Title
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Journal
American Journal of Preventive Medicine, 62(6)

ISSN
0749-3797

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Publication Date
2022-06-01

DOI
10.1016/j.amepre.2021.12.011

Peer reviewed

Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

American Journal of
Preventive Medicine

RESEARCH BRIEF

Life Expectancy and COVID-19 in Florida State Prisons

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Introduction: The heightened risk of COVID-19 infection and mortality in prisons is well documented, but COVID-19's impact on all-cause mortality in incarcerated populations has not yet been studied. This study analyzed mortality records from the Florida State Department of Corrections prison system population to evaluate the impact COVID-19 had on all-cause mortality and compare mortality rates and life expectancy with that of the overall state of Florida population.

Methods: Population age and sex data for Florida State Department of Corrections were ascertained from the Florida State Department of Corrections Offender Based Information System. Death data by age, sex, and cause of death were acquired from medical records and Florida State Department of Corrections offender reports. The state of Florida demographic and death data were collected from the Census Bureau, Florida Department of Health, and Centers for Disease Control and Prevention. Age- and sex-standardized life table measures were calculated, and COVID-19 contributions to changes in life expectancy were assessed using Arriaga's decomposition.

Results: The standardized mortality rate in the Florida State Department of Corrections population increased by 45% between 2019 and 2020, causing an overall 4.0-year decline in life expectancy. Over the same period, the state of Florida population's standardized mortality increased by 19%, resulting in an overall 2.7-year decline. Within the Florida State Department of Corrections population, life expectancy decline could be attributed exclusively to COVID-19 mortality.

Conclusions: The state of Florida prison population saw a substantial increase in mortality driven solely by COVID-19 mortality, leading to an overall 4-year decline in life expectancy. Given the findings and continued threat of COVID-19 outbreaks, Florida State Department of Corrections and other prison systems should strive to increase vaccination uptake, decrease prison populations, and commit to COVID-19 data transparency.

Am J Prev Med 2022;62(6):949–952. Published by Elsevier Inc. on behalf of American Journal of Preventive Medicine.

INTRODUCTION

The heightened risk of coronavirus disease 2019 (COVID-19) infection and subsequent mortality for incarcerated people has been well documented,[1,2] yet the impact of COVID-19 on all-cause mortality in these populations has not been analyzed. To understand how the COVID-19 pandemic impacted all-cause mortality rates in prisons in the U.S., this study leveraged data from public records to analyze mortality trends in the Florida Department of Corrections (FLDOC) incarcerated population, the third largest state prison system in the country,[3] and compared them with trends in the state of Florida as a whole.

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0749-3797/$36.00
https://doi.org/10.1016/j.amepre.2021.12.011

METHODS

Demographic data for FLDOC, including age and sex, were ascertained using the FLDOC Offender Based Information System.[4] Monthly census counts were constructed for all months from January 2019 to December 2020. Equivalent data for the state of Florida were taken from the 2019 American Community Survey and held constant throughout the study period.[5]

The FLDOC mortality data were aggregated for 2019 and 2020 from FLDOC fiscal-year Inmate Mortality Reports, a publicly available database, with age and sex information, of all individuals who died while being held in FLODC custody since 2015.[6] Because causes of death were not provided in these reports, medical examiner records, obtained through record requests, for deaths within FLDOC in 2020 were used to identify COVID-19–related deaths. A death was considered COVID-19 related if the words COVID or SARS (severe acute respiratory syndrome) appeared in the first 5 causes of death. All-cause mortality and COVID-19 mortality data for the state of Florida were obtained from the Florida Department of Health[7] and Centers for Disease Control and Prevention,[8] respectively.

To assess differences in mortality, age-specific mortality rates and life expectancy were calculated for each calendar year, 2019 and 2020, for FLDOC and the state of Florida using standard life table methods. For this analysis, life tables were initiated at age 20 years given that individuals aged <20 years represented <1% of FLDOC. Consequently, *life expectancy* in this analysis refers to period life expectancy at age 20 years.[9] Because the female population of FLDOC is relatively small (~6%), life table measures were calculated together for male and female individuals because calculating them separately would result in unstable life table estimates for the female population. For the state of Florida, life table measures were first calculated separately for male and female individuals and then adjusted to match the sex distribution of FLDOC, thus making estimates comparable. For standardized mortality rates, rates were adjusted to match the age–sex distribution of the 2020 FLDOC. Mortality rate comparisons over time and between groups were tested for statistical significance by incidence rate ratio (IRR) tests.

To evaluate the impact that COVID-19 had on life expectancy, life table measures were decomposed using Arriaga's method.[10] Analyses were performed using R, version 4.1.0. The University of California, Los Angeles IRB deemed this study exempt.

RESULTS

Across the study period, FLDOC population was both younger (4% were aged ≥65 years) and disproportionately male (94%) compared with that of the state of Florida (27% were aged ≥65 years, 48% were male). From January 2019 to December 2020, FLDOC population substantially declined from 95,769 to 84,086 individuals. FLDOC population was reported to have 400 total deaths in 2019 and 590 total deaths in 2020, 184 of which were attributable to COVID-19.

In 2020, the standardized mortality rate of FLDOC population was 626.9 deaths per 100,000 individuals, a 40% increase from that of the previous year (451.0 per 100,000, IRR=1.40, 95% CI=1.23, 1.58, $p<0.001$) (Table 1). Overall, standardized life expectancy declined by 4.0 years for FLDOC, from 77.8 years in 2019 to 73.7 years in 2020.

In 2020, the standardized mortality rate of the state of Florida was 597.3 deaths per 100,000 individuals, a 19% increase from that of the previous year (502.9 per 100,000, IRR=1.19, 95% CI=1.18, 1.20, $p<0.001$) (Table 1). Overall, standardized life expectancy declined by 2.7 years for the state of Florida, from 80.5 years in 2019 to 77.8 years in 2020.

In 2020, the standardized COVID-19 mortality rate for FLDOC population was 203.9 deaths per 100,000 individuals, 4.45 times that of the state's population (IRR=4.45, 95% CI=3.85, 5.15, $p<0.001$). Decomposition analysis showed that for FLDOC population, 4.2 years (105%) of life-expectancy loss was attributable to COVID-19–related deaths, whereas reductions in all other causes of mortality increased life expectancy by

Table 1. Standardized Mortality Rates

Age, years	FLDOC mortality rate 2020	FLDOC rate ratio 2020–2019	Florida state mortality rate 2020	Florida state rate ratio 2020–2019
20–24	50.2	0.52 (0.14–2.02)	164.6	**1.17 (1.07–1.28)**
25–34	95.0	1.04 (0.60–1.79)	234.9	**1.23 (1.17–1.29)**
35–44	231.3	**1.72 (1.13–2.62)**	341.0	**1.27 (1.22–1.33)**
45–54	389.5	1.03 (0.74–1.44)	574.0	**1.17 (1.13–1.21)**
55–64	1,359.6	**1.48 (1.15–1.90)**	1,315.4	**1.16 (1.14–1.19)**
65–74	4,976.3	**1.64 (1.29–2.09)**	2,396.8	**1.19 (1.17–1.21)**
≥75	11,093.1	1.26 (0.94–1.69)	6,619.8	**1.10 (1.09–1.11)**
Standardized mortality rate	626.9	**1.40 (1.23–1.58)**	597.3	**1.19 (1.18–1.20)**

Note: This table shows standardized mortality rates per 100,000 individuals for 2020 and the rate ratio of mortality rate change from 2019 to 2020 for FLDOC and Florida state populations. A rate ratio >1 indicates an increase in mortality rate from 2019 to 2020. Age-specific values are sex standardized, whereas total values are both age and sex standardized.
FLDOC, Florida Department of Corrections.
Boldface indicates statistical significance (p<0.05).

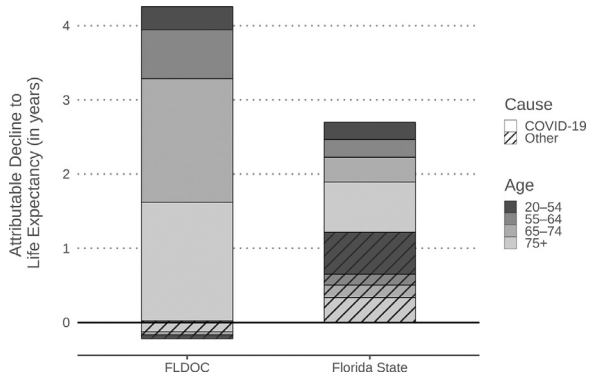

Figure 1. Life-expectancy decomposition.

Note: This figure shows the contribution, by age and cause of death, to the total change in life expectancy between 2019 and 2020. The overall decline was 4.0 years for the FLDOC population and 2.7 years for the Florida state population. COVID-19's contribution was a loss of 4.2 years for FLDOC population and a loss of 1.5 years for the Florida state population. Reductions in mortality from other causes added 0.2 years to life expectancy among the FLDOC population, whereas increases in other causes contributed 1.2 years of life expectancy decline for the Florida state population.

FLDOC, Florida Department of Corrections.

0.2 years. At the state level, COVID-19–related mortality contributed 1.5 years (55%) of life expectancy decline, whereas all other causes contributed 1.2 years of decline (Figure 1).

DISCUSSION

Although age-standardized all-cause mortality rates increased significantly from 2019 to 2020 for both FLDOC and the state of Florida, the percentage change was substantially higher for those in FLDOC prisons (40%) than for those in Florida as a whole (19%). As a consequence, the decline in life expectancy from 2019 to 2020 was also greater for FLDOC (4.0 years) than for the state in general (2.7 years).

Consistent with previous studies of incarcerated populations,[1,11] this study finds that during 2020, COVID-19 mortality burden was significantly higher among FLDOC population than among the population of the state of Florida. This study furthers these findings by showing that COVID-19–related mortality contributed to >100% of the overall 4.0-year life expectancy decline between 2019 and 2020. This pattern is markedly different from that of the state in general, in which 55% (1.5 years) of the decline was attributable to COVID-19.

Limitations

In this study, differences in the way COVID-19–related deaths were reported among FLDOC population and that of the state as a whole cannot be accounted for. Whereas for FLDOC, medical examiner records were used to attribute deaths to COVID-19, COVID-19 deaths for the state were obtained from the Centers for Disease Control and Prevention, where COVID-19 deaths were identified through a mixture of medical examiner records and doctors' reports.[12] Furthermore, differences in COVID-19 testing rates between contexts might have biased how many deaths received proper attribution. However, this difference would only bias the percentage of life-expectancy loss attributable to COVID-19 and not the total life-expectancy loss.

Although this analysis is limited to Florida, it is unlikely that these results are unique given the high case rate of COVID-19 in prison settings in the U.S.[1] The findings show the need for prisons to act quickly during pandemics to protect their populations from increases in mortality.

Increasing vaccination rates among both the incarcerated and staff populations should be prioritized. As of August 2021, it was reported that within Florida prisons, only 41% of the incarcerated population had been vaccinated, and staff vaccination rates had not been publicized.[13] If vaccination rates remain low, high COVID-19 mortality rates are likely to persist.

Although increasing vaccination rates will help in the short term by alleviating some COVID-19 risk, more systemic changes are required to lower the risk of disease spread in prisons.[14] Previous studies have documented that crowded, poorly ventilated prison settings create a high risk of communicable disease transmission.[15] To help lower this risk, corrections agencies should reduce population density in their prisons.

CONCLUSIONS

Although previous studies have documented the high rate of COVID-19 mortality among incarcerated populations, this study analyzes how COVID-19 contributed to changes to all-cause mortality and life expectancy. COVID-19 was a primary driver of changes in mortality among those in FLDOC custody, contributing to a markedly greater decline in life expectancy than that observed for the state's population overall.

Finally, given the disproportionate impact that COVID-19 has had on prison populations, having timely data on COVID-19 in prisons is essential for expedient public health decision making. To enable informed policy making, it is imperative that correctional departments resume mass testing and that they publicly report data on COVID-19 infections and deaths.

ACKNOWLEDGMENTS

The authors would like to thank Sara Curran and Ben Nyblade for their insight into the analysis.

This study was funded in part by Vital Projects Fund, Arnold Ventures, and the Centers for Disease Control and Prevention. NMM was funded by a National Institute of Child Health and Human Development P2C grant (P2C HD042828) as well as a National Institute of Child Health and Human Development T32 grant (T32 HD007543).

No financial disclosures were reported by the authors of this article.

CREDIT AUTHOR STATEMENT

Neal M. Marquez: Conceptualization, Formal analysis, Visualization, Writing - original draft. Aaron M. Littman: Conceptualization, Writing - review and editing. Victoria E. Rossi: Conceptualization, Data curation. Michael C. Everett: Data curation, Investigation. Erika Tyagi: Investigation, Data curation, Validation. Hope C. Johnson: Data curation, Investigation, Visualization. Sharon L. Dolovich: Conceptualization, Funding acquisition, Writing - review and editing.

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