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## Risk factors for *Leptospira* infection in female prison in Mato Grosso

Fatores de risco para infecção por *Leptospira* em prisão feminina Mato-Grossense

Factores de riesgo para la infección por *Leptospira* en prisión femenina Mato Grosso

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### ABSTRACT

**Introduction:** Incarcerated women are exposed to a potential environment precursor of risk for various types of illnesses, including leptospirosis. **Aim:** To identify the risk factors for *Leptospira* infection in female prison in the state of Mato Grosso (MT). **Outlining:** This is a quantitative open cohort study conducted between the years 2016, 2017 and 2018 in the Female Public Prison of a municipality in the middle-north region of MT. **Results:** Although there was no detection of seroreactivity among the incarcerated women, the profile points to young women, with a mean age of 31.45 years, brown, single, with education that did not exceed elementary school, with children and low income. Rodent contact was evidenced prior to incarceration, as well as in the prison environment by viewing the animal or its excreta, which may suggest the close and daily relationship between these women and rodents. **Implications:** The presence of the previous risk and during imprisonment reinforce the vulnerabilities to which these women are exposed from social interaction to the context of imprisonment, being fundamental propositions of health promotion and prevention of zoonoses in prisons.

### DESCRIPTORS

Prisons; Women; Zoonosis; Leptospirosis.

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## INTRODUCTION

Leptospirosis is considered an infectious zoonosis caused by the bacterium of the genus *Leptospira*, which causes global concern for the impact on public health and quality of life of the populations it affects. It is common mainly in countries with subtropical, tropical and developing climates.<sup>1</sup> Leptospirosis transmission occurs mainly through contact with infected rodents and their excreta. Brazil has a seasonality well marked by the periods of rain and floods resulting from the fragile conditions of basic sanitation and the infestation of these animals in urban environments. These factors contribute to increase the contact of the human population with the rodent with subsequent risk of infection by this group of zoonotic agents.<sup>2-4</sup>

According to data from the Ministry of Health, 3,358 new cases of leptospirosis were reported in Brazil in 2019, among which 26 were registered in the state of Mato Grosso, including three deaths.<sup>5</sup> According to a study conducted in Brazil, that same year, the leptospirosis mortality rate reached about 20%, due to non-diagnosis and early treatment of the disease.<sup>6</sup>

Some populations have additional risks of illness due to this zoonosis, due to social and demographic aspects, such as poor housing conditions, exposure to flooding, scarcity and extinction of basic sanitation, financial instability, low income and direct exposure to infected rodents, among other factors.<sup>7-9</sup>

The prison population is included in this group vulnerable to *Leptospira* illness, as well as other infectious agents. Factors related to the lack of structure and resources from the environment such as overcrowding of cells, lack of resources for proper hygiene, humidity, poor ventilation and unhealthy, favor the attraction and interaction with insects, rodents and venomous animals.<sup>10-12</sup>

Even though a large part of the prison population consists of men, currently the female public stood out for presenting annual growth of 3,7%

to 7%.<sup>13</sup> Brazil ranks fourth in the world in numbers of women in detention.<sup>14</sup> This group is generally more prone to health damage than the female population in general.

Even experiencing similar exposures to some risk factors that may impact the health-disease process, the female population deprived of liberty has greater vulnerability due to socio-cultural aspects such as the history of abuse from childhood, early pregnancy, financial deprivation and domestic violence.<sup>13,15</sup> In addition to the family frailty experienced in different life cycles, family abandonment is exposed during imprisonment, which can extend to the post-prison period.<sup>15-16</sup> Among other reasons for the increased risk of illness in incarcerated women, one can highlight the scarcity of health care, unsatisfactory hygiene situations, psychosocial vulnerability, inadequacy of female incarceration institutions, violence and poor nutrition.<sup>17</sup>

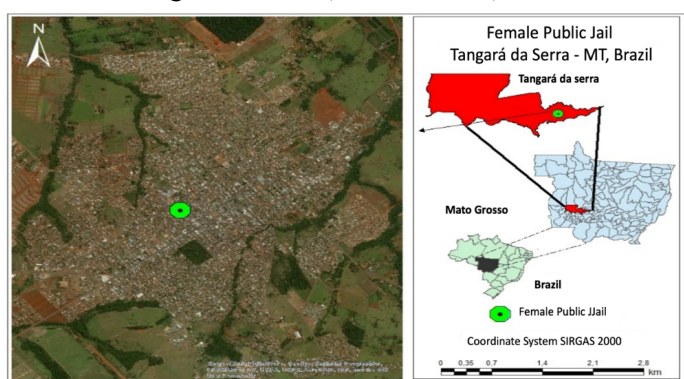
The difficulty of access to health services by these women is a challenge, since the early diagnosis and treatment of infectious diseases such as leptospirosis are generally unavailable.<sup>18</sup> When this fragility of access to health services is associated with favorable conditions for the spread and dissemination of infectious diseases present in the prison environment, it becomes fundamental to periodic active search actions in Brazilian prisons, which<sup>19</sup> as well as the use of health education actions to enable the promotion, prevention and recovery of women's health in prison.<sup>20</sup>

Looking at this scenario, the objective was to analyze the factors associated with the risk of leptospirosis in women from a female public prison in Mato Grosso. This is the first seroprevalence study for leptospirosis performed in a Mato Grosso female prison unit. There is a lack of scientific studies in Brazil that analyze the epidemiological situation of prison populations, especially those related to the Midwest region.

## METHOD

This is a quantitative and cross-sectional study, whose data collection occurred in the triennium 2016-2018. It was carried out in a female public prison in the middle-north region of Mato Grosso (Figure 1), and all women in the prison were included during the data collection period. The approach of the prison environment was chosen due to the high level of vulnerability in this environment, predisposing the life of incarcerated women to be infected by leptospirosis.

**Figure 1.** Location of the Female Public Prison in Tangará da Serra, Mato Grosso, 2019.



Source: Google Maps.

The inclusion criteria adopted were women convicted and on a provisional basis during the three years of study, while the exclusion criteria were women who received habeas corpus or were in the process of admission/ isolation on the date of data collection.

Data collection was carried out in two stages; the first occurred through interview in a reserved environment, lasting approximately 30 minutes, with the use of a standard semi-structured form, questions that addressed the variables related to the socioeconomic profile of these women, as well as the symptoms presented in the last 60 days and the risk factors for leptospirosis.

In the second stage, peripheral blood was collected, proceeding with centrifugation to obtain the serum, which was cryopreserved and transported to the National Reference Laboratory for Leptospirosis (LRNL), Oswaldo Cruz Institute in Rio de

Janeiro. Laboratory diagnosis of *Leptospira* spp. was performed from the microscopic agglutination test (MAT), gold standard method in which live *Leptospira* cultures are used, which allows the detection of antibodies in serum samples of the individual with suspicion of the disease.

MAT was performed in 134 serum samples in a two-stage procedure. Each serum was initially diluted 1/50 in saline and mixed with equal volumes of each of the 19 live cultures of *Leptospira* spp. that produce reactive results more frequently in Brazil, defined by the World Health Organization (WHO) and published in the International Leptospirosis Society Manual, 2003. The 19 serogroups and serovars of the strains used were: *Icterohaemorrhagiae*, *Copenhageni*, *Canicola*, *Grippothyphosa*, *Pomona*, *Australis*, *Bataviae*, *Castellonis*, *Cynopteri*, *Javanica*, *Panama*, *Pyrogenes*, *Hardjo*, *Sejroe*, *Patoc*, *Tarassovi*, *Autumnalis*, *Hebdomadis* and *Wolffi*. It was considered positive for those samples in which the titre of the maximum dilution of the serum was able to agglutinate about 50% of the leptospires.

Subsequently, the results were double typed and subsequently the data were compared in the Data Compare software. Then, the database was imported to STATA version 12.0 with subsequent descriptive statistical analysis and absolute and relative frequencies for sociodemographic and historical variables.

This study was approved by the Human Research Ethics Committee of the State University of Mato Grosso, under CAEE 50417815.8.0000.5166 and opinion 1,457,621/2016. All ethical aspects of research with human beings were respected, as recommended by Resolution 466/12.

## RESULTS

The sociodemographic profile of the incarcerated women in the triennium studied was mostly composed of young women, with a mean age of 31.59 in 2016, 31.28 in 2017 and 31.48 in 2018, with amplitude ranging from 18 to 61 years (Table 1).

**Table 1** - Sociodemographic profile of inmates in a prison in the mid-north region of Mato Grosso, Brazil (2016 to 2018).

Variable	N 2016	2016 (%)	N 2017	2017 (%)	N 2018	2018 (%)
<b>Age group</b>						
18-31	32	56.2	30	52.6	23	52.3
32-45	18	31.6	25	43.9	18	40.9
46-59	7	12.3	0	0	3	6.8
+ de 60	0	0	2	3.5	0	0
Total	57	100	57	100	44	100
<b>Color</b>						
White	7	12.3	6	10.5	8	18.2
Brown	42	73.7	41	72.0	32	72.7
Black	7	12.3	6	10.5	3	6.8
Yellow	1	1.8	4	7.0	1	2.3
Total	57	100	57	100	44	100
<b>Marital status</b>						
Single	27	47.4	31	54.4	16	36.4
Married	3	5.3	0	0	0	0
Stable union	17	29.8	26	45.6	27	61.4
Separated/divorced	7	12.3	0	0	0	0
Widow	3	5.3	0	0	0	0
Did not inform	0	0	0	0	1	2.3
Total	57	100	57	100	44	100
<b>Education</b>						
Illiterate	1	1.8	2	3.5	3	6.8
Elementary school	32	56.2	29	50.9	21	47.7
High school	21	36.8	18	31.6	12	27.3
College	3	5.3	8	14.0	8	18.2
Total	57	100	57	100	44	100
<b>Profession</b>						
Housekeeper	22	38.6	27	47.4	16	36.4
Saleswoman	6	10.5	6	10.5	5	11.4
Domestic employee	4	7.0	6	10.5	7	15.9
Drug dealer	3	5.3	5	8.8	8	18.2
Manicure	3	5.3	1	1.8	1	2.3
Hairdresser	3	5.3	1	1.8	0	0
Cooker	3	5.3	3	5.3	0	0
Own account worker	2	3.6	2	3.5	1	2.3
Sex worker	2	3.6	2	3.5	2	4.5
General servant	2	3.6	0	0	0	0
Others	7	12.3	4	7.0	4	9.1
Total	57	100	57	100	44	100

Source: Direct search.

There was a predominance of brown color in the three years analyzed, with 73.7%, 72.0% and 72.7%, respectively. Regarding marital status, single women prevailed in 2016 (47.4%) and 2017 (54.4%) and those living with a partner (a) in 2018 (61.4%). The number of children varied, two in 2016 (24.6%) and 2017 (29.3%) and three in 2018 (29.5%). In terms of education, he highlighted the elementary level in 2016 (56.2%), 2017 (50.9%) and 2018 (47.7%). Regarding the variable professional activity, work in

the home had a higher prevalence in all years, ranging from 36.4% to 38.6%.

Regarding the history of a clinical picture compatible with leptospirosis, nonspecific clinical manifestations were reported, with headache in 68.4% (2016), 66.7% (2017) and 63.4% (2018), myalgia in 49.1% (2016), 52.2% (2018), vomiting in 79.0% (2016), 7.2% (2018) and fever in 24.5% (2016), 22.8% (2017) and 27.2% (2018) (Table 2).

**Table 2** - Symptomatology and risk factors for Leptospirosis in inmates from a prison in the mid-north region of Mato Grosso, Brazil (2016 to 2018).

Variables	2016 N	2016 (%)	2017 N	2017 (%)	2018 N	2018 (%)
<b>Signs and symptoms of the last 60 days</b>						
Fever	14	24.5	13	22.8	12	27.2
Headache	39	68.4	38	66.7	28	63.4
Myalgia	28	49.1	28	49.1	23	52.2
Vomiting	12	79.0	04	7.0	09	20.4
<b>Rodent contact prior to incarceration</b>						
Contact with rodent in jail	48	84.2	36	63.1	30	68.1
Contact with rodent excreta in jail	09	15.8	08	14.0	06	13.7
<b>Experienced flooding or contact with contaminated water before incarceration</b>						
Knowledge about Leptospirosis	12	21.0	12	21.0	09	20.4
<b>Total</b>	<b>57</b>	<b>100</b>	<b>42</b>	<b>100</b>	<b>35</b>	<b>100</b>

Source: Direct search.

Regarding exposure to risk factors, contact with some type of rodent was identified prior to incarceration, at 80.7%, 72.0% and 20.5% in 2016, 2017 and 2018, respectively. In the prison environment this contact was maintained, either through the visualization of the animal (2016, 84.2%; 2017, 63.1% and 2018, 68.1%) or its excreta 2016 (15.8%), 2017 (14.0%) and 2018 (13.7%). Regarding knowledge about leptospirosis there was a variation, since in 2016 and 2018 most women reported knowing the disease (73.7% and 77.2%), while in 2017, only 36.9% pointed to knowledge of the pathology.

There was no detection of seroreactivity in the incarcerated women during the period studied, but due to the high index of risk factors for leptospirosis infection it is of fundamental importance to disclose the results of this study.

## DISCUSSION

The absence of seroreactivity for leptospirosis detected in this female prison of Mato Grosso reflects, in general, the epidemiological profile of this zoonosis in Brazil where the highest number of cases occurs in the southern and southeastern regions, predominantly affecting men aged 20 to 49 years. In fact, of the total of 3060, 3000 and 3067 cases of leptospirosis reported in Brazil in the years

2016, 2017 and 2018, respectively, an average of 65 cases in the Midwest region and 12 cases per year in the state of Mato Grosso in the three years included in the study was confirmed. However, considering the identification of risk factors for leptospirosis in the female prison group, it is necessary a permanent surveillance, as also described in a study developed in Palermo - Italy.<sup>21</sup> Even in the absence of immunological memory in this population, it is essential to maintain actions for health promotion in the prison environment. This can be intensified with the analysis of the socioeconomic profile of the incarcerated women, since these findings are similar to the results of national and international studies covering cases of leptospirosis.<sup>22-26</sup>

Regarding the sociodemographic data, the profile of the incarcerated women even without seroreactivity was compared to the profile of other populations with evidence of infection by *Leptospira* spp., Thus, it was observed that the prevalence of the productive age group found in this study coincides with a study that describes reported cases of leptospirosis in a municipality in the northern region of Brazil.<sup>27</sup> Data of this nature, similar to those of this study, were evidenced in other national studies, including the predominance of brown skin color,<sup>28</sup> basic schooling<sup>29</sup> and low income.<sup>30</sup> In a descriptive

analysis of leptospirosis cases in Santa Catarina pointed to the prevalence of infection in males, reaching the percentage of 87.3% of cases, in line with data from the Ministry of Health.<sup>31</sup>

Regarding the higher prevalence of *Leptospira* infection in the male population, it can be justified due to the risky work activities they perform, when compared to the most frequent professional occupations performed by the female population.<sup>28,32</sup> Other authors also highlight the hypothesis of the occurrence of milder cases of leptospirosis in women, diverting attention from health surveillance services to more serious cases, which can lead to underreporting and, consequently, a drop in detection of the infection in this public.<sup>33,31</sup> Therefore, in the prison environment, the risk is common for both sexes, since the precariousness of the environment and coexistence with rodents is a reality throughout the national scenario.

The milder cases of leptospirosis involve nonspecific clinical manifestations such as headache, emesis, myalgia and pyrexia.<sup>34</sup> This symptomatology was reported by the participants of this study, with an average of the studied triennium of headache in 66.1%, vomiting in 35.4%, myalgia in 50.1% and pyrexia in 24.8%. However, due to the non-detection of seroreactive agents, it is understood that these symptoms may be related to other febrile and acute infections endemic in the region, such as dengue, Zika, chikungunya, malaria and hantavirus. In addition to the inespecificity of this condition, the asymptomatic clinical form of leptospirosis should be considered, alerting to differential diagnoses and careful and continuous investigation in order to favor the recovery of the individual.<sup>35-36</sup>

The investigation of leptospirosis should encompass both clinical and epidemiological characteristics. In this sense, it was found a significant percentage of women who had contact with the rodent or its excreta, either previously or during incarceration. This finding was also identified in a descriptive study conducted in southern Brazil,

where 46.9% of participants reported direct contact with the rodent and 55.8% stated exposure to environments with signs of rodent circulation.<sup>9</sup> Another relevant data pointed out by the incarcerated women, was the experience of flooding situations or contact with contaminated water, which can increase the risk of contagion by the disease.

The survival period of *Leptospira* spp. is directly linked to the humidity of the environment, where flooding cases corroborate the occurrence of this infection.<sup>37</sup> A review of the main epidemiological studies on leptospirosis also found the high risk of contagion in rainy periods and flooded areas.<sup>38</sup> The lack of basic sanitation is another aggravating factor, as it contributes to the use of contaminated water and exposure to waste from the lack or fragility of the sewage system, whether in prison or in the experiences that preceded it.<sup>39</sup> Contact with contaminated water also was described as a risk factor for leptospirosis in the United States, directing to the relevance of interdisciplinary actions that include the implementation of sanitary and health public policies.<sup>40</sup>

Incarcerated women do not have knowledge about various aspects of health, including some common health problems that can be acquired in the prison environment, thus, it is necessary to develop strategies that reduce this impact by health professionals. The health education activities carried out by the university in the prison environment favored the acquisition of knowledge related to this infection, which may have contributed to the identification of risk factors and, consequently, the adoption of preventive strategies. In this sense, the need for articulation between teaching and service as a facilitating resource for the control of the transmission of diseases among vulnerable populations is reinforced.<sup>41-44</sup> The results of this study highlight the importance of dialoguing about this infectious disease, model for others considered endemic, so that there is the promotion of the quality of life of this population. In Brazil, there is

still no immunization against leptospirosis, in this sense, the best way to prevent the disease are prevention and education actions aimed at reducing risk factors and behaviors that can potentiate the infection.<sup>45,35</sup>

Given the above, it is essential to contribute to the proposal of health promotion and prevention of zoonosis in prisons in order to increase health status and minimize the risks of illness. In addition, for suspected cases, the local epidemiological surveillance service should be notified so that measures of monitoring and assertive intervention are adopted.<sup>46</sup> Leptospirosis is a health problem in chains that can become endemic due to rainy seasons, infrastructure, becoming a complication for the fragile health system that serves these populations.<sup>47,44</sup>

## CONCLUSION

The analysis of this study with the women from the penitentiary system provided the consecutive observation of unspecific symptoms that could indicate leptospirosis, the presence of risk factors that may increase the chance of infection by *Leptospira* spp. in the prison environment.

The pioneering nature of this study in Mato Grosso prisons should be highlighted, because when

describing the presence of risk factors for leptospirosis illness in the female prison system, the absence of seroreactive women for this disease in addition to pointing to the absence of infected rodents in the chain, put in evidence the vulnerability of the detainees to situations of risk during floods. The limitation of this study may be associated with the lack of investigation regarding rodent infection in the prison environment, as well as the risk of false negatives in laboratory tests.

It is suggested that new research aimed at this population be developed, focusing on the reduction of risk factors and timely surveillance of suspected cases, as well as capture of rodents in a prison environment, ensuring a better quality of life for all incarcerated women.

Finally, even in the absence of seroreactivity in the samples of the women from the MT prison system, in the period of investigation, it is possible to reinforce the importance of developing actions to combat various infectious diseases. Thus, health actions and investigations of contact with factors favorable to leptospirosis, should be performed routinely to provide minimization of the inherent risks of prison.

## RESUMO

**Introdução:** As mulheres em situação de cárcere estão expostas a um ambiente potencial precursor de risco para diversos tipos de adoecimentos, incluindo a leptospirose. **Objetivo:** Identificar os fatores de riscos para infecção por *Leptospira* em prisão feminina no estado de Mato Grosso (MT). **Delineamento:** Trata-se de um estudo de coorte aberta quantitativo realizado entre os anos de 2016, 2017 e 2018 na Cadeia Pública Feminina de um município da região médio-norte de MT. **Resultados:** Mesmo não havendo detecção de sororreatividade entre as reeducandas, o perfil aponta para mulheres jovens, com média da idade de 31,45 anos, de cor parda, solteiras, com escolaridade que não superou o ensino fundamental, com filhos e de baixa renda. Foi evidenciado contato com roedor previamente ao encarceramento, bem como no ambiente prisional pela visualização do animal ou de suas excretas, o que pode sugerir a relação próxima e cotidiana entre essas mulheres e roedores. **Implicações:** A presença do risco anterior e durante o cárcere reforçam as vulnerabilidades a que essas mulheres são expostas desde o convívio social até no âmbito da reclusão, sendo então fundamentais proposições de medidas de promoção da saúde e prevenção das zoonoses nas prisões.

## DESCRIPTORIOS

Prisões; Mulheres; Zoonoses; Leptospirose.

## RESUMEN

**Introducción:** Las mujeres en situación de cárcel están expuestas a un entorno potencial precursor de riesgo para diversos tipos de enfermedades, incluida la leptospirosis. **Objetivo:** Identificar los factores de riesgo para infección por *Leptospira* en prisión femenina en el estado de Mato Grosso (MT). **Delineación:** Se trata de un estudio de cohorte abierta cuantitativo realizado entre los años de 2016, 2017 y 2018 en la Cadena Pública Femenina de un municipio de la región medio-norte de MT. **Resultados:** Aunque no haya detección de sororreactividad entre las reeducandas, el perfil apunta para mujeres jóvenes, con media de la edad de 31,45 años, de color parda, solteras, con escolaridad que no superó la enseñanza fundamental, con hijos y de baja renta. Fue evidenciado contacto con roedor previamente al encarcelamiento, así como en el ambiente carcelario por la visualización del animal o de sus excretas, lo que puede sugerir la relación cercana y cotidiana entre esas mujeres y roedores. **Implicaciones:** La presencia del riesgo anterior y durante la cárcel refuerzan las vulnerabilidades a las que estas mujeres son expuestas desde la convivencia social hasta en el ámbito de la reclusión, siendo entonces fundamentales proposiciones de medidas de promoción de la salud y prevención de las zoonosis en las prisiones.

## DESCRIPTORES

Prisiones; Mujeres; Zoonosis; Leptospirosis.

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#### COLLABORATIONS

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Not applicable.

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#### CONFLICTS OF INTEREST

There are no conflicts of interest to declare.