

## High incidence of acute Q fever among incarcerated people in Cayenne, French Guiana

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### ABSTRACT

Q fever is a major public health problem in French Guiana. In recent years, a considerable number of cases has been reported in French Guiana's penitentiary center. The main objective of this study was to describe the epidemiology of these cases. A retrospective study was conducted at the prison to identify cases of acute Q fever in people incarcerated between 2010 and 2021. During the study period, 16 patients were diagnosed with acute Q fever. The positivity rate varied between 13 and 57%. The annual incidence rate in 2019, 2020 and 2021 was 269 (95% CI: 0-640) 1,120 (95% CI: 290-1950) and 1,931 (95% CI: 60-3810) per 100,000 person-years, respectively. While several vertebrate species have already been shown to play an important role in the transmission of *Coxiella burnetii*, the full epidemiology picture in the tropics is far from clear, and the prison context, with its controlled environment, could help provide answers.

**KEYWORDS:** Q fever. Zoonotic diseases. Prison. Inmates. French Guiana.

### INTRODUCTION

Q fever is a ubiquitous zoonotic disease caused by the intracellular bacterium *Coxiella burnetii*. In French Guiana (FG), a French territory located on the Northern coast of South America, in the Amazon region, more than 90% of the cases present pulmonary infection as the main symptom, accounting for 24 to 38% of the pneumonia cases registered in Cayenne's hospitals, its main city<sup>1,2</sup>. It is the territory with the highest known incidence of Q fever in the world, with a stable annual average incidence rate of 37 cases per 100,000 inhabitants, compared to 0.32 to 0.58 cases per 100,000 inhabitants in metropolitan France<sup>3</sup>. Over the last two years, an increase in the number of acute Q fever cases has been observed in FG's penitentiary center. The main objective of this study was to describe these cases' epidemiology.

### MATERIALS AND METHODS

A retrospective study was conducted in FG's only penitentiary center to identify cases of acute Q fever in people incarcerated between 2010 and 2021. The penitentiary is located on the forested outskirts of the greater Cayenne area. A case was considered confirmed acute Q fever when there was an association of fever with respiratory signs and anti-*C. burnetii* antibodies seroconversion, with a 4-fold increase in phase II antibody titers. A case was considered probable acute Q fever

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when there was an association of fever with respiratory signs and, in cases where the day zero sample was not available (first serology was performed too late), and a serum sample of phase II antibody titers present IgG titers  $\geq 1:200$  and IgM titers  $\geq 1:50$ . Serodiagnosis of Q fever was performed using IgG and IgM antibodies against *C. burnetii* during phase II (acute infection) by means of an indirect immunofluorescence assay. Exclusion of *Streptococcus pneumoniae*, *Legionella spp*, *Mycoplasma pneumoniae*, *Chlamydia psittaci*, and *Chlamydia pneumoniae* as etiologic agents was performed at the clinician's discretion. All Q fever serological tests were performed at the Pasteur Institute in Cayenne. The length of incarceration and the number of inmates per year were used to calculate the incidence rate. The study was conducted retrospectively and anonymously based on medical charts of the penitentiary center without outsourcing the data. The study followed the recommendations of the CNIL (Commission Nationale de l'Informatique et des Libertés) and was classified as an internal research. Collection information forms were provided to the patients, and the study was declared to the Data Protection Officer according to the European General Data Protection Regulation.

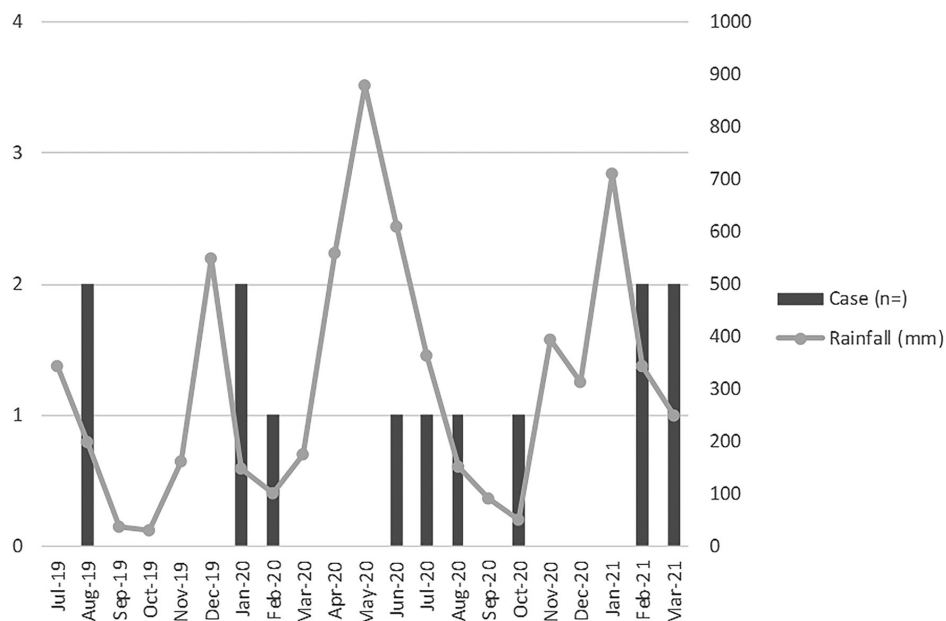
## RESULTS

Over the study period, 16 patients were diagnosed with acute Q fever, 13 as confirmed cases and three as probable cases (due to late collection of samples). Between 2010 and 2019, only five cases were identified, compared to the 11 cases diagnosed between January 2020 and March

2021. Most cases appeared to occur at the end of the rainy season (Figure 1). The median age of the affected inmates was 39 years (IQR 34-43) and 34 years (IQR 27-42) for all inmates. All cases were male, and 37.5% had at least one comorbidity. One patient had an HIV infection and two had chronic hepatitis B infection. The clinical presentation of the infection was typical, with a high fever and pulmonary manifestations. Most patients (94%) were treated with amoxicillin and doxycycline. Fifteen out of 16 patients (94%) had a chest x-ray, among whom, 14 (87.5%) had a radiological confirmation of infection. All patients were incarcerated for at least two months prior to symptom onset with a mean incarceration time of 17 months (min-max: 2-80), confirming that the infection was acquired in the penitentiary center. The number of serologies performed at the health unit varied by year, ranging from one in 2014 to 19 in 2020. The positivity rate varied between 13 and 57%. There were no chronic Q fever infections detected in the initial serology (all of the initial phase I IgG values were below 50). Between 2011 and 2021, the number of detention years ranged from 625 to 909. Consequently, the annual incidence rate in 2019, 2020 and 2021 was 269 (95% CI: 0-640), 1,120 (95% CI: 290-1,950) and 1,931 (95% CI: 60-3,810) per 100,000 person-years, respectively (Table 1).

## DISCUSSION

The clinical presentation of acute Q fever cases diagnosed at FG's penitentiary center was typical and similar to cases described in other environments<sup>4</sup>. As reported in the literature, the cases seemed to be associated



**Figure 1** - Cases of acute Q fever in the penitentiary center of Cayenne between 2019 and 2021 (n = 13), and monthly rainfall (in mm).

**Table 1** - Number of days and years of detention, incidence rate of acute Q fever cases in Cayenne's penitentiary center between 2011 and 2021.

Years	Detention years	Acute Q fever cases	Incidence (per 100,000 persons-years)	95% Confidence interval	Number of serologies performed	Positivity rate (%)
2011	648	0	0	-	2	0
2012	651	0	0	-	3	0
2013	708	1	141	(0-420)	8	13
2014	727	0	0	-	1	0
2015	751	1	133	(0-390)	6	17
2016	909	1	110	(0-330)	3	33
2017	863	0	0	-	3	0
2018	828	0	0	-	2	0
2019	742	2	269	(0-640)	4	50
2020	625	7	1,120	(290-1,950)	19	37
2021 (First quarter)	207	4	1,931	(60-3,810)	7	57

with the end of the rainy season<sup>5</sup>. While few studies have described cases of Q fever in prisons, the disease onset reported in those studies was typically a one-time epidemic event associated with the passage of cattle in the prison's surroundings, as opposed to the endemic form described in our environment<sup>6,7</sup>.

The incidence rate in the penitentiary center in 2020 was up to 30 times higher than that of FG, which is already the highest in the world<sup>3</sup>. Although the incidence rate is unreliable given the numbers involved, the reason for this very high incidence is still unclear. One possible explanation for the increase in the incidence rate of Q fever cases over recent years might be a more systematic search for Q fever, reflecting the caregivers' awareness of the symptoms of the disease, as illustrated by the higher number of serodiagnosis requested in 2020 (19 versus four in the previous year). Alternatively, the increment may actually reflect environmental changes within the facility.

Several limitations can be cited, including the small number of patients and the retrospective nature of the study. However, the main objective of this study was to highlight an important public health problem for the Guyanese and possibly in the Amazonian context. The closed environment of the prison could help solve some problems.

While the source of the contamination remains unknown, all patients were definitely infected in prison. Unlike other countries, the reservoir of Q fever bacteria in FG does not seem to be the cattle, but rather the wildlife animals such as three-toed sloth - *Bradypus tridactylus*), capybara (*Hydrochoerus hydrochaeris*), wild suidae (white-lipped peccary - *Tayassu pecari*), and collared peccary (*Pecari tajacu*) or even domesticated dogs<sup>8-10</sup>. Nevertheless, there

might be a potential reservoir in prison, which seasonally hosts several thousand swallows (mainly grey-breasted martin - *Prognechalybea*) and where rats (*Rattus rattus* and/or *Rattus norvegicus*) are regularly seen. It is also possible that the source of the contamination lies within the particles carried by the wind since the prison is exposed to Northeast and East winds coming from the nearby rainforest.

## CONCLUSION

French Guiana has one of the highest incidences of acute Q fever in the world. It seems that the prison is not spared, despite its environmental and human isolation. Long-term prospective studies are needed to elucidate the source of contamination of inmates and to better clarify the epidemiological cycle of Q fever in FG, which remains mysterious.

## CONFLICT OF INTERESTS

The authors declare no competing interests.

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