



# Descriptive epidemiology of suicide attempts and suicide in the remote villages of French Guiana

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## Abstract

**Objective** The overall rate of suicide in French Guiana is estimated at 6 per 100,000, a rate that is lower than in mainland France. Given the frequent reports of suicide in Amerindian communities, our hypothesis was that this figure fails to capture a more contrasted reality. Our objective was to refine estimates and determine suicide rates in remote villages of French Guiana.

**Methods** We included patients for whom a suicide attempt or suicide was mentioned in medical records. The Health centers were grouped into two zones according to geographical remoteness.

**Results** The highest suicide rates observed in the remote Amerindian villages of Camopi and Trois Sauts were, respectively, 118 and 78/100,000. The median age at the time of suicide was significantly younger in remote zones [23 years (95% CI 21.59–25.06)] than in non-remote zones—[27 years (95% CI 24.47–29.31)]. The most frequent methods were hanging (78%) and intoxication (22%).

**Conclusions** The suicide rate in remote areas in French Guiana was eight times higher than in France. The suicide of young people in remote areas in French Guiana and specifically in Amerindian villages must be better understood and prevented with contextualized and adapted care.

**Keywords** Suicide · French Guiana · Isolation · Amerindians · Maroons

## Introduction

In 2012, there were an estimated 800,000 suicides worldwide, which corresponds to 11.4 suicide deaths per 100,000 population (15 among men and 8 among women) [1].

In mainland France, the National Suicide Observatory estimated that there were 12,000 suicides per year (16 per

100,000 in 2012). The most at-risk populations were men aged 45–54 years and > 75 years [2, 3].

French Guiana does not have any suicide registry. Suicide data obtained from death certificates compiled by the CEPIDC estimates the suicide incidence in 2014 at 15 for 252,338 which represents a rate of 6 per 100,000.

Patient management in French Guiana mostly relies on the three hospitals located along the coastal area, in Cayenne, Saint Laurent du Maroni, and Kourou. Outside of these areas, patient care rests on a network of health centers [Centres Délocalisés de Prévention et de Soins (CDPS)]. Some of these health centers are located in the coastal area, where 80% of the population resides, and are connected by road [4]. The others deliver care for the remaining 20% of the population, and they are only accessible by canoe or by air. Thus, the most severe cases lead to emergency medical evacuations by helicopter mostly towards the main regional hospital in Cayenne.

In France, death is pronounced by a doctor which is problematic in the remote villages in French Guiana, where doctors are not always present; in addition, early burials without

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soliciting the help of health professionals lead to an under-reporting of suicide cases.

Published data on suicide in French Guiana are scarce and mostly mention Amerindian territories for which there are actually few reliable data to estimate the magnitude of the problem [5–7].

Autochthonous populations living in the interior of French Guiana are concentrated along the Maroni (Antecum Pata and Talhuen) and Oyapock (Camopi and Trois-Sauts) rivers. The Amerindian population in these areas is estimated at 2700 persons, whereas for all of French Guiana it is around 10,000 [8].

In the absence of objective data on a phenomenon that is highly reported in the media, the main objective of the present study was to describe the epidemiology of suicide and suicide attempts in the remote health centers of French Guiana between 2007 and 2016.

## Materials and methods

A retrospective observational study was conducted using data from the health centers' network's information system and Cayenne hospital emergency department's medical records between 2007 and 2016.

Our definition of suicide was based on the 2014 WHO report "the term suicide refers to the act of killing oneself", suicide attempts "the term suicide attempt refers to any non lethal suicidal behavior, and to self-intoxication, self mutilation, self-aggression with or without the intention to die" [1]. However, in an Amazonian context where accidents are frequent, we only considered cases where the intent of attempting to harm one's life was explicit.

### Inclusion criteria

Cases were compiled from the health centers' information system and from the medical records at the emergency department for patients who were not in the health centers' database and benefitted from medical evacuation towards Cayenne.

Cases were selected using the tenth international classification of diseases ICD10 coding for self-intoxication, or self-inflicted injury. Some cases for which only a suicide attempt (intentional self-injury or intoxication with a notion of lethal intent) was specified in the medical record were retained.

Cases were classified as intoxications when the following main diagnoses were coded: X40, X60, X61, X62, X69 and X84 or as injuries when the consultation diagnosis was: W33, X70, X71, X72–X73, X74, X78 and X84. These codes were used as main diagnosis in the health centers' information system because it is not integrated

in the hospital's French standardized information system (PMSI) that would not allow for it. Some of these codes are not related to suicide but they were part of the first data queries to verify if there was any lethal intention in the records, in which case the patient was excluded. The aim of this was to avoid missing suicides that would have been mistakenly coded as intoxications.

### Exclusion criteria

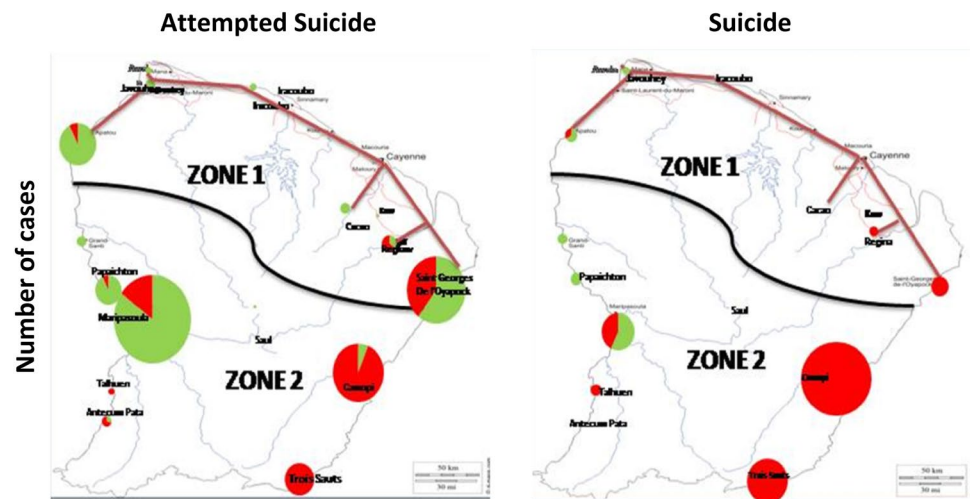
Self-intoxications among children less than 10 years, and self-intoxications among adults without confirmation in the medical records were excluded from the study.

In zone 1, the coastal area, it is possible (although very rare especially for a severe psychiatric or organic problem) that a few patients may directly reach the hospital without first being seen by a doctor in the health center. However, in Kourou and Saint Laurent, the emergency ward medical records are not computerized and were not accessible, they were available in Cayenne where, in the 10-year study period, three suicide attempts and zero suicides came directly to the hospital without first going through a health center. Given the heterogeneity in data collection introduced by the absence of data from Kourou and Saint Laurent Emergency wards, we decided to adopt a uniform criterion, which seemed more rigorous. Suicide attempts for which patients went directly to the hospital without first going to the local health center were thus excluded. This possibility only concerned zone 1. In zone 2, corresponding to the most remote areas, all suicide attempts must go through the health center. Only suicide attempts, for which there was an intervention of the local medical team were counted. All suicide attempts that were reported a posteriori for which there was no health center solicitation were excluded.

### Grouping of health centers

Health centers connected to the road system are located in zone 1 which included the health centers of Apatou, Awala, Javouhey, Iracoubo, Cacao, Regina and St Georges. The total population for zone 1 according to the 2011 census was estimated to be 18,122 inhabitants. Zone 2, for which access is only possible by canoe or by air (plane/helicopter) includes the health centers of Camopi and TroisSauts on the Oyapock, and the health centers of Grand Santi, Papaïchton, Maripasoula, Talhuen and Antecum Pata on the Maroni, and finally, Kaw and Saul in central French Guiana. The population of zone 2 is estimated to be 22,719 inhabitants [9] (Fig. 1).

**Fig. 1** Number of cases of suicides and suicide attempts by location in French Guiana, 2007–2016



## Statistical analysis

First, a descriptive analysis was performed on the data from the interior of French Guiana. Then, suicide numbers and suicide attempts in zone 1 and zone 2 were compared. Chi squared or Fisher's exact test were used where appropriate. The rank-sum test was used to compare non-normally distributed variables. Suicide rates were obtained by dividing the number of suicide cases by the population size as estimated during the 2011 census. The data was analyzed using STATA 13 (Stata Statistical Software Release 13. College Station, TX, USA: Stata Corp LP.).

## Results

### Suicide attempts' numbers and rates

Between 2007 and 2016, 236 suicide attempts were tallied, which corresponds to a yearly suicide attempt rate of 58 per 100,000.

In zone 1, there were 84 known suicide attempts and in zone 2 there were 152, which yields an annual average incidence rate of 46 and 67 per 100,000, respectively (Table 1).

The highest suicide attempt rates were localized in zone 2 notably in Trois Sauts and Camopi on the Oyapock river. In the Amerindian territories on the Maroni, the rates are also high (Figs. 1, 2, 3).

### Number and rate of suicide attempts according to age and sex

The sex ratio was 0.46 (75 men and 161 women) with no significant difference between zones. The youngest patient was 10 years old, and the oldest was 86 years.

The median age at the time of suicide attempts was significantly younger in zone 2 than in zone 1, 23 versus 27 years ( $p=0.0087$ ) (Table 1).

The 10–19-year-olds represented 41% of cases. When considering the 10–29-year-old group, it represented 75% of cases (Fig. 3).

### Suicide attempt method by sex and area of residence

Suicide attempts in women mostly consisted of intoxications (which could consist of different products or medications), while men were twice less likely to use this method (Table 2).

Among women, suicide attempt methods were significantly different between zone 1 and 2, with a greater proportion of hangings in zone 2, notably in Camopi, Trois Sauts, Antecum Pata and Talhuen which concentrated 88% of hanging attempts of women in zone 2, on par with males (Table 2).

Among men, suicide attempts mostly corresponded to hangings.

It was noteworthy that in Maripasoula, 50% of suicides corresponded to paraquat intoxications (Fig. 3).

**Table 1** Comparison of suicide attempts and suicides by area in the health centers: French Guiana 2007–2016

	Suicide attempt												Suicides																			
	Zone 1				Zone 2				Statistic				Total				Zone 1				Zone 2				Statistic				Total			
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%		
n	84	35.6	152	64.4	236	–	7	18.9	30	81.1	37	–	7	18.9	30	81.1	37	–	7	18.9	30	81.1	37	–	7	18.9	30	81.1	37	–		
Rate (/100,000/year)	46		67		58		4		13		9		4		13		9		4		13		9		4		13		9			
n inhabitants	17,973		22,721		40,694		17,973		22,721		40,694		17,973		22,721		40,694		17,973		22,721		40,694		17,973		22,721		40,694			
Sex																																
Men	26	21.8	49	31.8	75	31.8	4	57.1	20	66.7	24	64.9	4	57.1	20	66.7	24	64.9	4	57.1	20	66.7	24	64.9	4	57.1	20	66.7	24	64.9		
Women	58	69.0	103	68.2	161	68.2	3	42.9	10	33.3	13	35.1	3	42.9	10	33.3	13	35.1	3	42.9	10	33.3	13	35.1	3	42.9	10	33.3	13	35.1		
Sex ratio M/W	0.4	0.5			0.5		1.3		2.0				1.3		2.0				1.3		2.0				1.3		2.0					
Age																																
Median age	26.89	23.33			24.59	23.33	32.6	23.85			25.51	23.85	32.6	23.85			25.51	23.85	32.6	23.85			25.51	23.85	32.6	23.85			25.51	23.85		
95% CI	(24.47–29.31)	(21.59–25.06)			(23.18–26.01)	(21.59–25.06)	(27.24–37.97)	(19.49–28.22)			(21.74–29.28)	(19.49–28.22)	(27.24–37.97)	(19.49–28.22)			(21.74–29.28)	(19.49–28.22)	(27.24–37.97)	(19.49–28.22)			(21.74–29.28)	(19.49–28.22)	(27.24–37.97)	(19.49–28.22)			(21.74–29.28)	(19.49–28.22)		
Min	10	11			10	11	23	13			13	13	23	13			13	13	23	13			13	13	23	13			13	13		
Max	57	86			86	86	38	61			61	61	38	61			61	61	38	61			61	61	38	61			61	61		
Age group (years)																																
10–19	25	29.8	72	47.4	97	47.4	0	0.0	17	56.7	17	45.9	0	0.0	17	56.7	17	45.9	0	0.0	17	56.7	17	45.9	0	0.0	17	56.7	17	45.9		
20–29	30	35.7	50	32.9	80	32.9	2	28.6	5	16.7	7	18.9	2	28.6	5	16.7	7	18.9	2	28.6	5	16.7	7	18.9	2	28.6	5	16.7	7	18.9		
30–39	17	20.2	18	11.8	35	11.8	5	71.4	5	16.7	10	27.0	5	71.4	5	16.7	10	27.0	5	71.4	5	16.7	10	27.0	5	71.4	5	16.7	10	27.0		
40–49	7	8.3	7	4.6	14	4.6	0	0.0	1	3.3	1	2.7	0	0.0	1	3.3	1	2.7	0	0.0	1	3.3	1	2.7	0	0.0	1	3.3	1	2.7		
50–59	5	6.0	4	2.6	9	2.6	0	0.0	1	3.3	1	2.7	0	0.0	1	3.3	1	2.7	0	0.0	1	3.3	1	2.7	0	0.0	1	3.3	1	2.7		
> 59	0	0.0	1	0.7	1	0.7	0	0.0	1	3.3	1	2.7	0	0.0	1	3.3	1	2.7	0	0.0	1	3.3	1	2.7	0	0.0	1	3.3	1	2.7		
Method	84	152			236	100.0																										
Intoxication	61	74.4	82	55.0	143	60.6	2	28.6	6	20.0	8	21.6	2	28.6	6	20.0	8	21.6	2	28.6	6	20.0	8	21.6	2	28.6	6	20.0	8	21.6		
Lesion	21	25.6	67	45.0	88	37.3	5	71.4	24	80.0	29	78.4	5	71.4	24	80.0	29	78.4	5	71.4	24	80.0	29	78.4	5	71.4	24	80.0	29	78.4		
Rope	13	15.9	55	36.9	68	28.8	5	71.4	19	63.3	24	64.9	5	71.4	19	63.3	24	64.9	5	71.4	19	63.3	24	64.9	5	71.4	19	63.3	24	64.9		
Household chemical products	19	23.2	33	22.1	52	22.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0		
Medications	30	36.6	21	14.1	51	21.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0		
Pesticide <sup>a</sup>	12	14.6	24	16.1	36	15.3	2	28.6	6	20.0	8	21.6	2	28.6	6	20.0	8	21.6	2	28.6	6	20.0	8	21.6	2	28.6	6	20.0	8	21.6		
Gun/rifle	2	2.4	6	4.0	8	3.4	0	0.0	5	16.7	5	13.5	0	0.0	5	16.7	5	13.5	0	0.0	5	16.7	5	13.5	0	0.0	5	16.7	5	13.5		
Phlebotomy	3	3.7	4	2.7	7	3.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0		
Missing	2	2.4	4	2.7	6	2.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0		
Other intoxication	1	1.2	3	2.0	4	1.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0		
Burn	2	2.4	0	0.0	2	0.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0		
Drowning	0	0.0	2	1.3	2	0.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0		

<sup>a</sup>Pesticides included paraquat, malathion, or diazinon (for suicides only paraquat was used)

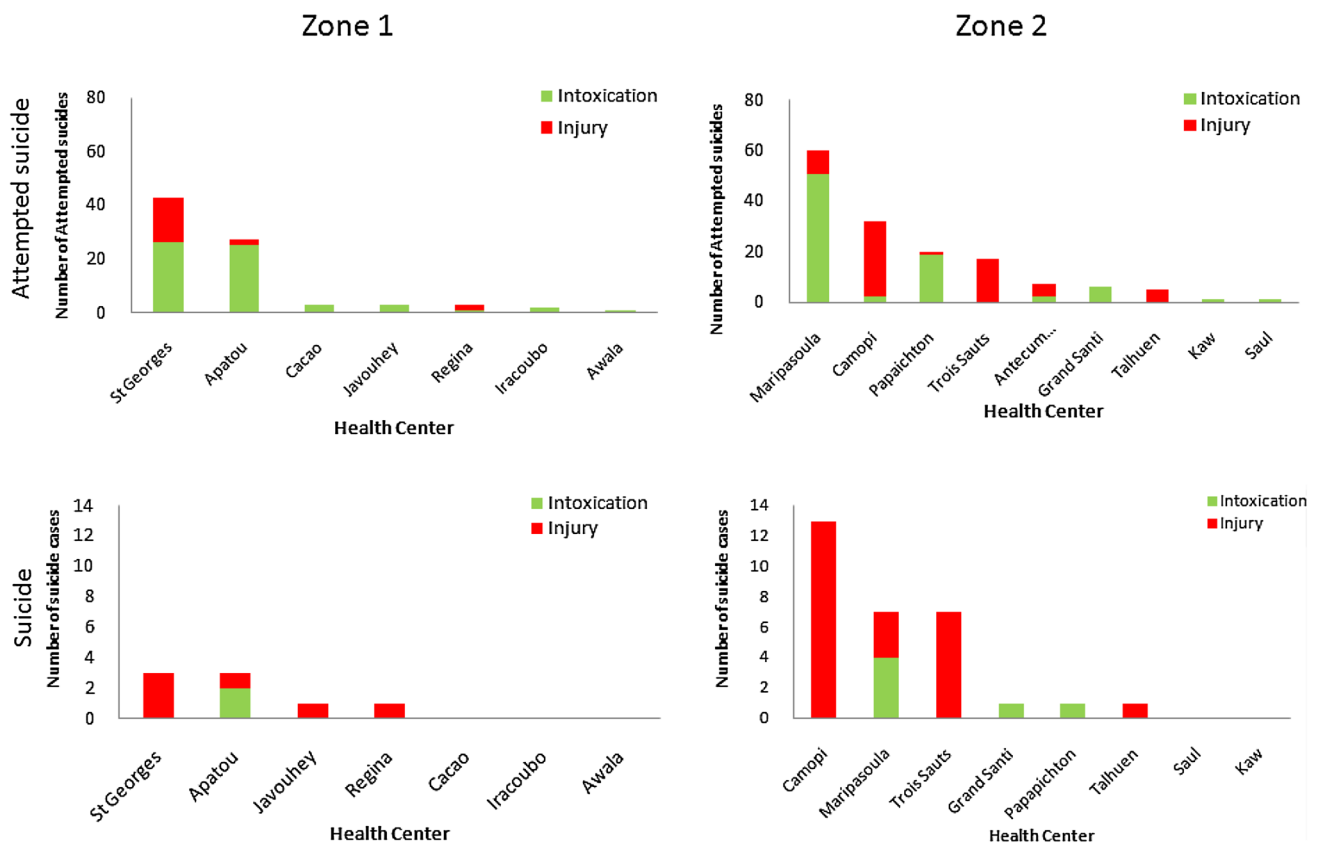


Fig. 2 Number of attempted suicides and suicides by method in health centers in 2007–2016 (n = 236)

### Suicide numbers and rate

From 2007 to 2016, 37 suicides were registered in the health centers, which is a yearly rate of 9 per 100,000. This rate was more than three times higher in zone 2 than in zone 1 (13 per 100,000 versus 4 per 100,000) (Table 1).

The largest numbers were in Camopi and Trois Sauts (Fig. 1). Although total numbers were small, there was a gradual increase over time (Fig. 4).

### Suicide by age and sex

The sex ratio was 2 and the median age was 26 years. The 10–19-year-olds represented 46% of cases, followed by the 30–39 (27%) then the 20–29 (19%).

In zone 2 the median age was significantly younger than in zone 1: 24 versus 33 years ( $p=0.015$ ) (Table 1). For comparisons with Latin America, we computed the 10–19 year old average suicide rate which was 42 per 100,000.

### Suicide by method and sex

78% of suicides were injuries (65% hanging, 13% gunshot wound), and were more frequent in men than in women.

Suicide by intoxication (22%) was exclusively linked to paraquat and there was no difference between men and women (Tables 1, 2; Fig. 5).

### Suicide attempt fatality rate

Among all suicide attempts, 13.5% led to death. In zone 2, fatality was 19.7%, whereas in zone 1 it was 8.3% ( $p<0.001$ ). Among the 31 who ingested paraquat, the fatality rate was 26% (8 died and 23 survived).

### Discussion

French National estimates for French Guiana, based on hospital records, reported an incidence rate of 51 suicide attempts per 100,000 in 2013, which was 71% lower than in mainland France [6, 9, 10]. These estimates are biased by the fact that 78% of suicide attempts in the interior do not lead to medical evacuation in the main hospitals of French Guiana. Thus, these macro statistics do not capture the heterogeneity of the epidemiology of suicide attempts and suicides in French Guiana.

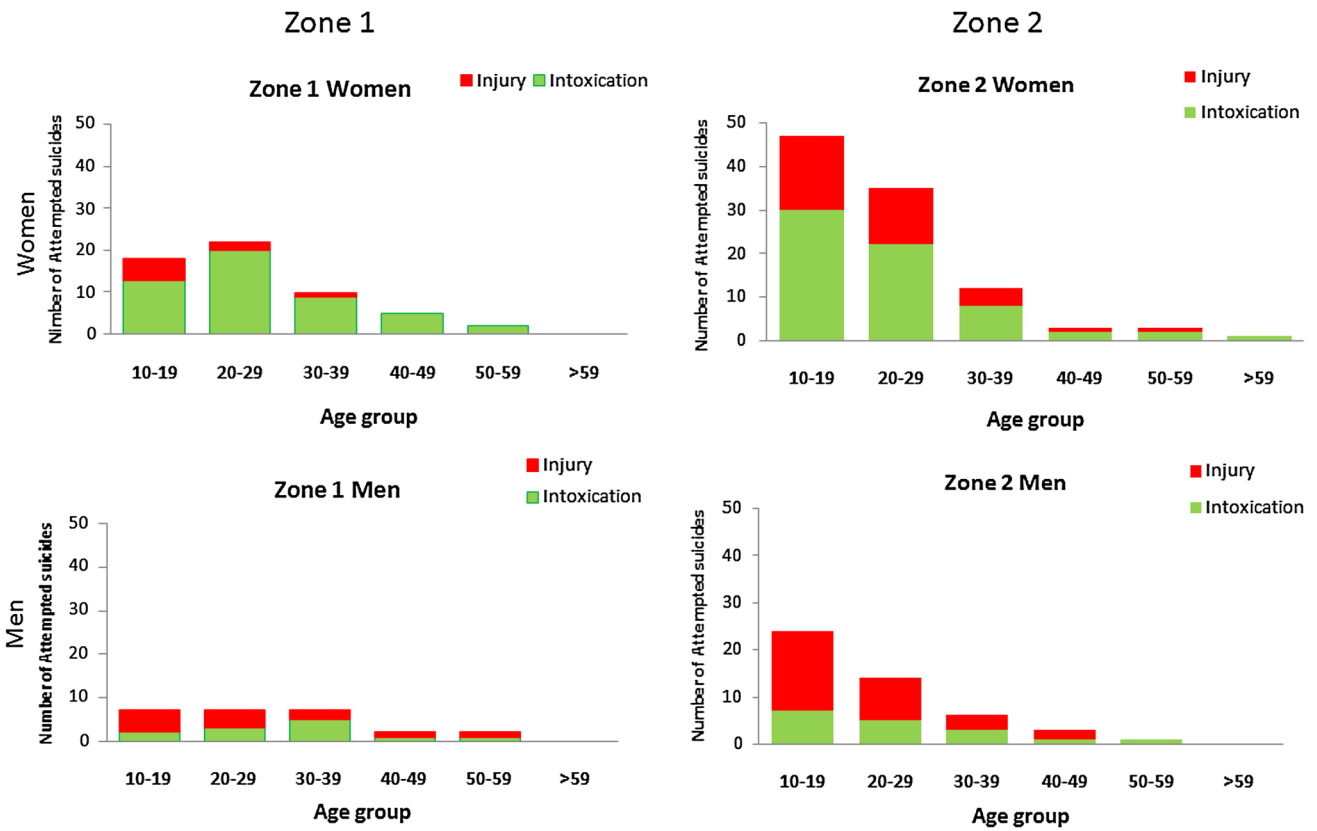


Fig. 3 Number of suicide attempts by age group, gender, zone, and method in the health centers in 2007–2016 (n = 236)

Table 2 Repartition of method of suicide attempt and suicide by sex and zone in the health centers (n = 236 suicide attempts and n = 37 suicides)

	Suicide attempts						Suicides					
	Men			Women			Men			Women		
	Zone 1	Zone 2	Total	Zone 1	Zone 2	Total	Zone 1	Zone 2	Total	Zone 1	Zone 2	Total
	%	%	%	%	%	%	%	%	%	%	%	%
Rope	30.8	46.9	41.3	8.6	31.1	23	75	65	66.7	66.7	60	64.9
Medication	26.9	10.2	16	39.7	15.5	24.2	0	0	0	33.3	30	10.8
Pesticide <sup>a</sup>	15.4	16.3	16	13.8	15.5	14.9	25	15	16.7	0	0	10.8
Gun/rifle	7.7	12.2	10.7	0	0	0	0	20	16.7	0	10	13.5
Household chemicals	3.8	6.1	5.3	31	29.1	29.8	0	0	0	0	0	0
Phlebotomy	0	2	1.3	5.2	2.9	3.7	0	0	0	0	0	0
Burn	7.7	0	2.7	0	0	0	0	0	0	0	0	0
Missing	3.8	2	2.7	1.7	2.9	2.5	0	0	0	0	0	0
Other	3.8	0	1.3	0	1.9	1.2	0	0	0	0	0	0
Gasoline	0	2	1.3	0	0	0	0	0	0	0	0	0
Drowning	0	2	1.3	0	1	0.6	0	0	0	0	0	0
Total	100	100	100	100	100	100	100	100	100	100	100	100

<sup>a</sup>Pesticides included paraquat, malathion, diazinon for attempted suicide. For suicide pesticides were only paraquat

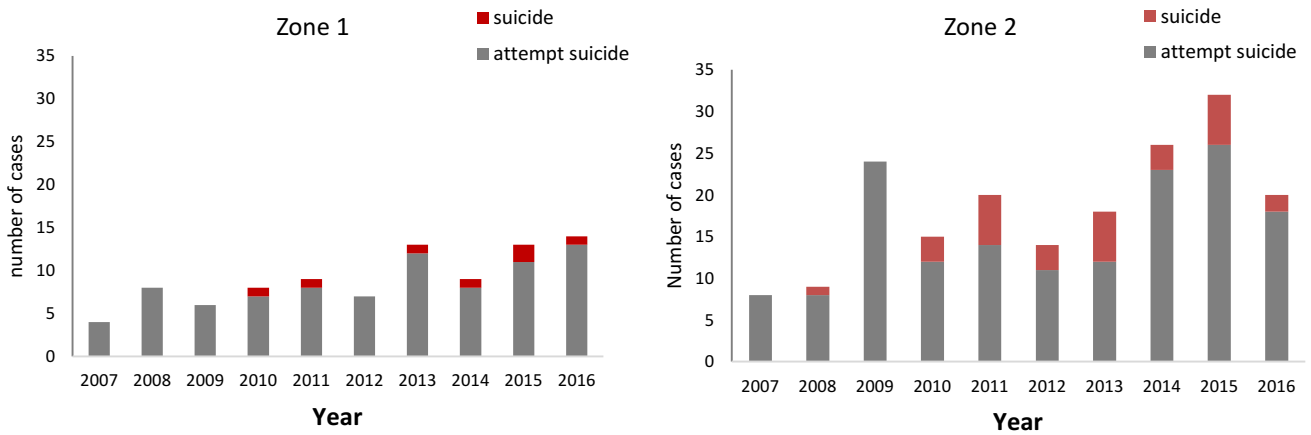


Fig. 4 Number and rate of attempted suicides and suicides from 2007 to 2016

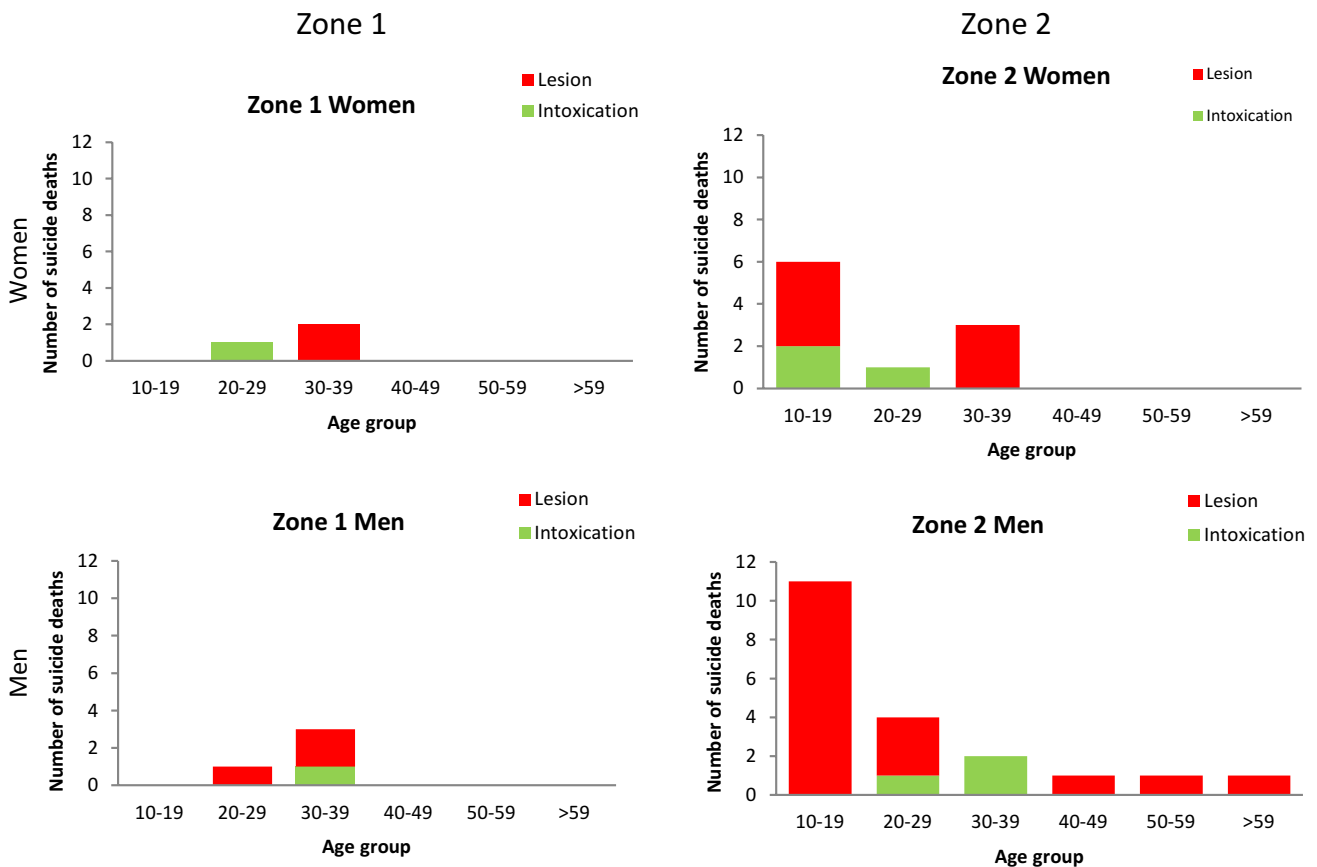


Fig. 5 Number of suicides by age group, gender, zone, and method in the health centers 2007–2016 ( $n = 37$ )

Our study shows that behind the falsely reassuring suicide statistics in French Guiana there are high risk areas for suicide, with a suicide rate that is eight times higher than in France and a suicide attempt rate double of that in mainland France [3, 10].

Beyond the quantitative aspects there are remarkable qualitative features of suicide in the interior of French Guiana. Global and French national statistics indicate that women are three times more likely to attempt suicide than men, mostly through medication intoxication [1, 2, 6, 9,

10], but in our study there are some spatial/ethnic heterogeneities regarding the methods: in the maroon territories of Grand Santi, Papaïchton and Maripasoula medications or pesticides are mostly used, whereas in the Amerindian territories women use hanging or guns. These differences were not salient among men for whom most suicide attempts relied on hanging. Suicide attempts through intoxication were only observed along the Maroni.

For suicide, this regional/ethnic pattern was even more pronounced. There was a focus of suicide in the Amerindian towns of Camopi and Trois Sauts where hanging was the most frequent method used.

Whereas in mainland France, the suicide rate increases with age [2, 3], and the data in the remote territories of French Guiana show that suicide disproportionately affects teenagers and young adults and declines with age. Suicide prevention should thus target the most at-risk age ranges. With 30% lethality among men and 17% among women, and the methods used in suicide attempts underline the frequent intentionality of dying. These observations are similar to what is observed in the region where suicide among youth is a major problem and where similar methods are used [11]. When comparing the incidence rates of suicide among youth in different Latin American countries, we find that on the Guiana shield, Guyana, and Suriname have the highest suicide rates among young people [11, 12]. Although the present study presents a more isolated subset of the population of French Guiana, the rates we observed were also very high, and even higher when we only included the younger age groups. Hence in zone 2, on average the suicide rate was 42 per 100,000, whereas in Guyana it was 31.4 and in Suriname 19.8. Slow economic growth has been hypothesized to contribute to high suicide rates in Latin America, although the interior of French Guiana may offer few economic prospects, French Guiana has the highest GDP per capita in Latin America which seems to rule out the socioeconomic hypothesis. In Suriname and Guyana, suicide disproportionately affects patients in Hindustani cultures, whereas in French Guiana it mostly affects Amerindians. Whereas in French Guiana, there were marked spatiotemporal trends, it has been reported that in Guyana there was little evidence for Tarde's theory of imitation, and little evidence for geographical patterns [13]. The main problem was linked to relational problems within the Hindustani community, with strong pressures for young generations to conform. Therefore apart from being countries of comparable sizes on the Guiana shield with remote areas, one common factor between Hindustani cultures in Guyana and Suriname and Amerindian cultures of the interior of French Guiana may be the strong pressure for the young generation and its global cultural references to conform to the older generations' entrenched values and status ladder [13]. Cultural

and/or geographical isolation leave few ways of escaping conflicts that unfold behind closed doors.

The vulnerability of autochthonous populations and the frequency of suicide have been extensively described in Canada, Alaska, Brazil, or the USA. In the above autochthonous populations, the cases' profile is often similar to what we observed [14–23].

However, the precise reasons explaining these broad trends are debated. Some authors have raised the hypothesis of specific genetic or epigenetic factors influencing decision making and the acuteness of the feeling of rejection leading to a higher vulnerability for suicide [24–27]. Social and geographic isolation and intoxication have an important role on the enactment of suicide [1, 3, 28]. The present data show that the risk is much higher in the isolated Amerindian territories than in the isolated maroon territories, which suggests additional populational factors. A previous study in Camopi-Trois Sauts, with a small qualitative component showed a lethal mix of isolation, desperation in the perceived lack of future prospects, depression, frequent alcohol addiction and substance use, conflict, and a history of abuse [29]. An additional hypothesis, could be the turbulent transition between "gerontocratic" cultures where elders are at the top of the social structure to a more neontocratic modern culture where the values of youth become preeminent [30]. Indeed, new technologies permeate through the distant Amazonian villages and advertisements and music videos bring new status references, references that are reinforced when young generations go to the coastal part of French Guiana for their studies. Thus staying or returning to the most remote areas, with traditional values may be very confusing.

In the past 10 years, numerous suicide prevention programs have been developed. The prevention of suicide, the reduction of social isolation, and the diagnosis and treatment of depression in the interior of French Guiana still need to be developed [1, 28]. Several prevention programs have been developed in the Upper Maroni area. It is noteworthy that there was no suicide in Antecum Pata, where there is a stronger presence of a non-government organization and a sentinel system allowing the proximity of local cultural mediators and the population. Although it is no definite proof, it is tempting to infer that their intervention has been successful in reducing the risk of suicide. A factor that may not be neutral is the recent massive evangelization in Amerindian territories. The putative protective role of religion on suicide is however controversial and the impact of this trend on the well-being of populations needs to be monitored [31, 32]. The data from this study show that the high suicide rate does not concern all Amerindians in French Guiana but about 30% of this population, those living in the most isolated areas on the upper Maroni and Oyapock rivers. The remaining 70% do not seem to be disproportionately affected by the problem of suicide.



Although injury suicides, notably by hanging remain the most frequent method, in recent years there has been an increase in suicides with paraquat, a herbicide that is forbidden in French territories since 2007 but which is authorized in neighboring Suriname. Overall, 20% of suicides used paraquat, notably in Maripasoula, which is a business hub on the Maroni with neighboring Suriname.

A doctoral thesis on paraquat intoxications found a lethality rate of 51.7%, which is higher than the observed 26%, perhaps because the broader inclusion criteria included accidental ingestions by children, and intoxications in all hospitals and not only the health centers network [33].

The present study has some limitations. The exhaustivity of the compilation of suicide attempts may be debatable for several reasons. First, the WHO has no precise definition of suicide or suicide attempts, which would allow facilitating the task [1]. The direct link of the health centers with the hospital may have biased estimations through the undercounting of suicide attempts in the health centers in zone 1, where patients may have the option of driving to a hospital. In addition, early burial, which is more frequent in zone 2, may have led to underestimating actual suicide numbers in the interior. Given the complexity of counting suicides and suicide attempts, the process should ideally be proactive with different actors (NGO's, institutions) coordinated by a regional observatory for suicide. The small numbers in these remote areas, and the stratification in subgroups may lead to important fluctuations and are known to promote more extreme values. Rates are crude and could not be standardized because in some of the towns the age categorizations are not those used in the population used for standardization. Suicide rates may fluctuate in time with epidemic waves and Werther effects that our 10-year scale may mask.

Despite these limitations, and probable undercounting, the magnitude of the suicide rate in these remote areas is still patently very high with nearly all persons in the concerned villages witnessing the event, a very traumatizing experience for the local populations. This is a first quantification effort in these underserved areas that are living private dramas that are not captured by national statistics. Interdisciplinary efforts should be implemented to better understand and thus prevent suicide in the remote villages in the interior of French Guiana.

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## Compliance with ethical standards

**Conflict of interest** The authors declare no conflict of interest.

**Regulatory and ethical aspects** The retrospective analysis of aggregated data is authorized by the Commission Nationale Informatique et Libertés. The Information system of the Centres Délocalisés de Prévention et de Soins is declared and authorized by the health authorities.

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