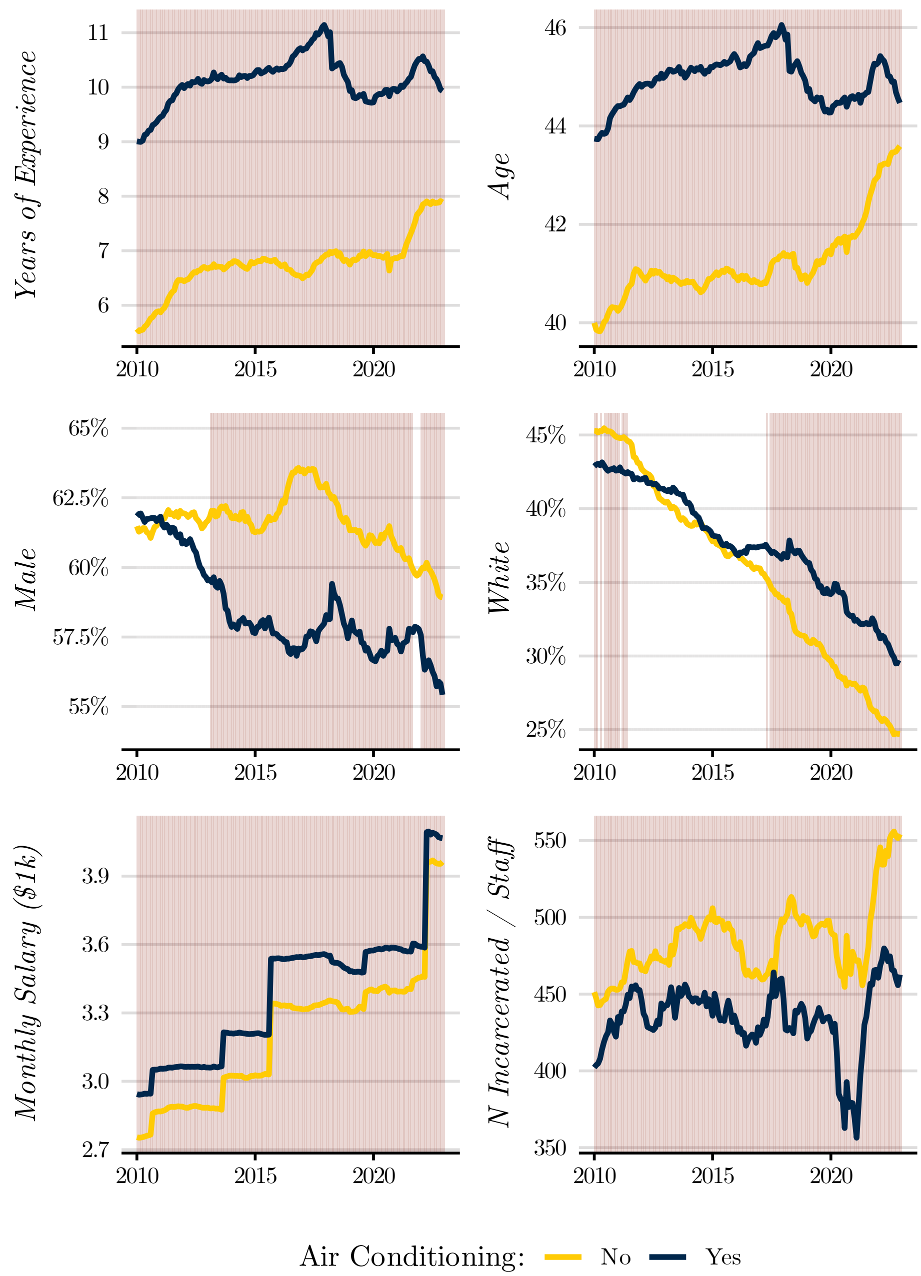
without air conditioning. We demonstrate that this association is isolated to the employees most likely to be affected by the heat — namely, new frontline correctional officers who are likely less acclimated to working in hot temperatures. In particular, employees with two or fewer years of experience with the TDCJ employed in a prison without air conditioning are approximately 20% more likely to depart in a given month than their peers with similar levels of experience in facilities with air conditioning. We also provide some evidence, via a conservative test, that seasonal temperature fluctuations moderate the relationship between excessive heat and departing. Among the least experienced frontline employees with two or fewer years of experience, those employed in prisons without and with air conditioning were, respectively, 0.9 and 0.6 percentage points more likely to depart in the hottest months of the year, relative to the coolest. Despite the difference between the two effect estimates not reaching standard levels of statistical significance ($p = 0.11$), we do not find a similar difference among the most experienced TDCJ employees ($p = 0.8$), reinforcing that employees who have become accustomed to excessive heat are less likely to depart on account of high temperatures.

Despite demonstrating a relationship between excessive heat, air conditioning, and correctional officer turnover, we also show that our results are, to some degree, time dependent. Our main findings disappear and, in some cases, reverse following the onset of the COVID-19 pandemic. It is difficult to know whether this is a result of new, unobserved variation in prison conditions brought about by the pandemic or changing trends in correctional officer departures unrelated to the pandemic. Regardless of the exact reason, the over-time changes suggest that there are ceiling effects to the benefits of air-conditioning prisons for stemming correctional officer turnover. While air conditioning can make difficult correctional work more palatable, targeted reforms like installing air conditioning are unlikely to resolve the other systemic challenges that undermine employee retention in correctional institutions.

Results

Correctional officers in prisons with and without air conditioning differ on a number of observable dimensions. Figure 1 shows descriptive characteristics of TDCJ correctional staff over the course of our study period. Monthly group means for employees in facilities with and without air conditioning are shown in blue and yellow, respectively, while red highlighting indicates that the null hypothesis of no difference in means is rejected using a two-sided t-test ($p < 0.05$). Employees in facilities without air conditioning are significantly younger with fewer years of experience and lower earnings than their peers in air-conditioned facilities. The demographic composition of correctional employees also changed considerably over the study period. In 2010, over 40% of correctional employees were white. By 2023, only 30% of correctional employees in prisons with air conditioning were white and an even smaller share of employees in prisons lacking air conditioning were white. Inmate-to-staff ratios are also higher in facilities without air conditioning, underscoring both the difficulty of staffing these positions and the difficult conditions faced by remaining employees.

Figure 1 – Correctional Staff Differ Across Prisons With and Without AC Shows the mean years of experience, age, monthly salary, share male, share white, and inmate-to-staff ratio in TDCJ facilities with and without air conditioning by month. Data includes both frontline and supervisory staff. Months are highlighted in red if the null hypothesis of no difference in means is rejected using a two-sided t-test ($p < 0.05$).



Our main outcome of interest is whether an employee departs the TDCJ workforce in a given month.[3] It encompasses both instances where an employee leaves the TDCJ workforce and does not return during our study period as well as cases of an employee leaving before later returning to correctional work.[4] Figure 2 shows the share of TDCJ correctional employees that depart each month from prisons with and without air conditioning. The figure highlights a few key trends. First, up to the onset of the COVID-19 pandemic, departures were more common in prisons without air conditioning. Second, departures from prisons with air conditioning began to increase around 2017. As a result, by the time the COVID-19 pandemic began, the difference in departures rates from prisons with and without air conditioning had narrowed considerably. Finally, employee departures from both types of prisons spike following the onset of the pandemic in March 2020. Departure rates peak in summer and fall of 2021 and by the beginning of 2022 are largely similar across both types of prisons.

3. See Section B in the Supplementary Information for more information on how we construct this variable.

4. We do not know whether someone voluntarily or involuntarily leaves the workforce, only that they depart our dataset.

Figure 2 – Correctional employees in Prisons Without AC More Likely to Depart Shows the share of correctional employees that depart from prisons with and without air conditioning each month. Data includes both frontline and supervisory staff. Months are highlighted in red if the null hypothesis of no difference in means is rejected using a two-sided t test ($p < 0.05$). Dashed line denotes the onset of the COVID-19 pandemic.

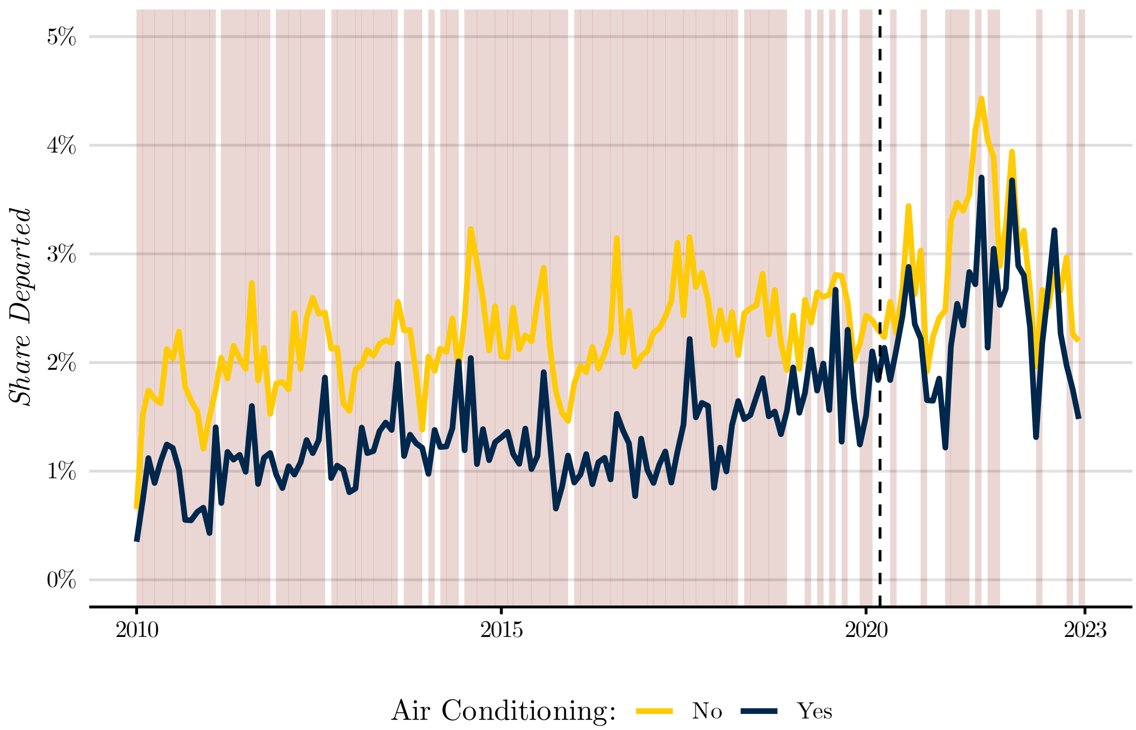


Figure 3 shows the results of our initial test of an overall correlation between working in a prison without air conditioning and departing the TDCJ workforce in a given month. Due to the significant changes to the correctional system brought about by the COVID-19 pandemic, we estimate separate models for before and after March 2020. We also estimate separate models for, respectively, frontline correctional officers and their supervisors. The top panel shows the predicted probability of departing in a given month by supervisory status, time period (i.e., before or after March 2020), and prison air conditioning. The bottom panel shows the associated Average Marginal Effect (AME) of working in a prison without air conditioning.[5] That is, it captures the average change in the predicted probability of

5. Predicted probabilities and AMEs are calculated using an observed-value approach (Hanmer and Ozan Kalkan 2013; Arel-Bundock, Greifer, and Heiss 2024). That is, we estimate the predicted probability of departing for every employee with the binary air conditioning variable set to each of its two respective values

departing across employees as prison air conditioning status changes.[6]

Before COVID-19, frontline correctional officers in prisons without air conditioning were more likely to depart the workforce. Working in a prison without air conditioning is associated with an approximately 0.2 percentage point increase in the probability of departing in a given month, which, relative to baseline departure rates, corresponds to an approximately 10% increase in the likelihood of leaving the TDCJ workforce. Notably, this result only holds for frontline employees before March 2020. After the onset of the COVID-19 pandemic, the relationship between heat and air-conditioning reverses. After March 2020, frontline employees are slightly less likely to leave their jobs if they work in a prison without air conditioning, although the estimate of the difference does not reach standard levels of statistical significance.[7] Given the considerable, and difficult to fully account for, challenges to correctional work introduced by the pandemic, we primarily focus our attention on the period before March 2020, but return to these unexpected post-pandemic results in the Discussion.

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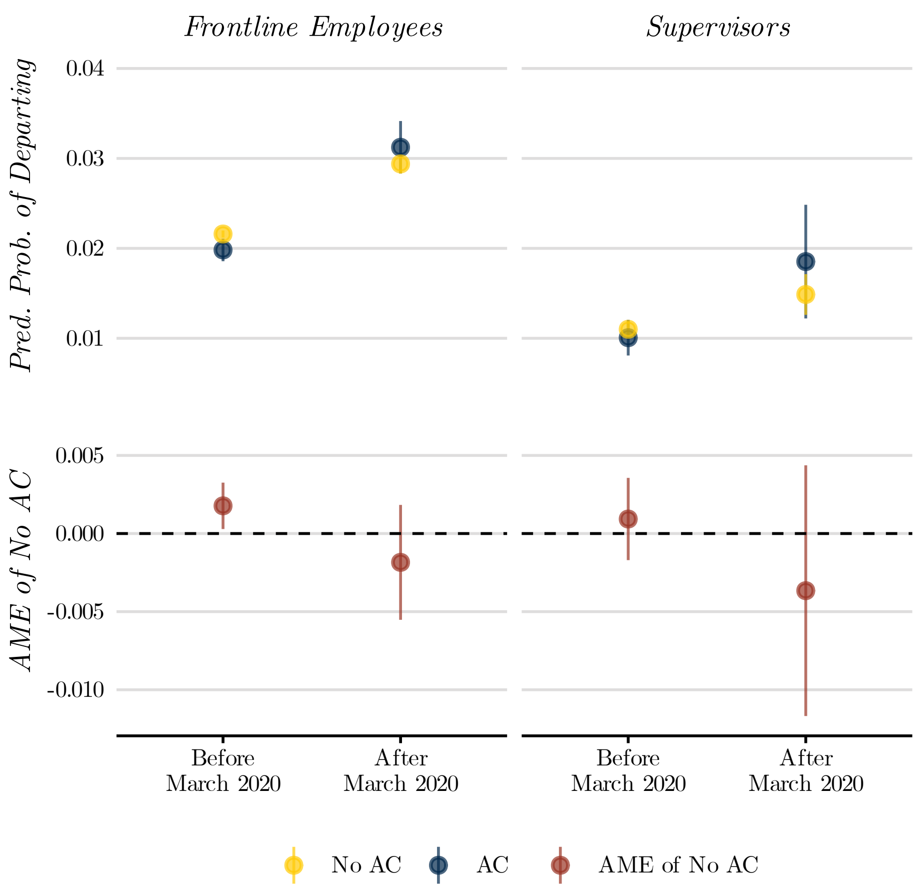
and the other controls set to their observed values. Means and standard errors are then calculated conditional on air conditioning status.

6. The AME of working in a prison with no air conditioning on departing for $i \in \{1, \ldots, n\}$ employees is defined as:

$$\text{AME} = \frac{1}{n} \sum_{i=1}^{n} \left[\Pr(\text{depart}_i \mid \text{AC}_i = \text{no}) - \Pr(\text{depart}_i \mid \text{AC}_i = \text{yes}) \right]$$

7. In Figure D.1 in the Supplementary Information we show that our results largely hold when using fixed effects for TDCJ-designated regions instead of an indicator for whether a prison is in a rural county. All estimates are pointed in the same direction, but the estimated AME among frontline employees for after (before) March 2020 becomes statistically (in)distinguishable from zero with $p < 0.05$.

Figure 3 – Frontline Employees in Prisons Without Air-Conditioning More Likely to Depart Before March 2020 The top facet shows the predicted probability of frontline correctional officers and supervisors departing in a given month before and after the onset of COVID-19. The bottom facet shows the average marginal effect of working in prison without air conditioning on the probability of departing by supervisory status and time period (i.e., before or after March 2020). Estimates calculated using the `marginaleffects` `R` package using control variables set to their observed values and standard errors clustered by employee. Bars denote 95% confidence intervals. Full tabular results are located in Table D.1.



The results from Figure 3 point toward a negative relationship between excessive heat and departing, at least before the COVID-19 pandemic. However, these findings likely mask important sub-group variation. In particular, newer frontline employees are likely less acclimated to the heat. Unlike their peers who have been on the job for at least a few summers, less-experienced correctional officers have not become acclimated to the hot conditions. As a result, their willingness to work in prisons in the summer without air conditioning is unknown. These employees, therefore, may be particularly likely to leave during hot times of the year, as well as in the spring or fall as they anticipate or react to hot temperatures.

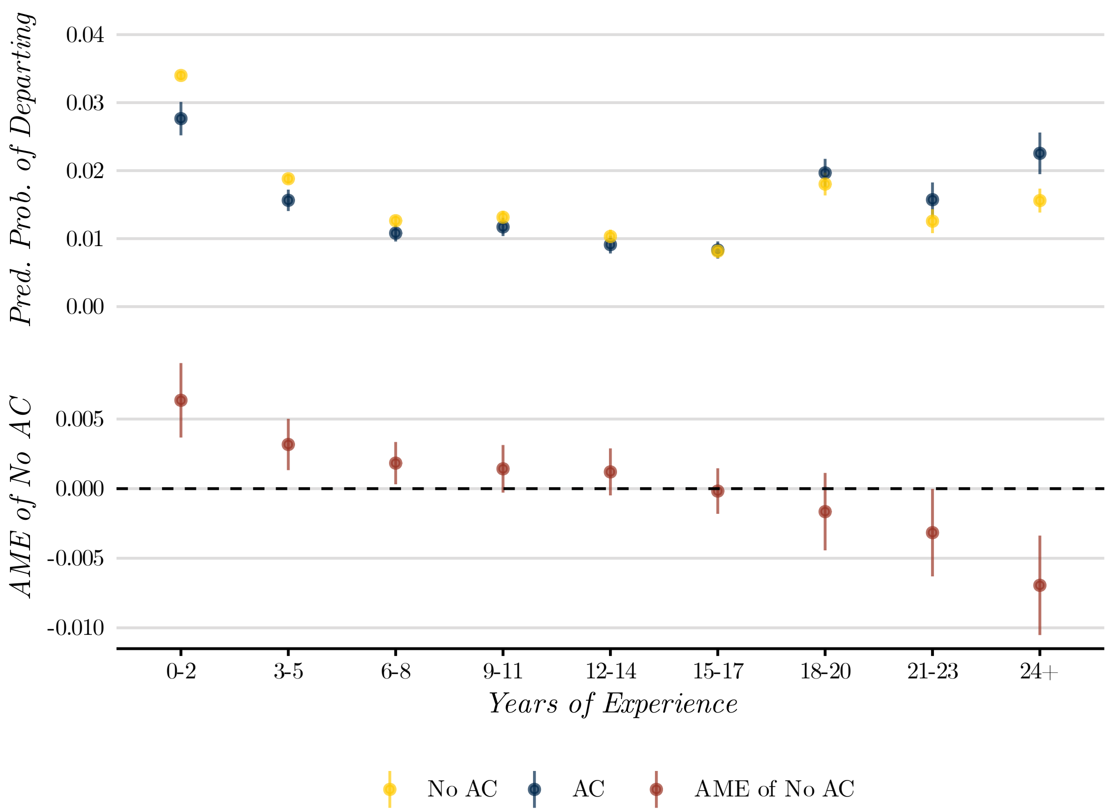
We test this expectation in Figure 4. The top panel shows the predicted probability of departing by air conditioning status and employees' years of experience. The bottom panel shows the associated AME of working in a prison without air conditioning by years of experience. The top panel highlights two key trends. First, departures from both types of prisons are highest among the least experienced employees. The predicted probability of departing is greatest among employees with two or fewer years of experience and then steadily decreases before increasing again when correctional officers are eligible to receive a lifetime annuity from the state's Law Enforcement and Custodial Officer Supplemental Retirement Fund after 20 years of service. Second, the difference in the predicted probability of departing between employees in prisons with and without air conditioning is initially high and then decreases. The bottom facet of Figure 4 emphasizes this trend by plotting the AME of working in a prison without air conditioning within each experience category.[8] Among the least experienced employees, working in a prison without air conditioning is associated with a 0.6 percentage point increase in the predicted probability of departing. Considering that the predicted probability of departing in a given month among employees with two or fewer years of experience hovers around 3%, this is a substantively large increase of approximately 20% in the probability of departing. The increased likelihood of departing

8. The AME of no air conditioning on departing for $i \in \{1, \ldots, n\}$ frontline correctional officers with J level of experience is defined as:

$$\text{AME}_J = \frac{1}{n}\sum_{i=1}^{n}\left[\Pr(\text{depart}_i \mid \text{AC}_i = \text{no}) - \Pr(\text{depart}_i \mid \text{AC}_i = \text{yes})\right]$$

declines with experience, becoming indistinguishable from zero before reversing among the most experienced employees.

Figure 4 – Least-Experienced Employees More Likely to Depart from Prisons Without Air Conditioning The top facet shows the predicted probability of frontline correctional officers departing in a given month before the onset of COVID-19 by years of experience and air-conditioning status. The bottom facet shows the average marginal effect of working in a prison without air conditioning on the probability of departing by years of experience. Results calculated using the `marginaleffects R` package using control variables set to their observed values and standard errors clustered by employee. Figure D.2 shows the results for months after March 2020. Bars in both facets denote 95% confidence intervals.



Preceding results capture the relationship between heat and air conditioning throughout the year. As a final test, we evaluate whether working in a prison without air conditioning leads to more departures during the summer months when excessive heat is most salient. This is a conservative test of our expectations. Departures in anticipation of summer or in reaction to a particularly brutal stretch of hot weather are not picked up as being the result of excessive heat. Given the results of Figure 4, we estimate the moderating impact of outside temperature separately by years of experience with the TDCJ (0-2, 3-5, and >5 years). The yellow (blue) points in Figure 5 show the AME of the average monthly temperature falling within 60-69°F, 70-79°F, or >79°F, relative to months with an average temperature of <60°F among employees with a certain experience level working in prisons without (with) air conditioning.[9] In order to test whether the AME of rising temperatures is different across prisons with and without air conditioning, we test for significant differences between a given pair of AME estimates and report the associated p values above the estimated effects.

As temperatures rise (moving from left to right in Figure 5), the probability of departing increases among employees in prisons both with and without air conditioning. Notably, as temperatures increase, the differences between the AME estimates for prisons with and without air conditioning also rise for less-experienced employees in the top two panels. Employees with 0-2 years of experience in prisons without (with) air conditioning are approximately 0.9 (0.6) percentage points more likely to depart in the hottest months of the year, relative to the coolest months. The difference between these two estimates, as well as the difference between the two AME estimates of the effect of average temperatures exceeding 79°F on departing among employees with 3-5 years of experience, does not quite reach standard levels of statistical significance ($p = 0.108$ and $p = .088$, respectively). However, among frontline correctional officers who have worked for the TDCJ for longer than 5 years, there is no associated gap in AME estimates as temperatures increase. The most experienced employees across all prisons are more likely to leave in months when average temperatures are above 79°F, but there is no evidence that those who work in prisons without air conditioning are at greater risk of departing.[10]

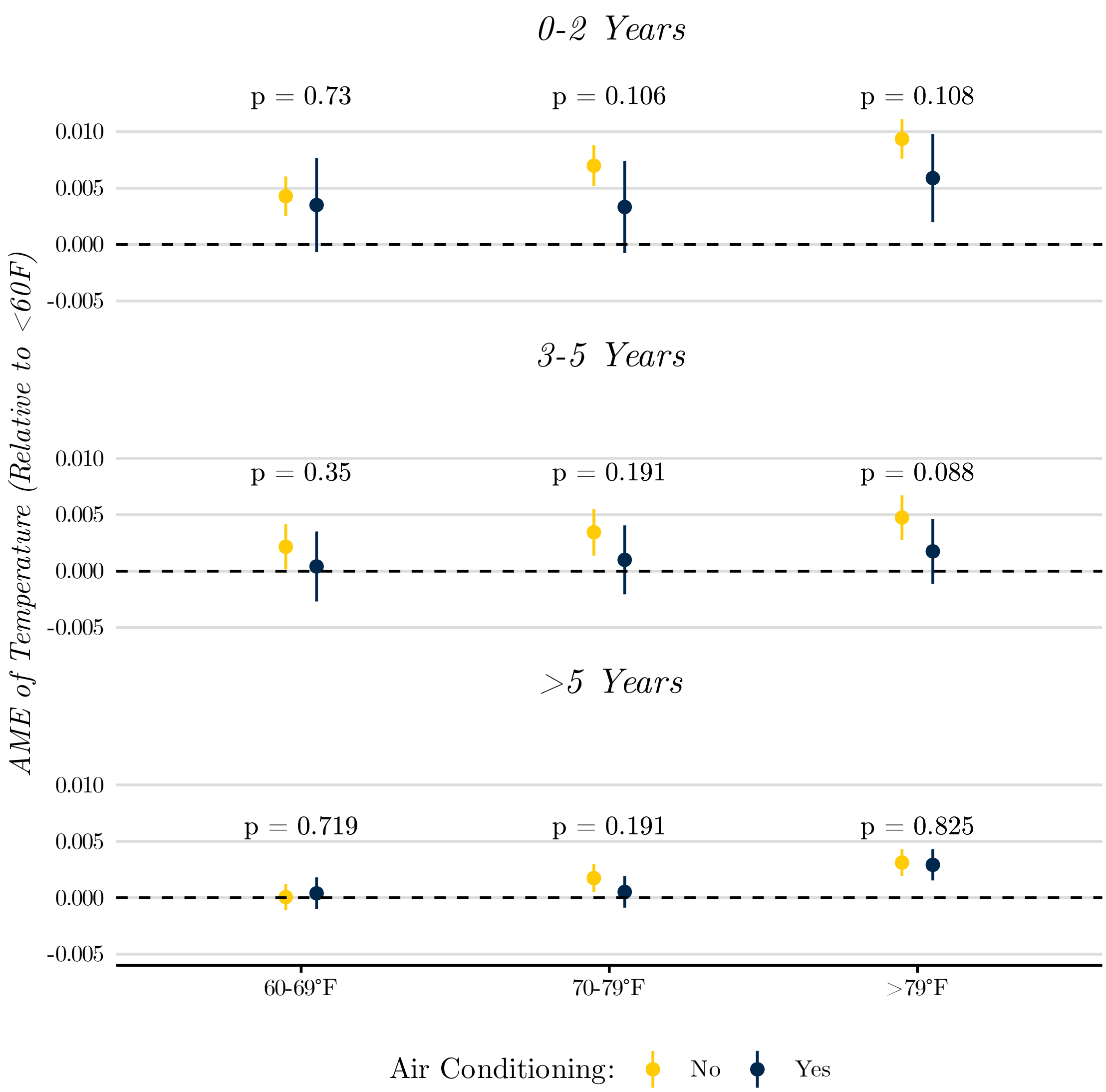
9. That is, the AME of temperature level $t \in \{60-69^o\text{F}, 70-79^o\text{F}, > 79^o\text{F}$ on the probability of departing for the subset of $i \in \{1, \ldots, n\}$ frontline correctional officers with experience level J and employed in a prison with or without air conditioning $AC \in \{yes, no\}$ is defined as:

$$\text{AME}_{\Gamma_{J,AC}} = \frac{1}{|\Gamma_{J,AC}|} \sum_{i \in \Gamma_{J,AC}} [\Pr(\text{depart}_i \mid \text{temp}_i = t) - \Pr(\text{depart}_i \mid \text{temp}_i < 60^o\text{F})]$$

Where $\Gamma_{J,yes} \subset \{i : AC_i = yes, J_i = J\}$ is the subset of employees with J level of experience working in a prison with air conditioning and $\Gamma_{J,no} \subset \{i : AC_i = no, J_i = J\}$ is the subset of employees with J level of experience working in a prison without air conditioning.

10. Similar, albeit noisier, results arise from estimating the average marginal effect of working in a prison without air conditioning at different temperature levels (Figure D.5).

Figure 5 – Least-Experienced Employees in Prisons Without Air-Conditioning More Likely to Depart During Summer Months Shows the average marginal effect of the average monthly temperature being 60-69°F, 70-79°F, and >79°F (relative to <60°F) by air conditioning status. The facets indicate employees' years of experience. P values from hypothesis tests of a difference between the two AME estimates for prisons with and without air conditioning, respectively. Results calculated using the `marginaleffects` `R` package using control variables set to their observed values. Bars denote 95% confidence intervals. Data is from before the COVID-19 pandemic. Figure D.4 shows results from after March 2020.



Discussion

Reformers have long framed the lack of air conditioning in many U.S. prisons as a moral and constitutional issue. We take a different, complementary approach, arguing that excessively hot conditions within prisons lacking air conditioning also creates poor working conditions that contribute to correctional officer turnover. Using personnel and air conditioning data from the largest state prison system in the U.S., we show that a substantively and statistically significant association exists between working in a Texas prison without air conditioning and departing the correctional workforce. Before the onset of COVID-19, frontline correctional officers working in prisons without air conditioning were 10% more likely to depart the TDCJ workforce. Additional tests support our expectation that it is in fact heat, and not some other unobserved factor, driving our results. New frontline officers with the least experience were especially likely to depart. Unlike their more senior peers who have grown accustomed to hot conditions, newer employees are more likely to depart from prisons lacking air conditioning.

Likewise, despite heat being able to influence turnover even during cooler seasons through anticipatory effects, we provide some suggestive evidence of a direct effect of heat on departures in the summer months. Among less experienced employees with five or fewer years of experience with the TDCJ, we show that rising temperatures lead to a relatively greater increase in the propensity to depart among employees in prisons without air conditioning compared to their peers in cooled facilities. Despite not reaching standard levels of statistical significance, we do find that the moderating effect of working in an air-conditioned prison diminishes among the most experienced employees. As with the main results, the moderating effect of temperature on departing is largely isolated to the least experienced employees who are not acclimated to working in prisons without air conditioning in hot Texas summers.

Nevertheless, we also find that many of the above findings disappear following the onset of the COVID-19 pandemic. There are a few possible reasons for this. The pandemic brought unprecedented challenges to prisons, many of which were particularly affected by the virus. As a result, new unobserved confounders that are difficult to control for may be masking an underlying relationship between air conditioning and departing.[11] While possible, two other scenarios seem more likely. For one, it may be the case that the challenges of the pandemic simply drowned out the benefits of air conditioning. Increasingly dangerous conditions due to the virus and heightened understaffing drove departures following the pandemic, rather than excessive heat. Another possibility is that COVID-19 is not actually the cause of the changes in our results over time. Figure 2 suggests that departures from prisons with air conditioning began to steadily increase in 2017. It may be that what appears to be a change due to the pandemic actually stems from a prior, alternative cause.

Our work has a few limitations, which should be improved upon in future work. First, while our longitudinal study is an improvement upon existing research, we are limited by the lack of within-prison variation in air-conditioning during the study period. Second, exiting the workforce is one, relatively extreme, measure that correctional workers can take in the wake of poor conditions. They can also take vacation days or be forced to work additional overtime shifts to cover vacancies. Future work should incorporate these other dependent variables. Finally, while Texas is a particularly salient case for studying the relationship between heat and correctional officer turnover, correctional officers in other states might be even more responsive to heat. Climate change is increasing the number of hot summer days across the country in places where people are less used to excessive heat (Tuholske et al. 2024). As a result, correctional officers in the Pacific Northwest, Midwest, and New England may be even more impacted by working in facilities without air conditioning than their peers in the South.

Finally, our results also underscore the other considerable challenges faced by correctional officers. Despite its benefits, air conditioning cannot alleviate the violence, stress, and trauma that make correctional work particularly taxing. While cooler prisons help both incarcerated people and correctional staff, air conditioning does not address other underlying pathologies within prisons and thus offers only partial relief from the structural conditions that drive burnout, turnover, and chronic understaffing.

11. In Table D.3, we show that controlling for monthly reported COVID-19 cases among staff and incarcerated people by prison does not change our findings.

Methods

Data

We use two datasets to examine the relationship between air conditioning and the departure of correctional employees. The first consists of monthly snapshots of all correctional staff employed by the TDCJ from January 2010 through January 2023, which we received via multiple public records requests to the agency. For each month, the data note the full name, age, facility, race, sex, full-time status, job title, and most recent hire date for all correctional staff employed in security positions at TDCJ facilities. Most employees in the dataset are in frontline correctional officer positions (83.7%), but the data also include first-line supervisors, such as sergeants, lieutenants, and captains, as well as managers (e.g., majors, assistant wardens, and wardens).[12] The personnel files do not include unique employee identification codes that follow employees throughout their tenure with the TDCJ. As a result, we assign unique employee identification codes by grouping together observations with similar ages and the same first name, middle initial, last name, race, last hire date, and sex. Since the codes include employees' last hire date with the TDCJ, they can capture instances where the same employee departs the workforce and then returns later in the study period.[13]

Second, we determine whether correctional employees work in air-conditioned facilities using data published by the TPCA, a nonprofit advocacy organization. Through public records requests, the TPCA gathered data on whether TDCJ prisons' housing areas were fully, partially, or not air-conditioned as of April 2022. According to the TDCJ, administrative, educational, and medical areas are air-conditioned in all facilities, even if housing areas are left uncooled. The TPCA data are static snapshots. They do not note how air-conditioning coverage changed over the course of our study period. Thus, we restrict our analysis to facilities with full air conditioning or no air conditioning. In addition to offering a cleaner test, the tails of the air-conditioning coverage distribution are also less susceptible to over-time fluctuations. We are only aware of two prisons, the Hodge and Pack Units, that

12. The data also include some employees in auxiliary roles, like food and laundry managers.
13. Of the unique employees in the dataset, 10.3% had more than one employment spell with the TDCJ.

had full air conditioning installed during our study period after previously lacking any air conditioning in housing areas. These installations followed a four-year legal battle between individuals incarcerated at the Pack Unit and the state, underscoring that the TDCJ rarely makes full-scale changes to prisons' air conditioning (McCullough 2017, 2018; Blakinger and Banks 2018).[14]

It is also unlikely that the TDCJ installed full air conditioning in a prison that was previously partially air-conditioned. Most partially air-conditioned prisons have, in practice, few air-conditioned beds.[15] Installing full air conditioning in one of these prisons is a considerable undertaking, similar to that which occurred in the Hodge and Pack Units. Finally, it is unlikely that a prison with no air conditioning in 2022 was air-conditioned in the past. Ten of the prisons identified in the TPCA data as having no air conditioning were built before 1920. Given the high costs of installation, it is unlikely that any prison, especially one over 100 years old, would remove air conditioning after initially providing it.

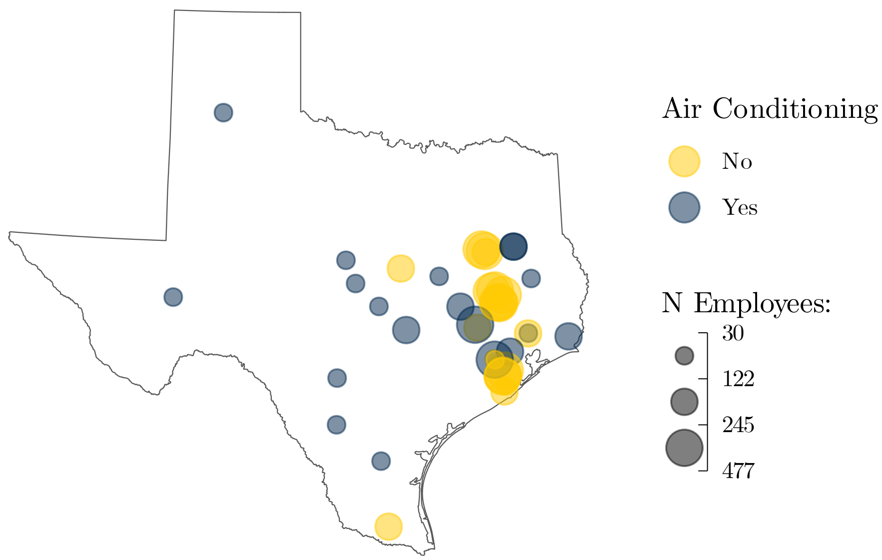
The resulting dataset includes 40,334 distinct employees, 45,022 employment spells, and 1,558,601 employee-month observations across forty-one facilities with either full or no air conditioning (Figure 6).[16] Air-conditioned facilities employ fewer correctional staff and are more evenly distributed across the state than prisons without air conditioning, which are concentrated in the eastern part of the state.

14. The TDCJ has increased the pace of air-conditioning installation since around 2022 (Betts 2025). An archived version of a TDCJ dashboard tracking how many "cool beds" were installed between 2018 and October 2023 suggests that 5,876 beds were installed over the period. Besides the 2,467 cool beds installed in the Hodge and Pack units, only 26 air-conditioned beds were installed in a facility (Hilltop Unit) noted as having no air conditioning in the TPCA data from April 2022 ("TDCJ Air Conditioning Construction Projects" 2023). A more recent snapshot of facility air-conditioning status provided by the TPCA dated August 2024 suggests that only fourteen TDCJ facilities now have no air-conditioning coverage, usually due to the installation of 50 or fewer cool beds.

15. As of April 2022, 19% of beds in partially air-conditioned facilities were air-conditioned.

16. This is a subset of all TDCJ facilities with either full or no air conditioning. The personnel data provided by the TDCJ does not include employees in private prisons, private state jails, some pre-release facilities, and some intermediate sanction facilities for parole violators. Table A.1 lists the 41 TDCJ facilities for which we have personnel data by air-conditioning status.

Figure 6 – Location of TDCJ Prisons by Air-Conditioning Status and Number of Employees Shows the location of the forty-one prisons operated by the TDCJ at some point between 2010 and 2023 that had either full or no air conditioning in housing areas. Points are binned into tertiles based on the number of employees working in the facility in the last month for which data is available. For most prisons, the last observed month is December 2022. The Jester I and Scott units were closed in 2020 and employee counts are therefore pulled from August and December 2020, respectively. The Hodge and Pack units are shown as having full air conditioning.



Research Design

We use a selection-on-observables approach to test whether correctional officers employed in TDCJ prisons without air conditioning are more likely to leave their jobs. The dependent variable is whether an employee departs the TDCJ workforce in a given month, while the independent variable is a binary indicator for whether an employee works at a prison without air conditioning.[17] We control for a series of confounders. At the individual-level, we control for employees' race, age, squared age, monthly salary, and sex. Since air conditioning coverage rarely changes over our study period, we are not able to utilize facility-level fixed effects to control for variation across prisons. Instead, we opt to include a number of facility-level variables that are likely to correlate with whether a prison is air-conditioned and employees

17. Since we count instances where an employee leaves the TDCJ and then returns in a future month as a departure, the unit of analysis is an employment spell rather than an employee.

risk of departing. In particular, we include controls for the monthly unemployment rate of the county containing the prison, the percent change in the number of correctional employees working at the prison over the prior six months, the age of the facility, the number of security staff working at the facility in the given month, the number of people incarcerated in the facility in the given month, whether the facility only houses individuals who require minimal security, whether the facility is located in an urban zip code,[18] and the physical size of facility grounds. Officials in the state have pointed to rising oil and natural gas production during the beginning of our study period as contributing to understaffing in the TDCJ, and we therefore control for the monthly amount of oil and natural gas produced in the county containing the given prison (Foxhall 2012; McCullough 2019).[19] Finally, we include monthly fixed effects to pick up on state-wide trends, such as the four salary raises shown in Figure 1, and fixed effects for years of experience working with the TDCJ.

We also account for outside temperature. We measure temperature as the average monthly temperature (in Fahrenheit) of the county containing a prison.[20] Following other researchers (Mukherjee and Sanders 2021; Deschênes and Greenstone 2011; Barreca et al. 2016; Heutel, Miller, and Molitor 2021), we bin average temperature readings to pick up on nonlinear trends. In particular, we create five bins by degrees: less than 60°F, 60-69°F, 70-79°F, and 80°F or higher.[21] We estimate all models using logistic regression with standard errors clustered by employment spell.

The initial models shown in Figure 3 and Table D.1 provide an estimate of the correlation between air conditioning status and departing. It is not a causal estimate of the effect of excessive heat on turnover. Air conditioning is not randomly installed in TDCJ prisons.

18. We use the 2020 Rural-Urban Commuting Area codes published by the United States Department of Agriculture to define whether an area is rural. In particular, a zip code is deemed urban if it is located in a metropolitan core or a metropolitan area outside of a metropolitan core. Figure A.1 shows the location of TDCJ prisons by urban status. In addition, the TDCJ groups prisons into six regions that are each overseen by a separate regional director. Therefore, we also estimate alternative models that use regional fixed effects instead of an indicator for whether a prison is located in an urban area. Figure A.2 shows the location of TDCJ prisons grouped by region.

19. Figure A.3 shows the distribution of oil and natural gas production over time.

20. Temperature data downloaded from the National Centers for Environmental Information's "nClimDiv" dataset. Figure C.1 shows that counties with and without air conditioning have similar seasonal temperature fluctuations.

21. Figure C.2 in the Supplementary Information shows the distribution of our binned temperature variable.

Older, larger prisons are less likely to have air conditioning and employees in both types of prisons differ on dimensions, such as years of experience and age, that likely influence the likelihood of departing. While our approach is able to control for many of these confounders, unobserved factors may still introduce bias. We account for this issue by extending our main model in two different ways. First, we test for a relationship between heat and air conditioning among a subgroup of the workforce—new frontline correctional officers—where effects are likely to be more pronounced. As displayed in Figure 4, we extend the initial model to account for frontline employees' experience working in hot conditions by interacting our main independent variable with employees' years of experience with the TDCJ. Due to likely nonlinearities, we opt to measure years of experience as a categorical variable.[22]

Second, in Figure 5 we test whether working in a prison without air conditioning has a greater impact on departures in the summer months. While this approach does not allow for departures in anticipation of heat, it does offer a more causally-identified estimate of the effect of air conditioning on departing. We test for a moderating effect of heat by interacting the binned temperature variable with the binary indicator for whether an employee works in a prison without air conditioning. The result is a model that not only estimates how departure propensities vary by season, but also how heat mitigation moderates that relationship.[23]

22. In particular, we bin years of experience into the following categories: 0-2, 3-5, 6-8, 9-11, 12-14, 15-17, 18-20, 21-23, and > 24 years of experience.

23. We substitute annual fixed effects for monthly fixed effects to pick up on seasonal temperature fluctuations while still controlling for over-time changes in departure rates.

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Supplementary Information

Excessive Heat and Correctional Officer Turnover: Evidence from Texas

Benjamin Goehring and Jacob Harris

A TDCJ Facilities

Figure A.1 – TDCJ Facilities, by AC and Urban Status Shows prisons' air conditioning status and whether a prison is located in an urban zip code, as defined by the USDA's Rural-Urban Commuting Area (RUCA codes).

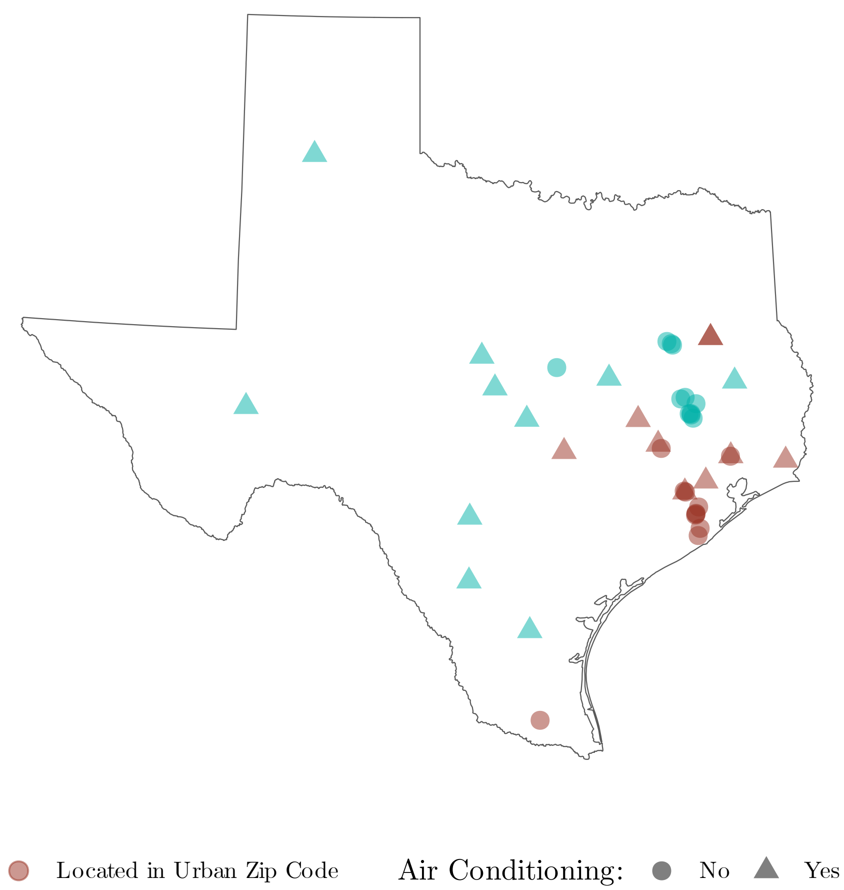


Figure A.2 – TDCJ Facilities, by AC Status and Region Shows the TDCJ-designated region and air-conditioning status of TDCJ prisons with either full or no air conditioning.

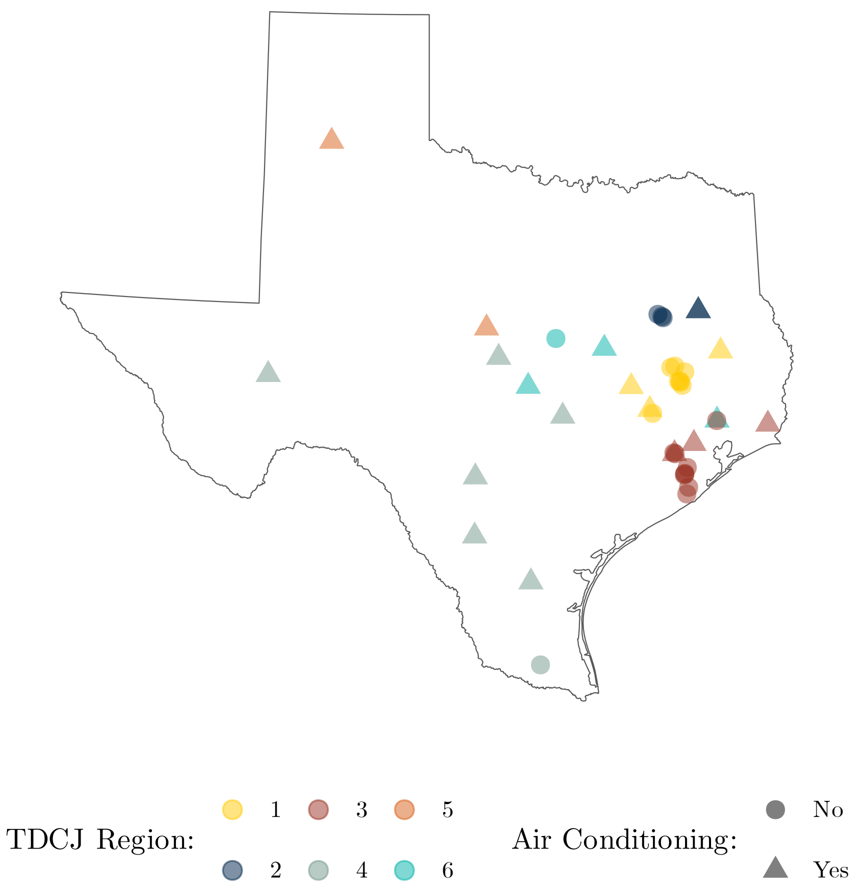
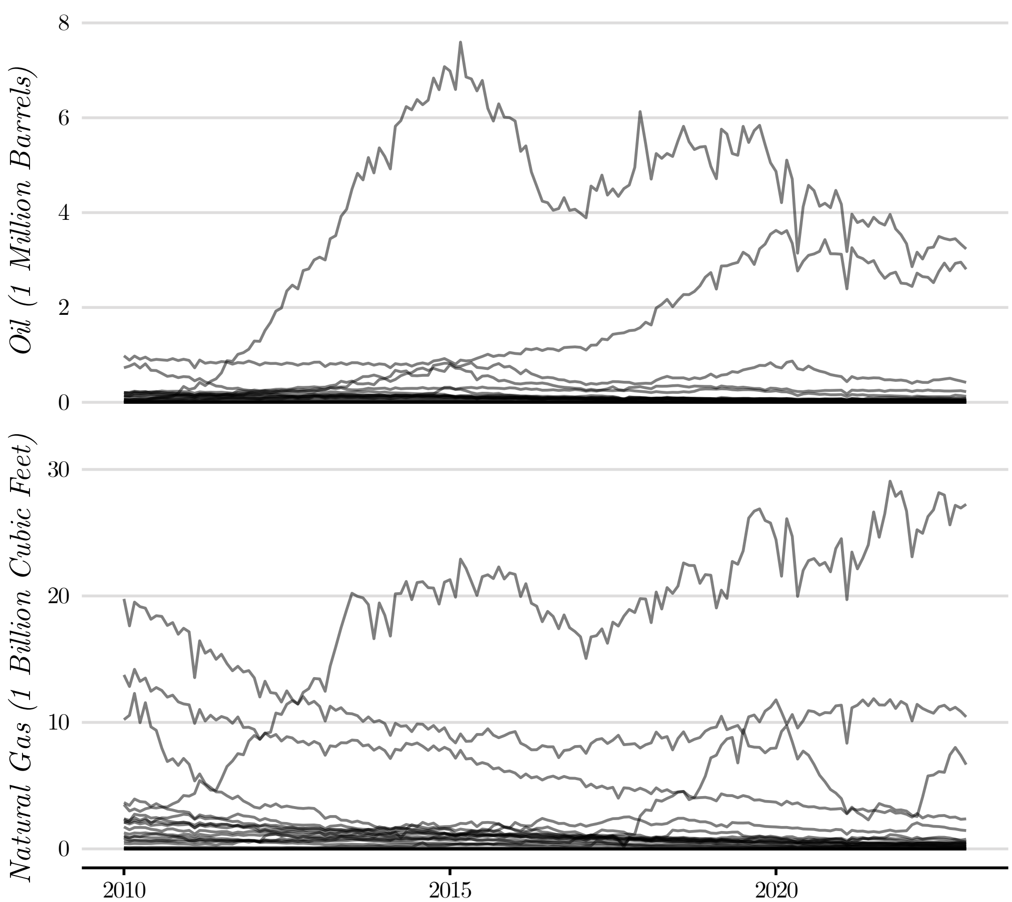


Table A.1 – TDCJ Facilities, by Air-Conditioning Status Lists the TDCJ prisons with either full or no air conditioning in housing areas for which we have personnel data. Hodge and Pack, the two units that switched air-conditioning status during our study window, are listed separately.

AC Level	Facilities
Full (N = 17)	Cotulla, Duncan, Fort Stockton, Glossbrenner, Halbert, Hamilton, Havins, Henley, Kegans, Leblanc, Marlin, Mechler, Ney, San Saba, Scott, Skyview, Travis
None (N = 22)	Beto, Byrd, Clemens, Coffield, Ellis, Ferguson, Goree, Hightower, Hilltop, Huntsville, Jester I (Closed), Lopez, Luther, Memorial, Powledge, Ramsey, Scott (Closed), Stringfellow, Terrell, Vance, Wainwright, Wynne
Switched (N = 2)	Hodge, Pack

Figure A.3 – Monthly Oil and Natural Gas Production, by County Shows monthly oil and natural gas production in the 25 counties where TDCJ prisons with full or no air conditioning are located.



B Defining Employee Departures

The dependent variable in all analyses is whether an employee departs the TDCJ in a given month. We use information from two different sources to define an employee's month of departure. First, via the personnel dataset, it is straightforward to find the last month of observed continuous employment (i.e., the end of an employee's spell of employment with the TDCJ). However, since the personnel data is a snapshot of all TDCJ security employees on the last day of the given month, it is unclear whether someone actually departed on the last day of the month or at some point before the last day of the next month. The second source of information is an additional dataset provided to us by the TDCJ that lists all employees who departed during our study period and their actual separation date (which we truncate to the actual month of separation). While more precise, these data do not include instances of employees moving from security to non-security (e.g., case manager) roles within the TDCJ. Despite their differences, the two data sources are largely similar. Employees' last observed month of employment and actual month of separation have a Jaccard index value of .88.

Given the benefits and drawbacks of both data sources, we use a two-pronged approach to define employees' month of departure. First, via the additional data provided to us by the TDCJ, we merged in the actual separation date for all employees who departed during our study period. Second, if an employee spell ends before the last month that we have data (December 2022) without a separation, we deem it to be an instance of an employee moving to a non-security role within the TDCJ and assign it as a departure.

C Heat in Texas

Figures C.1 and C.2 show the distribution of monthly mean temperatures in Texas. Figure C.1 shows that average temperatures vary significantly by month and are nearly identical in counties with prisons with and without air conditioning. Figure C.2 shows the distribution of our binned temperature variable. It shows that facility-month observations are more likely to have average temperatures lower than 60°F or greater than 79°F.

Figure C.1 – Mean Monthly Temperature of Counties with Prisons, by AC Status Shows the mean monthly temperature of counties containing prisons that have full and no air conditioning, respectively.

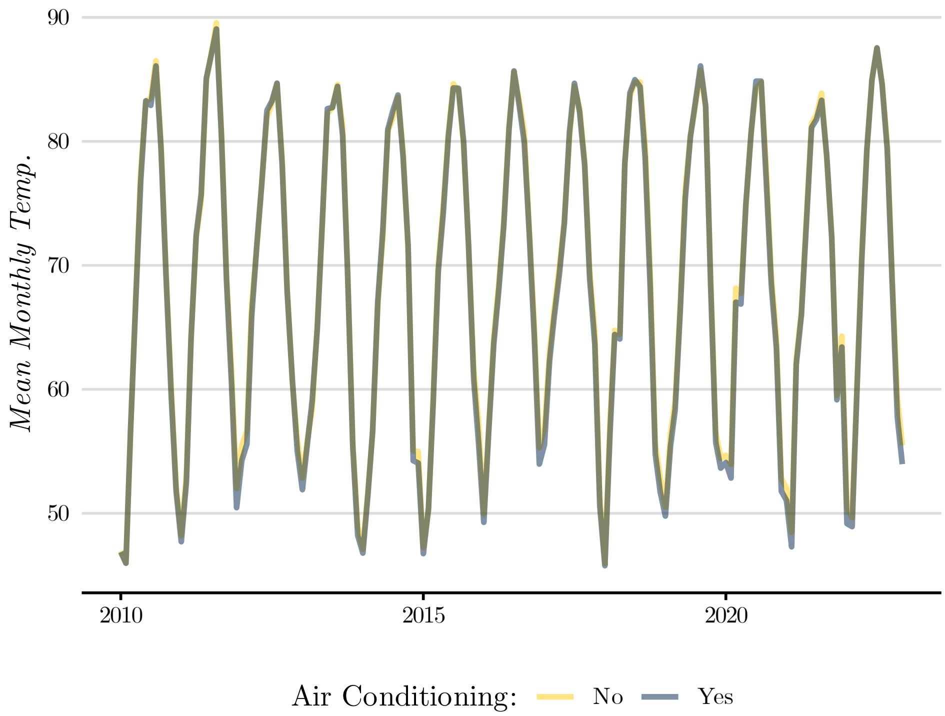
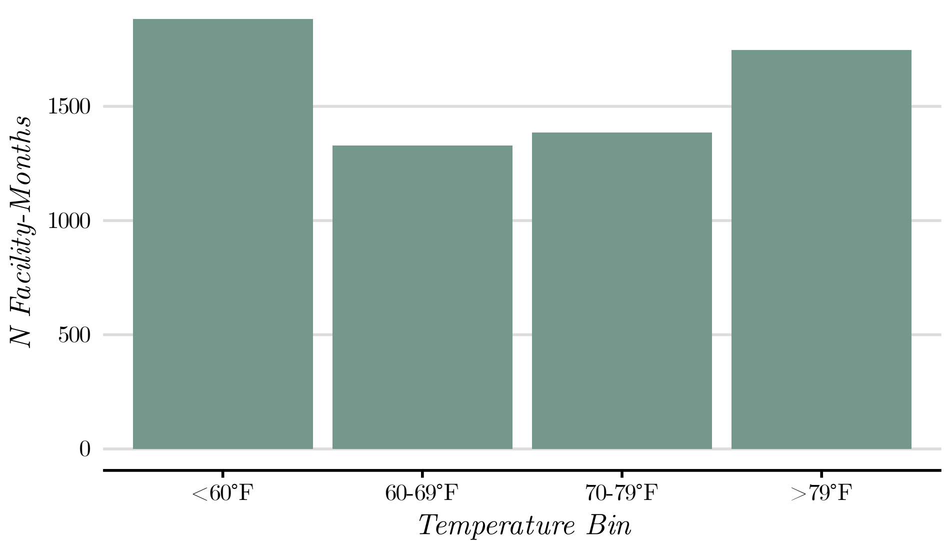


Figure C.2 – Distribution of Facility-Months by Temperature Bin Shows the number of facility-months that fall in each of the temperature bins.



D Additional Results

Table D.1 provides the full results of the coefficients used to calculate the predicted probabilities and AMEs in Figure 3. Table D.2 shows results for all employees over the entire study period, while Table D.3 runs the models for after March 2020 while controlling for reported staff and inmate COVID-19 cases. Table D.4 replicates Table D.1 but uses fixed effects for TDCJ-designated regions instead of a binary indicator for whether a prison is located in an urban county. Skewed continuous variables—*Monthly Salary, Facility Size, Facility Age, N Incarcerated, Oil Production,* and *Natural Gas Production*—are logged in all models. Standard errors are clustered by employee and all results are presented on the odds-ratio scale with 95% confidence intervals in brackets.

Figure D.1 replicates Figure D.1 but uses the models displayed in Table D.4 instead of Table D.1 to calculate predicted probabilities and AMEs. Figure D.3 is an alternative version of Figure 5 that calculates the AME of working in a prison without air conditioning by month of year rather than the temperature within a prison's county. Figures D.2 and D.4 replicate, respectively, Figures 4 and 5 from the main text for the period following March 2020. Figures D.5 and D.6 are alternative versions of, respectively, Figures 5 and D.4 that

Table D.1 – Frontline Employees in Prisons Without AC More Likely to Depart Before March 2020 Shows the tabular results underlying Figure 3.

	Frontline Employees		Supervisors	
	Before March 2020	After March 2020	Before March 2020	After March 2020
No AC	1.09*	0.94	1.09	0.80
	[1.01; 1.18]	[0.83; 1.06]	[0.84; 1.42]	[0.50; 1.28]
White	1.29*	1.36*	1.17*	1.30*
	[1.25; 1.33]	[1.29; 1.44]	[1.05; 1.31]	[1.08; 1.55]
Log(Monthly Salary)	0.57*	0.47*	0.40*	0.45
	[0.52; 0.62]	[0.42; 0.52]	[0.25; 0.63]	[0.19; 1.06]
Age	0.90*	0.93*	0.84*	0.88*
	[0.90; 0.91]	[0.92; 0.94]	[0.81; 0.88]	[0.83; 0.94]
Age^2	1.00*	1.00*	1.00*	1.00*
	[1.00; 1.00]	[1.00; 1.00]	[1.00; 1.00]	[1.00; 1.00]
Male	0.85*	0.93*	0.84*	0.95
	[0.83; 0.88]	[0.89; 0.98]	[0.73; 0.95]	[0.78; 1.15]
60-69°F	1.04	1.08	1.24	1.44
	[0.95; 1.13]	[0.93; 1.26]	[0.88; 1.74]	[0.78; 2.66]
70-79°F	1.05	1.16	1.25	2.04
	[0.93; 1.20]	[0.95; 1.43]	[0.75; 2.10]	[0.94; 4.45]
>79°F	1.00	1.10	1.41	2.00
	[0.85; 1.18]	[0.85; 1.43]	[0.74; 2.68]	[0.76; 5.27]
Unemployment Rate	0.99	1.02	1.05	1.09
	[0.97; 1.01]	[1.00; 1.05]	[0.98; 1.11]	[1.00; 1.18]

	Frontline Employees		Supervisors	
	Before March 2020	After March 2020	Before March 2020	After March 2020
Minimum Security	0.90*	1.06	0.93	1.47
	[0.84; 0.98]	[0.94; 1.20]	[0.72; 1.20]	[0.91; 2.37]
Log(Facility Size)	1.01*	1.00	1.00	1.06
	[1.00; 1.02]	[0.99; 1.02]	[0.96; 1.03]	[0.99; 1.13]
N Employees (100)	1.02*	1.01	1.00	1.08
	[1.00; 1.04]	[0.97; 1.06]	[0.94; 1.06]	[0.92; 1.26]
Pct. Change Employees	0.99*	1.00	1.00	1.00
	[0.99; 1.00]	[0.99; 1.00]	[0.99; 1.02]	[0.98; 1.01]
Log(Facility Age) (in 2025)	1.00	0.99	0.98	1.16
	[0.97; 1.04]	[0.94; 1.05]	[0.86; 1.11]	[0.92; 1.46]
Log(N Incarcerated)	1.04	1.18*	0.99	1.01
	[0.99; 1.09]	[1.08; 1.30]	[0.85; 1.14]	[0.76; 1.32]
Log(Oil Prod.)	1.03*	1.02	1.05*	1.07
	[1.02; 1.04]	[0.99; 1.04]	[1.01; 1.10]	[1.00; 1.15]
Log(Nat. Gas Prod.)	0.98*	0.98*	0.97*	0.96
	[0.97; 0.99]	[0.96; 1.00]	[0.94; 1.00]	[0.91; 1.01]
Urban County	1.04	0.99	0.98	0.76*
	[0.99; 1.08]	[0.91; 1.07]	[0.85; 1.14]	[0.60; 0.98]
Tenure FE	✓	✓	✓	✓
Month FE	✓	✓	✓	✓
Region FE				
N Observations	991,794	248,776	124,248	34,036

* Null hypothesis value outside the confidence interval.

Table D.2 – Results for All Employees, 2010-2022 Replicates the models in Table D.1 using frontline correctional officers and supervisors over the full time-frame.

	1	2
No AC	0.98	1.02
	[0.92; 1.05]	[0.97; 1.09]
White	1.31*	1.30*
	[1.27; 1.34]	[1.27; 1.33]
Log(Monthly Salary)	0.51*	0.52*
	[0.48; 0.55]	[0.49; 0.55]
Age	0.91*	0.91*
	[0.90; 0.91]	[0.90; 0.91]
Age^2	1.00*	1.00*
	[1.00; 1.00]	[1.00; 1.00]

	1	2
Male	0.87*	0.87*
	[0.85; 0.89]	[0.85; 0.89]
60-69°F	1.03	1.07
	[0.96; 1.11]	[0.99; 1.14]
70-79°F	1.04	1.10
	[0.93; 1.15]	[1.00; 1.22]
>79°F	0.97	1.05
	[0.84; 1.11]	[0.92; 1.19]
Unemployment Rate	0.99	1.01
	[0.98; 1.01]	[0.99; 1.02]
Minimum Security	0.88*	0.95
	[0.83; 0.94]	[0.89; 1.01]
Log(Facility Size)	1.00	1.01*
	[0.99; 1.01]	[1.00; 1.02]
N Employees (100)	1.01	1.01
	[0.99; 1.03]	[0.99; 1.02]
Pct. Change Employees	0.99*	0.99*
	[0.99; 1.00]	[0.99; 1.00]
Log(Facility Age) (in 2025)	1.00	1.01
	[0.97; 1.04]	[0.98; 1.04]
Log(N Incarcerated)	1.10*	1.07*
	[1.05; 1.15]	[1.03; 1.11]
Log(Oil Prod.)	1.01*	1.03*
	[1.00; 1.03]	[1.02; 1.04]
Log(Nat. Gas Prod.)	0.99	0.98*
	[0.98; 1.00]	[0.97; 0.98]
Frontline Employee	1.18*	1.18*
	[1.14; 1.23]	[1.14; 1.23]
Urban County		1.02
		[0.98; 1.05]
Tenure FE	✓	✓
Month FE	✓	✓
Region FE	✓	
N Observations	1,482,564	1,482,564

* Null hypothesis value outside the confidence interval.

Table D.3 – Results for After March 2020 Similar When Controlling for Reported COVID-19 Cases Replicates the models that include observations from after March 2020 in Table D.1 with controls for reported COVID-19 cases.

	Frontline Employees	Supervisors
No AC	0.92	0.76
	[0.81; 1.05]	[0.48; 1.21]
White	1.36*	1.34*
	[1.28; 1.43]	[1.12; 1.61]
Log(Monthly Salary)	0.46*	0.51
	[0.41; 0.51]	[0.21; 1.22]
Age	0.93*	0.87*
	[0.92; 0.94]	[0.82; 0.93]
Age^2	1.00*	1.00*
	[1.00; 1.00]	[1.00; 1.00]
Male	0.93*	0.91
	[0.89; 0.98]	[0.75; 1.11]
60-69°F	1.09	1.49
	[0.94; 1.27]	[0.80; 2.79]
70-79°F	1.17	1.82
	[0.94; 1.45]	[0.82; 4.07]
>79°F	1.11	1.80
	[0.85; 1.45]	[0.67; 4.84]
Unemployment Rate	1.02	1.11*
	[0.99; 1.04]	[1.02; 1.20]
Minimum Security	1.07	1.44
	[0.94; 1.22]	[0.90; 2.31]
Log(Facility Size)	1.00	1.06
	[0.99; 1.02]	[1.00; 1.13]
N Employees (100)	1.02	1.05
	[0.98; 1.07]	[0.89; 1.24]
Pct. Change Employees	1.00	0.99
	[0.99; 1.00]	[0.98; 1.01]
Log(Facility Age) (in 2025)	0.99	1.19
	[0.93; 1.05]	[0.94; 1.50]
Log(N Incarcerated)	1.18*	0.99
	[1.08; 1.30]	[0.75; 1.30]
Log(Incarc. Cases)	1.00	1.05
	[0.98; 1.01]	[0.99; 1.12]
Log(Employee Cases)	0.99	1.06
	[0.97; 1.02]	[0.97; 1.16]
Log(Oil Prod.)	1.02	1.07*
	[0.99; 1.04]	[1.00; 1.15]
Log(Nat. Gas Prod.)	0.98*	0.96
	[0.96; 1.00]	[0.91; 1.01]

	Frontline Employees	Supervisors
Urban County	0.98	0.75*
	[0.90; 1.06]	[0.58; 0.96]
Tenure FE	✓	✓
Month FE	✓	✓
Region FE		
N Observations	237,616	32,641

* Null hypothesis value outside the confidence interval.

Table D.4 – Results Largely Similar When Controlling for Region FEs Rather than Urban/Rural Status Replicates the models in Table D.1 using fixed effects for TDCJ-designated regions rather than a binary control for whether a prison is in an urban area. Figure D.1 provides a visual interpretation of these results.

	Frontline Employees		Supervisors	
	Before March 2020	After March 2020	Before March 2020	After March 2020
No AC	1.08	0.83*	1.19	0.94
	[0.99; 1.17]	[0.73; 0.95]	[0.89; 1.59]	[0.58; 1.51]
White	1.30*	1.36*	1.21*	1.32*
	[1.26; 1.34]	[1.29; 1.44]	[1.08; 1.36]	[1.10; 1.59]
Log(Monthly Salary)	0.57*	0.46*	0.39*	0.46
	[0.52; 0.61]	[0.41; 0.51]	[0.25; 0.62]	[0.19; 1.08]
Age	0.90*	0.92*	0.84*	0.88*
	[0.90; 0.91]	[0.91; 0.93]	[0.81; 0.87]	[0.83; 0.94]
Age^2	1.00*	1.00*	1.00*	1.00*
	[1.00; 1.00]	[1.00; 1.00]	[1.00; 1.00]	[1.00; 1.00]
Male	0.86*	0.93*	0.83*	0.95
	[0.83; 0.88]	[0.89; 0.98]	[0.73; 0.95]	[0.78; 1.15]
60-69°F	1.01	1.05	1.13	1.33
	[0.93; 1.11]	[0.91; 1.22]	[0.80; 1.59]	[0.72; 2.45]
70-79°F	1.00	1.09	1.04	1.77
	[0.88; 1.14]	[0.88; 1.35]	[0.62; 1.76]	[0.80; 3.96]
>79°F	0.94	1.05	1.12	1.66
	[0.79; 1.11]	[0.80; 1.37]	[0.58; 2.17]	[0.59; 4.63]
Unemployment Rate	0.98*	0.99	1.01	1.05
	[0.96; 1.00]	[0.96; 1.02]	[0.94; 1.08]	[0.95; 1.16]
Minimum Security	0.86*	0.89	0.95	1.73*
	[0.79; 0.94]	[0.77; 1.02]	[0.71; 1.27]	[1.02; 2.95]
Log(Facility Size)	1.00	0.99	0.99	1.06
	[0.99; 1.02]	[0.97; 1.01]	[0.95; 1.03]	[0.98; 1.15]

	Frontline Employees		Supervisors	
	Before March 2020	After March 2020	Before March 2020	After March 2020
N Employees (100)	1.02*	0.98	1.02	1.06
	[1.01; 1.04]	[0.94; 1.03]	[0.96; 1.09]	[0.90; 1.25]
Pct. Change Employees	0.99*	0.99*	1.00	0.99
	[0.99; 1.00]	[0.99; 1.00]	[0.99; 1.02]	[0.98; 1.01]
Log(Facility Age) (in 2025)	0.98	1.03	0.94	1.19
	[0.94; 1.02]	[0.96; 1.10]	[0.81; 1.09]	[0.92; 1.55]
Log(N Incarcerated)	1.06*	1.26*	1.04	1.16
	[1.00; 1.11]	[1.13; 1.40]	[0.88; 1.23]	[0.84; 1.59]
Log(Oil Prod.)	1.02*	0.98	1.02	1.03
	[1.01; 1.04]	[0.95; 1.00]	[0.98; 1.07]	[0.95; 1.12]
Log(Nat. Gas Prod.)	0.99	1.01	0.99	0.98
	[0.98; 1.00]	[0.99; 1.04]	[0.96; 1.03]	[0.91; 1.06]
Tenure FE	✓	✓	✓	✓
Month FE	✓	✓	✓	✓
Region FE	✓	✓	✓	✓
N Observations	991,794	248,776	124,248	34,036

* Null hypothesis value outside the confidence interval.

Figure D.1 – **Before (After) March 2020, Frontline Employees in Prisons Without Air-Conditioning More (Less) Likely to Depart** Replicates Figure 3 but uses fixed effects for TDCJ-designated regions instead of a binary urban/rural control. Full tabular results are located in Table D.4.

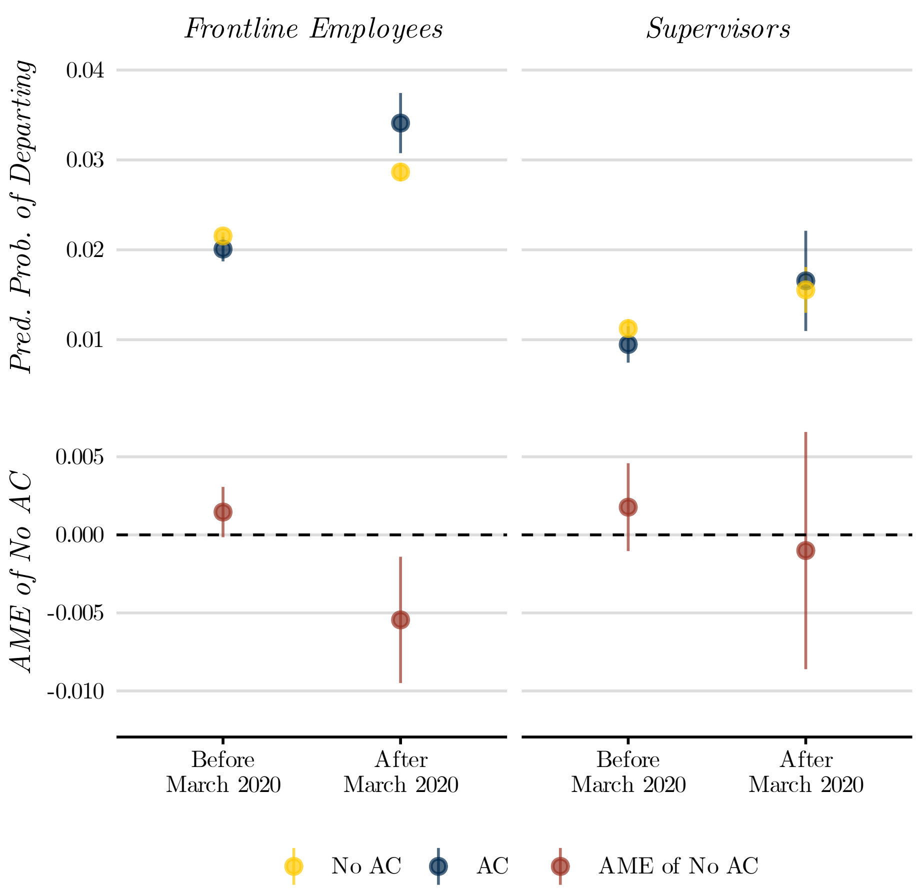


Figure D.2 – Air Conditioning Does not Lead to More Departures Among Newly Employed Following COVID-19. Replicates Figure 4 using data from March 2020 through January 2023. Results calculated using the `marginaleffects` R package using control variables set to their observed values.

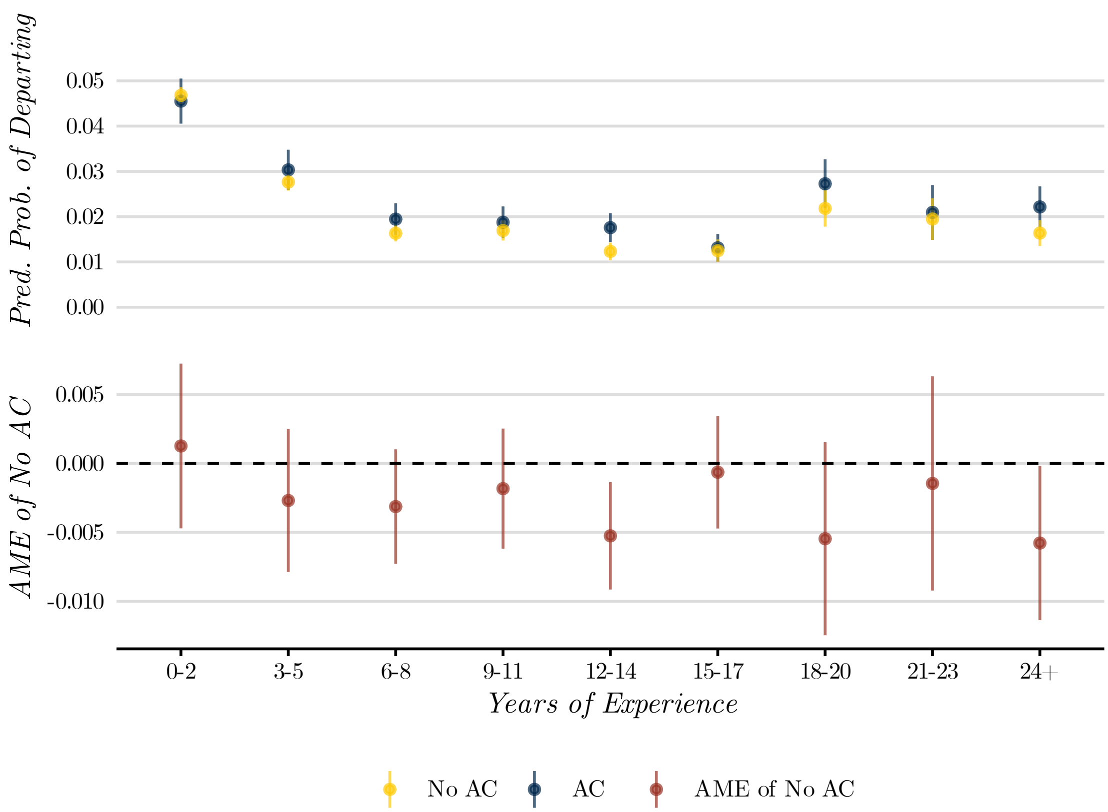


Figure D.3 – Predicted Probability of Departing, by Month of Year Shows the average marginal effect of working in a prison without air conditioning by month of the year. Data is from before March 2020. Each facet includes a subset of data: frontline correctional officers with 0-2, 3-5, and >5 years of experience, and all supervisors regardless of experience level. The model excludes controls for average monthly temperature and substitutes annual fixed effects for monthly fixed effects. Results calculated using the `marginaleffects` `R` package using control variables set to their observed values. Bars denote 95% confidence intervals.

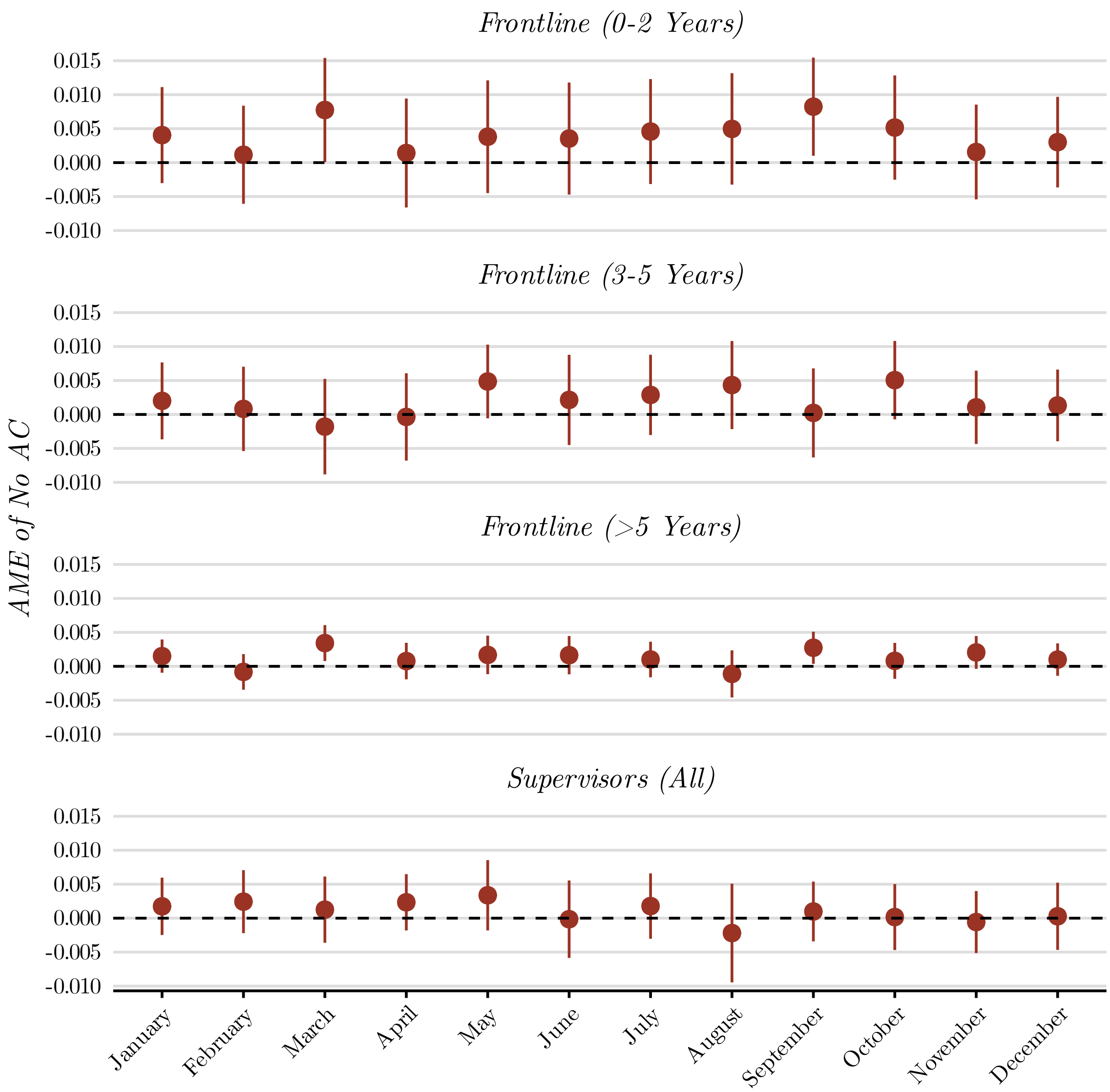


Figure D.4 – Departures More Likely in Hotter Months, but Little Difference Across Air Conditioning Types (COVID-19) Shows the average marginal effect of the average monthly temperature being 60-69°F, 70-79°F, and >79°F (relative to <60°F) by air conditioning status. Replicates Figure 5 using data from March 2020 through January 2023. The facets indicate employees' years of experience. P values from hypothesis tests of a difference between the two AME estimates for prisons with and without air conditioning, respectively. Results calculated using the `marginaleffects` `R` package using control variables set to their observed values. Bars denote 95% confidence intervals.

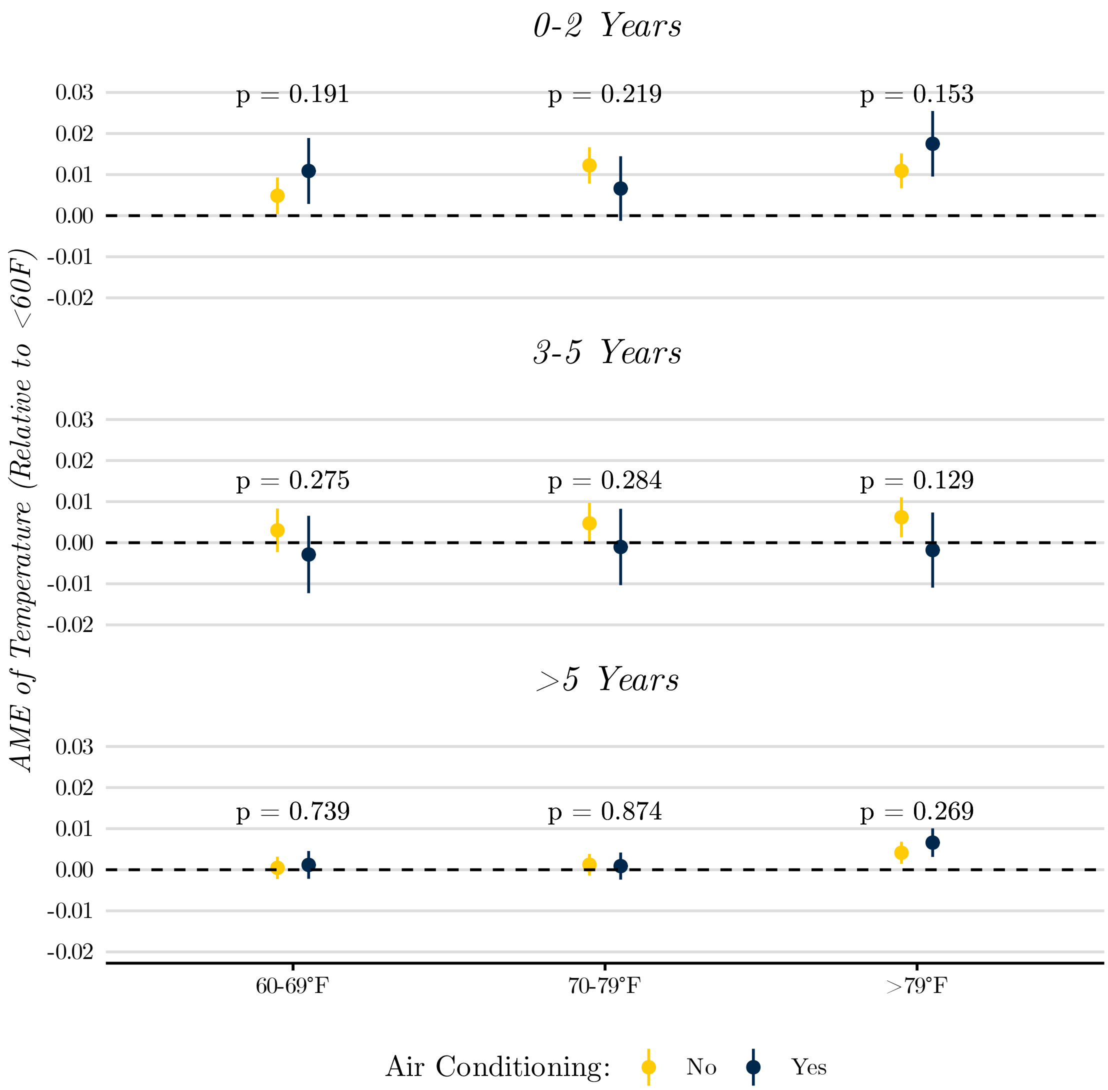


Figure D.5 – Least-Experienced Employees in Prisons Without Air Conditioning Slightly More Likely to Depart in Hotter Months Shows the average marginal effect of working in a prison without air conditioning before COVID-19 by average monthly temperature. Results calculated using separate models that restrict the data to employees with 0-2, 3-5, and >5 years of experience. Results calculated using `marginaleffects R` package using control variables set to their observed values. Figure shows the results for months after March 2020. All pairwise hypothesis tests of AME estimates within a given years of experience category have p values > 0.05.

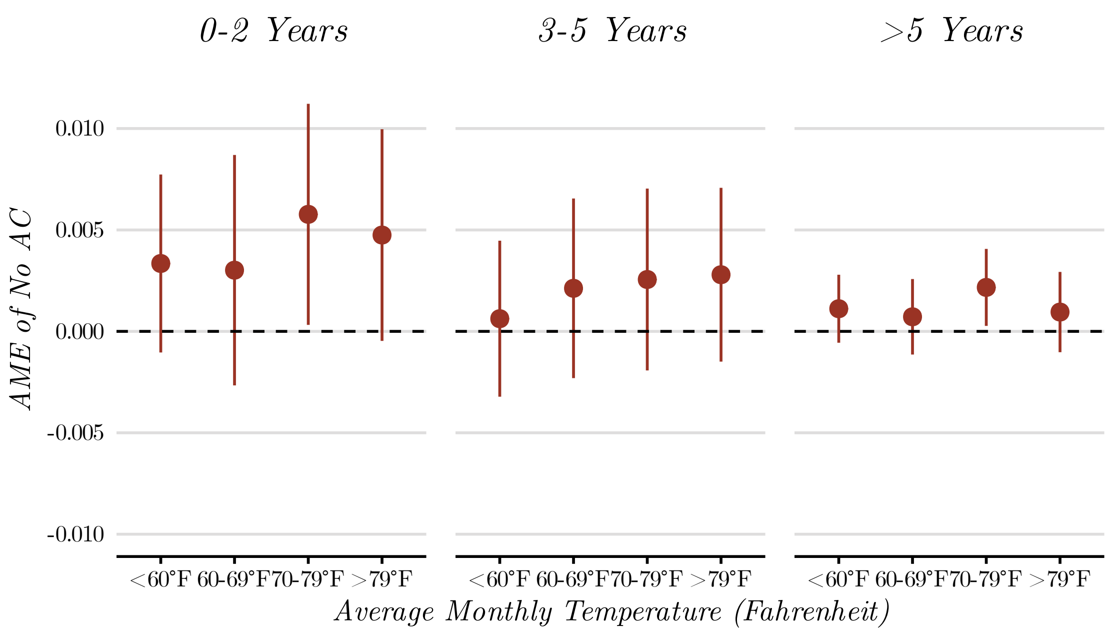


Figure D.6 – No Difference in Departures as Temperatures Increase Following Onset of COVID-19 Replicates Figure D.5 using data from March 2020 through January 2023. Results calculated using the `marginaleffects R` package using control variables set to their observed values.