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RESEARCH ARTICLE

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EPIDEMIOLOGY OF COVID-19 IN THE RESIDENT AND PRISON POPULATIONS OF THE CITY OF RECIFE-PE

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ABSTRACT

Background: Due to its rapid global spread, SARS-CoV-2 was quickly identified as a coronavirus and was named “the first pandemic of the 21st century” by the WHO. **Aims:** To analyze the prevalence and lethality of COVID-19 in the prison and resident populations of the city of Recife. **Methodology:** This is a quantitative analytical study using the database of positive COVID-19 cases among people deprived of their freedom in penitentiaries and in the population of Recife-PE. **Results:** A positive COVID-19 result was found in 65,535 patients, corresponding to prevalence of 4.0% in the resident population and of 2.8% in the group of inmate. The most prevalent age group was 40 to 49 years (22.9%) and most patients (75.8%) were female. In the resident population, the mortality rate was higher among males compared to females (3.9% vs. 1.2%) and among individuals with comorbidities compared to those without comorbidities (13.0% vs. 0.5%). **Conclusions:** The prevalence of COVID-19 was higher among residents of the city of Recife than in the prison population. The results of the study indicated an increase in the prevalence ratio and odds ratio of death associated with underlying medical conditions and an increase in the age group.

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INTRODUCTION

In January 2020, Chinese researchers identified a new coronavirus (SARS-CoV-2) as the etiological agent of coronavirus disease 2019, or simply COVID-19, which can cause severe acute respiratory syndrome (SARS), considered a pandemic by the World Organization Health (WHO). On January 30, 2020, the WHO declared a Public Health Emergency of International Importance (ESPII). With a scenario of more than 110,000 cases distributed across 114 countries,

the WHO declared COVID-19 a pandemic on March 11, 2020 (Cavalcante et al., 2020). In Brazil, the first cases were confirmed in February and several actions were implemented in order to contain and mitigate the spread of the disease. On February 3, 2020, the country declared a Public Health Emergency of National Importance (ESPIN) through Ordinance No. 188, of February 3, 2020 (Brasil, 2020). Insufficient scientific knowledge about the new coronavirus, its fast spread and its ability to cause death in vulnerable populations have generated uncertainty regarding the best strategies to fight the

pandemic in different parts of the world. In Brazil, the challenges would be even greater since little was known about the transmission characteristics of COVID-19 within a context of great social inequality, with populations living under precarious housing and sanitation conditions without systematic access to water and exposed to agglomerations (Werneck e Carvalho, 2020). Data on cases and deaths from COVID-19, collected and made available by the State Health Departments, have been consolidated since the beginning of the pandemic by the Brazilian Ministry of Health, providing information about the dynamics of the disease in the country and consequently facilitating the establishment of policies to slow down the rise in the number of cases (Cavalcante *et al.*, 2020). At the beginning of the pandemic, COVID-19 deaths were mainly observed among older patients since this group more frequently needed intensive care unit (ICU) treatment than younger patients. In a study using an observational database of 169 hospitals in Asia, Europe and North America, age over 65 years was associated with an increased risk of in-hospital death. In France, 3.6% of infected individuals needed to be hospitalized, with an average mortality rate of 0.7%. Older adults more commonly have comorbidities (for example, hypertension, obesity, diabetes) and therefore have a higher risk of death if infected than young adults (Fhon *et al.*, 2020). The symptoms of COVID-19 vary among individuals from asymptomatic infection to severe respiratory insufficiency. A cohort study carried out in the city of Vo' Euganeo showed that about 50-75% of individuals with positive throat swab results by RT-PCR remained asymptomatic, while others developed symptoms similar to those of influenza and a small percentage (about 10% of all symptomatic patients) developed dyspnea, which can lead to SARS and multiorgan dysfunction. Most individuals with more severe symptoms and clinical conditions had one or more coexisting medical conditions, with high mortality among elderly patients. Common symptoms of the disease are fever, cough, fatigue, mild dyspnea, sore throat, headache, and conjunctivitis. Gastrointestinal involvement was reported in a smaller percentage of cases, including diarrhea, nausea, and vomiting (Pascarella *et al.*, 2020). Many countries have implemented a series of interventions to reduce virus transmission and halt the rapid evolution of the pandemic. Such measures included the isolation of cases, encouraging hand hygiene, the adoption of respiratory etiquette, the use of face masks, and raising the awareness of the population regarding the need to stay at home. Progressive measures of social distancing were also implemented, which ranged from the closing of schools and universities, the prohibition of mass events and agglomerations and the restriction of travel and public transport to the complete prohibition of circulation in the streets, except for buying food and medicine or seeking health care. These measures have been implemented gradually and distinctly in different countries, to a greater or lesser extent, and their results probably depend on socioeconomic and cultural factors, characteristics of the political and health systems, and the operational procedures necessary for their implementation. The sustainability and effectiveness of these measures are dependent on the establishment of social protection policies and support for vulnerable populations in order to ensure the survival of individuals and families while restrictions in economic activities persist (Oliveira, 2020).

The COVID-19 pandemic has intensified and further exposed the violence, violations of rights, omissions and torture employed by the structures of justice and public security on incarcerated persons and their social relations, as well as making evident the inefficiency of the existing penal model to ensure the safety, life and physical and mental health of these populations. This failure is reflected on practical life with the suspension of visits to inmates by their relatives, without any type of study or control planning; lack of information provision; criminalization and vilification of the rights of family members as well as the stiffening and dehumanization of legal instruments aimed at the prison population (Oliveira, 2020). Of all countries, 59% have prison occupancy rates that exceed reported capacity (World prison brief, 2020). A challenge for prison systems around the world, COVID-19, whose most effective treatment is the prevention of its transmission, has exposed the precariousness of prisons in Brazil. Managers are challenged in terms of ensuring the implementation of

the actions provided for in the National Policy for Comprehensive Health Care for People Deprived of Liberty, to and organizing themselves against the risk of an explosion of cases and deaths. In 2019, there were 1,422 prisons in Brazil; 49% of them are dedicated to the detention of temporary prisoners and 79% are overcrowded. Furthermore, half of the prison facilities do not have medical clinics (Carvalho *et al.*, 2020). We found only few articles reporting the number of COVID-19 cases in Brazilian prisons. However, prison populations are known to be exceptionally vulnerable to COVID-19 for a variety of reasons, including older age and health status, as well as conditions such as overcrowding and limited or poor access to health care during in carceration (Stephensen, 2020). Andrade (2020) demonstrated that in the two months after Brazil became the second most affected country by the COVID-19 pandemic, cases in its prisons skyrocketed. The country recorded its first prison case in Rio de Janeiro in early March. Since then, the number of infected prisoners has doubled to more than 6,000 cases between May and July 2020 according to Brazil's National Penitentiary Department. Given the urgency of measures to contain the pandemic, especially considering the current possibility of a second and third wave of COVID-19, and the change in the operational flows of penitentiary institutions, the aim of this study was to analyze the prevalence and lethality of COVID-19 in the prison population of Recife compared to the resident population of the city.

METHODOLOGY

Study design: This is a quantitative analytical study using the database of positive COVID-19 cases in the city of Recife-PE and among people deprived of liberty in the penitentiaries of the city.

Study location: The study used data from the city of Recife, the largest city in the State of Pernambuco and part of the 1st Health Region. The estimated population is 1,653,461 in habitants (IBGE, 2020), with a population density of 7,039.64 in habitants per square kilometer. The city has 69.2% of households with adequate sanitation, 60.5% of urban households on public streets with trees, and 49.6% of urban households on public streets with adequate urbanization. In 2018, the average monthly income was 3.3 minimum wages (600US\$). The proportion of employed people in relation to the total population was 43.1% (IBGE, 2020). The prison system of the city of Recife consists of the following penitentiaries: Juiz Antônio Luis Lins de Barros Prison (PJALLB); Marcelo Francisco Araújo Aspiring Prison (PAMFA), Frei Damião de Bozzano Prison (PFDB), and the Women's Penal Colony (CPFR), better known as Bom Pastor. The system is characterized by overcrowding – the male prison complex has a theoretical capacity of approximately 1,800 inmates but houses around 7,000 people, and the Women's Penal Colony has a capacity of 150 inmates; however, at the time of data collection, there were 547 incarcerated women (Brasil, 2021).

Sample: The sample consisted of all residents and all inmates of the male penitentiaries and of the female penal colony in the city of Recife who tested positive for COVID-19. At the time of the survey, the population of each penitentiary was: PJALLB - 2481 inmates; PAMFA - 1623 inmates; PFDB - 1662 inmates, and CPFR - 547 inmates (Brasil, 2021a).

Inclusion criteria: All residents and deprived persons of both sexes diagnosed with COVID-19 between February (first case in Recife) and October 2020 were included in the study. No exclusion criteria were applied.

Data collection instrument and procedures: The data were collected directly from the database built by the Department of Planning and Management (SEPLAG) in cooperation with the Health Department (SES) and the State Information Technology Agency (ATI). The following demographic variables were extracted from the database: sex, age, race, and clinical variables including the presence of comorbidities (yes or no), severity of COVID-19 (mild and severe), hospitalization (yes or no), and disease evolution (recovered, home

treatment, in-patient treatment, ICU, and death). These data are in the public domain and are available at <https://dados.seplag.pe.gov.br/apps/corona.html>.

Data analysis and processing: Data were analyzed descriptively using absolute frequencies. Pearson's chi-square test was used to assess the association between two variables or between the two groups. Fisher's exact test was used when the condition for using the chi-square test was not given. To assess the strength of the association or difference, prevalence ratios and the respective confidence intervals were calculated. The level of significance for the statistical tests was set at 5%. Data were entered into an Excel spreadsheet and statistical analyses were performed using the IBM SPSS 25 program.

Ethical aspects: According to Resolution 466/12 of the National Health Council, this study was not sent to the Ethics Committee because secondary public data were used.

RESULTS

General Population Results: Table I shows the profile of the general population of 65,535 patients who tested positive for COVID-19 in the city of Recife. The characteristics of the prisoner population are reported in the following item. The most prevalent age group was 40 to 49 years (22.9%) and most patients (75.8%) were female and brown (44.1%). Regarding the profile of the population analyzed (Table II), 14.0% had some comorbidity; the majority of patients (97.0%) was classified as mild COVID-19 and 3.0% as severe COVID-19.

Table I. Demographic profile of the COVID-19 positive population in the city of Recife

Variable	N	%
TOTAL	65535	100,0
Age group		
0 to 9	2.244	3,4
10 to 19	2.871	4,4
20 to 29	10.428	15,9
30 to 39	14.003	21,4
40 to 49	14.999	22,9
50 to 59	11.587	17,7
60 to 69	5.612	8,6
70 to 79	2.558	3,9
80 or more	1.213	1,9
Undetermined	20	0,0
Sex		
Male	15.725	24,0
Female	49.693	75,8
Undetermined	117	0,2
Race		
White	18.158	27,7
Brown	28.924	44,1
Black	3.060	4,7
Yellow	3.350	5,1
Indigenous	84	0,1
Undetermined	11.959	18,2

Source: Author.

Two percent of the population required hospitalization, while no information was available in the database for 97.7%. Most patients (85.6%) recovered, no information on patient evolution was available for 11.9%, 1.6% died, 0.7% received home treatment, 0.6% received in-patient treatment, and 0.1% (n=9) were admitted to the ICU. Table III shows the results of comparison of demographic variables and clinical profile according to the occurrence of death.

As can be seen in the table, the percentage of patients who died ranged from 0.0% to 0.2% in the four younger age groups (0 to 9 years old, 10 to 19 years old, 20 to 29 years old, and 30 to 39 years), was 0.4% in the 40 to 49-year age group, and increased with

advancing age, reaching 26.8% in the 80 and over age group. Mortality was higher among male than female respondents (3.9% vs. 1.2%), although women more frequently fell ill. Mortality was 0.1% among patients with yellow skin color and ranged from 2.0% to 2.6% in the other races.

Table II. Clinical profile of the COVID-19 positive population in the city of Recife

Variable	N	%
TOTAL	65.535	100,0
Comorbidity		
Yes	9.157	14,0
No	530	0,8
Undetermined	55.848	85,2
COVID degree		
Serious	1.978	3,0
Slight	63.557	97,0
Hospitalização		
Yes	1.297	2,0
No	215	0,3
Undetermined	64.023	97,7
Evolution		
Recovered	56.121	85,5
Home treatment	440	0,7
Inpatient hospital treatment	398	0,6
ICU	9	0,1
Death	1.077	1,6
Undetermined	7.490	11,4

Source: Author.

It is noteworthy that there was no death among indigenous people. Deaths were more common among patients with comorbidities compared to those without comorbidities (13.0% vs. 0.5%). The mortality rate was 55.3% higher among cases with severe COVID-19 and no death occurred among cases with mild COVID-19. Deaths were much more frequent among patients who required hospitalization compared to those who did not (68.6% vs. 6.1%). Significant associations ($p < 0.001$) were found between the occurrence of death and each independent variable analyzed. Hospitalized patients were 11.2 times more likely to die from COVID-19 than non-hospitalized patients.

Comparative study of the general population and prison inmates in Recife: Table IV presents the comparative results between the groups of people residing in Recife and the 177 inmates to calculate the prevalence of COVID-19, considering data from the populations of Recife and inmates. The prevalence of COVID-19 was 4.0% among residents and 2.8% in the inmate group, a prevalence that is significant considering the size of the populations analyzed ($p < 0.001$, prevalence ratio 1.41). Table V shows the comparison of the demographic profile between the two groups. Regarding age group, the greatest difference was observed for the 20 to 29 year age group, with a higher percentage in the inmate group (38.1% vs. 15.9%), followed by the 30 to 39 year age group whose percentage was also higher in the inmate group (22.2% vs. 21.4%). The percentage of male patients was much higher among inmates than in the general population (75.1% vs. 24.0%).

The percentage of patients with comorbidities was much higher in the group of residents (94.5% vs. 15.3%). It is noteworthy that none of the inmates needed ICU treatment or died. All inmates recovered, except for two patients who received home treatment. In the group of residents, 96.7% recovered and the remaining patients died (1.9%). There were 85.8% of resident patients who required hospitalization but only 2.3% of inmates. With the exception of evolution, there are significant differences between the two groups in the other variables shown in Table V.

Table III. Assessment of the occurrence of death according to demographic and clinical profile

Variable	Death						p value	PR (CI to 95%)
	Yes		No		TOTAL			
	n	%	n	%	n	%		
Age group							$p^{(1)} < 0,001^*$	
0 to 9	3	0,2	1.505	99,8	1.508	100,0	**	
10 to 19	1	0,0	2.393	100,0	2.394	100,0	**	
20 to 29	12	0,1	9.092	99,9	9.104	100,0	**	
30 to 39	24	0,2	12.492	99,8	12.516	100,0	**	
40 to 49	57	0,4	13.655	99,6	13.712	100,0	**	
50 to 59	133	1,3	10.271	98,7	10.404	100,0	**	
60 to 69	253	5,1	4.736	94,9	4.989	100,0	**	
70 to 79	295	12,9	1.986	87,1	2.281	100,0	**	
80 or more	299	26,8	818	73,2	1.117	100,0	**	
Total Group	1.077	1,9	56.948	98,1	58.025	100,0		
Sex							$p^{(1)} < 0,001^*$	
Male	548	3,9	13.409	96,1	13.957	100,0	3,3 (2,9 to 3,7)	
Female	529	1,2	43.442	98,8	43.971	100,0	1,0	
Total Group	1.077	1,9	56.851	98,1	57.928	100,0		
Race							$p^{(1)} < 0,001^*$	
White	405	2,4	16.169	97,6	16.574	100,0	**	
Brown	537	2,0	26.198	98,0	26.735	100,0	**	
Black	72	2,6	2.750	97,4	2.822	100,0	**	
Yellow	2	0,1	3.068	99,9	3.070	100,0	**	
Indigenous	-	-	82	100,0	82	100,0	**	
Total Group	1.016	2,1	48.267	97,9	49.283	100,0		
Comorbidity							$p^{(1)} < 0,001^*$	
Yes	1.075	13,0	7.201	87,0	8.276	100,0	**	
No	2	0,5	389	99,5	391	100,0		
Total Group	1.077	12,4	7.590	87,6	8.667	100,0		
COVID degree							$p^{(1)} < 0,001^*$	
Serious	1.077	55,3	869	44,7	1.946	100,0	**	
Slight	-	-	56.099	100,0	56.099	100,0		
Grupo Total	1.077	1,9	56.968	98,1	58.045	100,0		
Hospitalization							$p^{(1)} < 0,001^*$	
Yes	881	68,6	403	31,4	1.284	100,0	11,2 (6,6 to 19,1)	
No	13	6,1	200	93,9	213	100,0	1,00	
Total Grupo	894	59,7	603	40,3	1.497	100,0		

(*) Significant association at the level of 5.0%

(**) It was not possible to determine due to the occurrence of null or very low frequencies

(1) By Pearson's chi-square test.

Source: Author.

Table IV. Percentage of patients with COVID-19 registered by group

With COVID-19	Group				Total group	P value	P value
	Resident people	Inmates					
Yes	65.535	4,0	177	2,8	65.712	4,0	$p^{(1)} < 0,001^*$
No	1.587.926	96,0	6.136	97,2	1.594.061	96,0	1,00
Population	1.653.461	100,0	6.313	100,0	1.659.773	100,0	

(*) Significant difference at the 5.0% level

(1) By Pearson's chi-square test.

Source: Author.

DISCUSSION

With the arrival of the new coronavirus pandemic in Brazil, society has been waiting for state responses that would minimize the results of the economic, political and public health crises that have taken place, including within the scope of the national penitentiary system. This system is already facing a crisis of a structural nature that results, among other factors, from the overpopulation of people deprived of liberty (Piase *et al.*, 2020). In Brazil, the health needs of people deprived of liberty are under the responsibility of the State according to the Penal Execution Law (Brasil, 1984), but policies have also been

implemented for the inclusion of the prison within SUS. In 2014, the National Policy for Comprehensive Health Care for Persons Deprived of Liberty was instituted, whose objective is centered on guaranteeing care for persons deprived of liberty at all levels of complexity, with the expansion and organization of the forms of financing the prison health teams and the main health actions for prisoners (Carvalho *et al.*, 2020). This study, the first conducted in Brazil, analyzed data on the prevalence of COVID-19 among people deprived of liberty in the city of Recife, State of Pernambuco, compared it to the prevalence of the disease in the non-incarcerated population from the same municipality. The prevalence ratio of COVID-19 was 1.41 (CI=1.23-1.66; $p < 0.001$).

The prevalence ratio as a measure of association showed a higher prevalence of the disease among residents compared to prisoners. According to Costa *et al.* (2020), there is an increased risk of disease transmission in prisons. Similarly, the United Nations Subcommittee for the Prevention of Torture issued recommendations for the protection of people deprived of their liberty during the pandemic, highlighting measures aimed at reducing the prison population. Also within the scope of the National Penitentiary System, Piasea *et al.* (2020) conducted an analysis of the legal documents edited in response to the fight against COVID-19, highlighting the regulation of Interministerial Ordinance No. 7, of March 18, 2020 (Brasil, 2020a), which, disregarding the reality of overcrowding and unhealthy conditions in national prisons, guides the penitentiary administration towards individual isolation, in the event of the identification of suspected or confirmed cases. The Ordinance states that “if isolation of suspected or confirmed cases in an individual cell is not possible, it is recommended to adopt isolation by cohort and the use of curtains or markings on the floor to delimit a minimum distance of two meters between inmates”. Examination of the COVID-19 monitoring panel in prison systems in Brazil (2021) showed a prison population of 748,009 in October 2020; of these, only 3.84% were tested for Sars-Cov-2, corresponding to a prevalence of 2.41%. In Recife, the prevalence found in this study was 2.8% among prisoners and 4.0% among residents (Table IV). Andrade (2020) highlighted that positive cases are still a gross underestimation, given the general lack of testing capability and low priority for testing prisoners, making it impossible to know the true extent of the pandemic in prisons. In Recife, no deaths from COVID-19 were recorded among inmates during the data collection period (until October 31, 2020) (Table V). On the other hand, data published by the Brazilian National Council of Justice (Brasil, 2021) show prevalence of 0.29% in the resident population and of 31.51% among prisoners.

The COVID-19 lethality among inmates was 1.72% versus 0.34% in the resident population. The rapid spread of Sars-Cov-2 across borders was first accompanied by the view that it was a “democratic virus” that “does not distinguish between rich and poor or between statesman and ordinary citizen” (Costa *et al.*, 2020). In Brazil, the democratic nature of the virus is put to the test by the observation of higher lethality rates in black and peripheral populations compared to the rest of the population. In Rio de Janeiro, in early May 2020, data revealed that the fatality rate in the Maré shantytown complex was 30.8%, while in the Leblon neighborhood it was only 2.4% (Schmidt, 2021). In fact, analysis of Table I shows that the disease affected almost 50% of brown and black people and the highest percentage of deaths occurred in the black race. Demenech *et al.* (2020) highlight that the findings regarding the association between economic inequality and infection and death from COVID-19 do not seem to be spurious and provide a plausible explanation for the differences observed in the COVID-19 pandemic among Brazilian states. Economic inequality can have a significant impact on the health of populations, in addition to the effect of poverty itself. In the case of COVID-19, this seems to have at least two distinct effects: an absolute – direct impact of income distribution on outcomes, and a contextual individual regardless of socioeconomic status who live in unequal societies end up having poorer health. In that study, the progression of COVID-19 incidence and mortality rates was more pronounced in the most unequal states, while only subtle increases occurred in the least unequal states. Jiménez *et al.* (2020) demonstrated that the rate of COVID-19 among incarcerated individuals was almost three times that of the general population of Massachusetts and five times the rate observed in the United States. Due to structural racism and the criminalization of poverty, racial/ethnic inequalities of COVID-19 can be exacerbated among incarcerated individuals. Likewise, Hawks *et al.* (2020)²² reported the first case of the new coronavirus on Riker’s Island in mid-March 2020, the main prison complex in New York City. Within 2 weeks, more than 200 cases were diagnosed within the unit, despite efforts to contain the spread. The sanitary situation in prisons around the world is chaotic and, in times of a pandemic, social distance, mask use, vaccination and personal hygiene are essential to contain the spread

of the virus. According to Carvalho *et al.* (2020), social distancing is practically impossible in correctional facilities where individuals live in confinement in overcrowded and poorly ventilated environments and share bathrooms and showers, in addition to common areas such as cafeterias, patios and classrooms. The authors highlight that inequities in the social determinants of health that affect groups that are disproportionately likely to be incarcerated – racial and sexual minorities, people with mental disorders, individuals who use psychoactive substances, and those without access to health care or education – lead to higher frequencies of some diseases in incarcerated populations. These inequalities and inequities in the social determinants of health are pointed out by Costa *et al.*, (2020) based on data from the National Penitentiary Department, with an even stronger manifestation when the numbers of contagions inside and outside the prison system are compared. In a prison population of 748,009 people, there are 4,045 confirmed cases and 59 deaths from COVID-19, showing that the incidence and mortality rates are, respectively, up to 38 times and 9 times higher than in the general population. With such numbers, Brazil ranks as the country with the fourth largest number of people deprived of liberty diagnosed with COVID-19 in the world. In this scenario, prisons operate as “powder kegs” in the unfolding pandemic; for this reason, measures of extrication are adopted around the world, supported by the WHO and the United Nations.

On the other hand, despite the overcrowding, it is necessary to discuss the social isolation imposed by the condition of incarceration. There is no single social distancing policy in Brazil, with significant variation in the degree of rigor and format of measures adopted by states and municipalities (Moraes, 2020). Taking these issues into account, several countries have adopted extrication measures, including the United States, France, Italy, Portugal, Iran, Morocco, Burkina Faso, Chile, and Colombia. Thus, in Brazil, the National Council of Justice – the largest inspection and standardization body for the Judiciary and the prison and socio-educational system – issued Resolution 62 (CNJ, 2020) on March 17, 2020. The document guides the competent courts and magistrates in adopting preventive measures against the spread of the new coronavirus in the prison and socio-educational system, including extrication (Costa *et al.*, 2020). However, if on the one hand this reduction policy allows some confined people to return to their communities and have access to community resources, which are generally of better quality than those in prisons and also reduce the population of people who remain incarcerated, allowing greater social distance and better access to the limited resources available (Henry, 2020), on the other hand, there is no possibility of supervision of these people as they remain isolated in their homes.

Therefore, the WHO (2020) has recommended that people released from prisons remain in quarantine for 14 days, and that prison health authorities provide a release plan to identify appropriate quarantine locations keeping people in follow-up care. Furthermore, it is known that most prisoners return to their communities with their illnesses, occasionally untreated and sometimes worsening. These prisoners increase the public health burden by acting as reservoirs of infection (Fazel e Baillargeon, 2011). Block *et al.* (2020) proposed simple behavioral rules that can help keep the dissemination curve flat based on three distancing and interaction strategies: looking for similarities in people (family); strengthening interactions within communities, and repeated interaction with the same people to create social bubbles. Probably, these strategies explain the low prevalence ratio of COVID-19 found in the penitentiaries of Recife – they are the same people living in the same environment, with a lack of mobility to external prison environments and the adoption of protection policies against the spread of illness by employees, such as the use of masks and 70% alcohol and personal hygiene. According to Souza (2020), the measures adopted by the Brazilian Criminal Justice System may have had an impact on reducing the epidemiological situation in terms of the risk of spreading the virus within the community of people deprived of liberty, with the benefits being extended to the entire Brazilian population.

The recommendations were divided into five interdependent categories: a) focus on recommendations for risk groups; b) reduction of prison visits; c) maintenance of social distance and/or social isolation; d) management measures; e) acting in suspected cases.

Most COVID-19 cases in Recife occurred among female residents (75.8%) and male prisoners (75.1%), with being a male prisoner increasing the chance of having the disease by 9.6 times when compared to the resident population (Tables I, III and IV). The risk of death was 3.3 times greater for male residents than for female residents. A study carried out in Ceará (Lima *et al.*, 2020) with 2259 participants highlighted that the questions asked had their answers compared between males and females and an association was observed between females as perceiving themselves at high risk of contamination ($p=0.044$) and males with non-voluntary performance of quarantine ($p<0.001$). There is still controversy regarding gender predilection of COVID-19. Chen *et al.* (2020) observed a larger number of men contaminated with COVID-19 than women. According to Gomes *et al.* (2007), within the social imaginary, man sees himself as an invulnerable being, which contributes to less care and more frequent exposure to risky situations. Comparison of the ages of the resident and prison populations infected with COVID-19 showed a statistically significant difference ($p<0.001$). In incarcerated people, the disease affected younger individuals (Table V), while among residents, the percentage of deaths increased with increasing age (Table III). In the study by Souza *et al.*, (2020) the authors highlighted that, in relation to the age structure, people over 60 years old, once infected, experience a greater risk of death. In Italy, a possible effect of age composition was observed, in which 95.3% of deaths occurred in the population aged 60 years. In Brazil, this percentage is lower (71.4%), which may be explained by the younger age structure and the comorbidity profile of the population. Contrary to mortality, only 39.2% of hospitalizations due to SARS occur in people aged 60 years and over. Comorbidities were significantly associated ($p<0.001$) with an increase in deaths from COVID-19 in the resident population (Tables III and V). Chen *et al.* (2021) demonstrated that laboratory markers at hospital admission were associated with disease severity and mortality in patients with COVID-19. Predictors of mortality from COVID-19 were different between patients with and without comorbidities. Carneiro *et al.* (2021) studied the association of prevalence of cure and death from COVID-19 with comorbidities in 46,032 patients infected with SARS-CoV-2 in Bahia. The results of the study indicated an increase in the prevalence ratio and in the odds ratio of death associated with underlying medical conditions and increasing age. On March 17, 2020, the National Council of Justice (Brasil, 2020b) published Recommendation No. 62, which suggests to the courts and magistrates the adoption of preventive measures against the spread of the new coronavirus infection within the scope of the criminal justice and socio-educational systems. For both situations, they recommend the granting of early exit from the closed and semi-open regimes, in accordance with the guidelines established by the Binding Precedent No. 56 of the Federal Supreme Court, especially in relation to the population that fits into the risk group and people imprisoned in penal establishments with occupation exceeding capacity, among other recommendations. The data from the Recife penitentiaries showed that, among suspected cases, 69.2% of the people deprived of liberty remained isolated in the prison unit itself and 30.8% stayed together in the pavilion.

According to Prando and Godoi (2020), the management of prison administration secretariats and the ways they frame the death and health of the prison population open a research agenda on how the administrative and communicational practices produce conditions of possibility for recognition or, at most, the denial of the life of this population. The pandemic takes these modes of management to an extreme point. According to Carvalho *et al.* (2020), measures to contain the pandemic adopted around the world reveal a consensus on releasing prisoners and suspending visits, but other actions are put aside, such as health education and mass tests in the prison population. Such measures could help with epidemiological projections considering that prison populations are closed and

controlled groups. The WHO (2020) recommended prioritizing the release of individuals who are part of the risk group for COVID-19 if they do not pose a danger to society. Another consensus was that the lack of available health data on this population prevents the adoption of more effective measures. This study is limited because it was based on officially reported data, which may be subject to inaccuracies and missing data; however, they were the only data available. Another limitation is related to the fact that the data were only collected from penitentiaries in the city of Recife and did not include prisons or other detention facilities, such as those for minors where an outbreak of COVID-19 may have occurred.

CONCLUSIONS

The prevalence of COVID-19 cases was low in the prison population of the city of Recife when compared to the general population, with no record of deaths in this population during the period studied.

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