

# Factors Associated with SARS-CoV2 Infection and Care Pathways Among the Most Vulnerable Populations Living in Marseille: A Case Control Study

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## Research article

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# Abstract

**Background:** Mainland France has been seriously affected by the Covid-19 epidemic, which has brought significant and unexpected morbidity and mortality. Precarious people cared for in accommodation centers are particularly at risk of infection because of collective housing, their dependence on the support system and therefore their difficulty in applying barrier measures. These populations are also subject to a risk of more severe infections or a delay in seeking treatment. This study aims to identify the factors associated with SARS-CoV2 infection in the most vulnerable populations in Marseille.

**Methods:** The sample on which the study was carried out consists of association users, whether or not presenting a symptomatology suggestive of Covid-19, and routinely treated between March 2020 and May 2020. Through univariate and multivariate analyzes, we studied the influence of several variables on morbidity attributable to SARS-CoV2.

**Results:** 64 participants were enrolled in the study with 29 cases and 35 control subject. Median age was 21.16 years old with a younger age in the case group ( $p < 0.005$ ). Sex ratio was 7. Risk factors of SARS-CoV2 in multivariate analysis were living in a shared apartment and a low compliance for distancing measure. Participants presented frequent mental health problems such as anxiety.

**Conclusions:** The allocation of housing to structures involved with the most precarious people appears to be a decisive factor in the fight against the spread of SARS-CoV2 and therefore deserves more attention from public authorities.

## 1. Background

During the first half of 2020, the whole world has been plunged into an unprecedented health crisis linked to a new virus, the SARS-CoV2, responsible for an infection called Covid-19 for *Corona Virus Disease 2019*. [1] The pandemic caused by this virus emerged from China at the end of December 2019, in the city of Wuhan (Hubei province). It spread exponentially, resulting in millions of cases around the world. [2] Europe and mainland France have been particularly affected by this epidemic which has resulted in significant and unexpected morbidity and mortality. [3,4] People with co-morbidities and advanced ages appear to be at greater risk of morbidity and mortality. [5] Furthermore, the spread of Covid-19 is ongoing. [6]

Migrant addressed on accommodation centers and precarious people are particularly at risk of infection. [7] Collective housing and their dependence on the support system make it hard for these populations to maintain recommendations and apply barrier measures. [8] On the other hand, because of their urban and precarious lifestyles, these populations are possibly at risk of more severe infections or a delay in seeking treatment. [9] Indeed, precarious populations are particularly affected by the epidemic. [10] The economic crisis and the indirect consequences linked to the epidemic have greatly worsened the health situation among these populations. Therefore, measures to ensure healthy housing for these people are central in the management of Covid-19. [11]

The “Association of Aid to Young Workers” (AAJT) NGO has been involved since 1954 in the support and accommodation of people in difficulty minors or adults (around 800 people per year), in Marseille and its surroundings. The association offers accommodation for precarious populations, and especially collective accommodation which is particularly at risk of spreading SARS-CoV2.[12]

For more than a year, the AAJT has also been carrying out a regional program for access to prevention and care for the most deprived people (PRAPS) including assistance in the care pathway, trainings, a mapping of the care network and prevention activities. The AAJT is aware of the crucial role that the care pathway represents in the quality of life and of the negative consequences related to renunciation of healthcare. Therefore, the AAJT has set up a dedicated “health team” within its structure, made up of caregivers. The mission of the dedicated health team is to put into practice this program, and thus support users in taking charge of their health. In this current health crisis context, the health team staff pays a special attention to their patients presenting symptoms suggestive of Covid-19.

Marseille is a port city and the second largest city in France. The city represents an important passageway and living point in terms of migratory flow.[13] Also, this city is very marked by poverty and inequalities.[14] So, studying this geographical area is necessary to propose appropriate strategic axes. By focusing on patients affected by Covid-19, we aim to identify the determinants of infection within this precarious population and thus help limit the spread of Covid-19.[8]

The aim of this study is to identify the possible factors associated with SARS-CoV2 infection among precarious people benefiting housing by AAJT. The secondary objective is to describe their care pathways in an epidemic context.

## **2. Methods**

This is a retro-prospective case-control observational study.

### **2.1 Study design and participants**

Our study focuses on vulnerable populations, mainly migrants and homeless people, present in Marseille and hosted within associative structures such as the AAJT. The AAJT takes in charge almost a thousand users yearly.[15] The sample on which the study was carried out consists of users, with or without symptoms suggestive of Covid-19, routinely cared of by the dedicated health team between March and May 2020. The individuals included in our study come from 8 different services: Support for young adults; reception center for asylum seekers; social residence for young workers; social integration facilities; emergency accommodations; social children houses (Collective & diffuse); professional & social inclusion facilities.

For being included in this study, each subject must have been monitored by the AAJT dedicated health team between March 2020 and May 2020, within the perimeter of the city of Marseille and must be consenting to the data concerning him being used in the context of this study.

By the size of the number of people received and by the implementation of specific health monitoring, this framework was a privileged place to conduct our study.

## 2.2 Data collection

In order to carry out this study, we relied both on AAJT available databases and also on the information collected via a questionnaire adapted to the study and based on the recommendations from the French National Authority for Health.[16] This standardized anonymous questionnaire made it possible to collect the users socio-demographic data, recent life history, medical history and comorbidities, treatments, clinical-biological and medical follow-up data. The questionnaires were completed essentially by the dedicated health team staff. Each user suspected of carrying SARS-CoV2 received medical surveillance and home follow-up on Day1, Day3, Day5, Day9 and 14 days after the onset of symptoms.

## 2.3 Biological analysis

A RT-PCR for SARS-CoV2 screening campaign ran between May 4<sup>th</sup> 2020 and May 15<sup>th</sup> 2020. RT-PCR was done by nasopharyngeal swab. The nasopharyngeal samples were taken by a medical team made up of nurses and doctors. These sessions were open to all AAJT users. At each of these sessions, we submitted the questionnaire to several randomly selected users. Rapid diagnostic orientation serological tests for SARS-CoV2 were also carried out later during 2 screening sessions organized on June 24<sup>th</sup> 2020 and July 1<sup>st</sup> 2020. Rapid serological diagnostic prick test used was the BIOSYNEX<sup>®</sup> test.

## 2.4 Cases definitions

To assess the precarious nature of our subjects, we considered the definition provided by The High Committee for Public Health. They define precariousness as a state of social instability characterized by the loss of securities.[17]

From the clinical and biological data gathered, 4 distinct groups could be formed [18] :

**Confirmed SARS-CoV2 cases:** *Any patient with a positive search for SARS-CoV2 test by PCR and/or by rapid diagnostic serological orientation test.*

**Suspected SARS-CoV2 cases:** *Any patient presenting a compatible clinical situation and/or compatible chest scan, and without search for SARS-CoV2 by PCR and/or by rapid diagnostic serological orientation test.*

**Users not suspected of carrying SARS-CoV2:** *Patients who are not symptomatic but who have not performed a screening test.*

**Users not carrying SARS-CoV2:** *Patients who are not symptomatic and with a negative search for SARS-CoV2 by PCR and/or by rapid diagnostic serological orientation test.*

A patient was considered to have a Covid-19 compatible symptomatology when he presented a fever added to a cough or 2 other symptoms suggestive of Covid-19 (Headache, asthenia, dyspnea, chest pain, anosmia, or myalgia) according to French guideline.[19] Each symptomatology that could raise suspicion of Covid-19 presence benefited from a medical evaluation aimed at confirming the initial diagnosis.

In order to have 2 groups to compare, we brought together users who are carriers or suspected of being carriers of SARS-CoV2 in a "Case" group and users who are not carriers or who are not suspected of being carriers of SARS-CoV2 in a "Control" group.

Symptoms severity was assessed by their duration and severity [20] :

**Asymptomatic form** : *The patient did not have any of the symptoms suggestive of a Covid infection.*

**Benign form** : *The symptoms were mild in intensity and they were greatly reduced before D5.*

**Moderate form** : *The intensity of the symptoms was moderate and they were greatly reduced before D9.*

**Severe form** : *The intensity of symptoms was severe and/or in large numbers and/or the patient exhibited signs of severity requiring hospitalization.*

Finally, we considered a subject at risk of contracting a severe form when he/she had one or more risk factors or was a carrier of tuberculosis or was affected by multimorbidity. [21,22,23,24,25]

## 2.5 Statistical analyses

The primary outcome was the associated factors associated to SARS-CoV-2 infection.

We carried out univariate and multivariate analyzes (Case vs. control). Depending on the explanatory variable considered, several tests were used to perform the univariate analyzes: Wilcoxon's Rank sum test (Quantitative variables),  $\chi^2$  test et Fisher's exact test (Qualitative variables). The difference between the delays for medical advice (Temporal variable) was assessed through Kaplan-Meir estimate using Log-rank test. All results were presented as crude percentages.

Logistic regression was chosen to conduct multivariate analyzes, due to the heterogeneity of the variables nature. Beforehand, in order to select the variables to include in our models, we used a top-down step-by-step procedure. We chose to keep the model characterized by the lowest Akaike information criterion. A p value lower than 0.05 was considered significant.

All the analyses and graphics were carried out using R software (v. 3.6.3).

## 3. Results

A total of 64 were included in the study, with 29 subjects in the "Case" group and 35 subjects in "Control" group from April 15<sup>th</sup> to May 15<sup>th</sup> 2020.(Fig.1) The first table shows the number of users within the

different services of the AAJT (Table 1). The other tables summarize socio-demographic characteristics (Table 2), situations during the confinement (Table 3), compliance to prevention measures (Table 4) and health cares (Table 5).

The median age of the study population is 21.16 years ( $CI_{95\%} = [20.10 ; 22.22]$ ) and was lower in the case group ( $p < 0.005$ ) (Table 2). The majority (87.50%,  $n = 56/64$ ) are men (Sex ratio M/F = 7). Most of the users are single (87.50%,  $n = 56/64$ ) and have no dependent children (90.63%,  $n = 58/64$ ). The majority of users have an educational level equivalent to a middle school level (54.9%,  $n = 35/64$ ) or have no diploma (32.81%,  $n = 21/64$ ). A substantial portion of them are still students (54.69%,  $n = 35/64$ ) or do not practice a professional activity (20.31%,  $n = 13/64$ ). More than half of users come from West Africa (53.13%,  $n = 34/64$ ) and users from the Middle East represent almost a fifth of users (18.75%,  $n = 12/64$ ). The rest of subjects (28.12%,  $n = 28/64$ ) come from other parts of Africa, Europe or overseas France. Their presence on French territory is, on average, 5.37 years ( $CI_{95\%} = [3.43 ; 7.31]$ ). Different types of accommodation are occupied by users, but single rooms represent the majority (54.69%,  $n = 35/64$ ). Among the PCR tests performed, 2 were positive and 49 were negative. As for the rapid diagnostic tests, the 10 tests performed in our sample were negative. Concerning addictions, some users reported regular consumption of tobacco, alcohol or cannabis, but no one reported hard drugs use or medicine misuse. Considering product consumptions, presences of chronic diseases and multimorbidities, 51,56% ( $n = 33/64$ ) of users had a risk of developing a severe form of COVID-19.

**Table 1 – Number of users according to their care services**

Services supporting users	AAJT users ( $n = 64$ )	Case group ( $n = 29$ )	Control group ( $n = 35$ )
<i>Support for young adults</i>	<b>3.45% (1)</b>	8.57% (3)	6.25% (4)
<i>Reception Center for Asylum Seekers</i>	<b>13.79% (4)</b>	2.86% (1)	7.81% (5)
<i>Social Residence for Young Workers</i>	<b>13.79% (4)</b>	20% (7)	17.19% (11)
<i>Social integration facilities</i>	<b>10.35% (3)</b>	31.43% (11)	21.88% (14)
<i>Emergency accommodations</i>	<b>6.90% (2)</b>	11.43% (4)	9.38% (6)
<i>Social Children House (Collective)</i>	<b>10.35% (3)</b>	5.71% (2)	7.81% (5)
<i>Social Children House (Diffuse)</i>	<b>37.93% (11)</b>	14.29% (5)	25% (16)
<i>Professional &amp; social inclusion facilities</i>	<b>3.45% (1)</b>	5.71% (2)	4.69% (3)

\*AAJT : Association for Helping Young Workers

Table 2 – Description of socio-demographic characteristics by study group

<b>Variables</b>	<b>Modalities</b>	<b>AAJT users (n=64)</b>	<b>Case group (n = 29)</b>	<b>Control group (n = 35)</b>	<b>Univariate analysis (<math>\alpha = 0.05</math>)</b>
<b>Sex</b>					<b>p = 0.451</b>
	<i>Men</i>	<b>87.5% (56)</b>	82.76% (24)	91.43% (32)	
	<i>Women</i>	<b>12.5% (8)</b>	17.24% (5)	8.57% (3)	
<b>Age</b>					<b>p = 0.005935</b>
		<b><i>m = 21.16 years</i></b>	m = 19.69 years	m = 22.55 years	
		<b><i>s = 4.34 years</i></b>	s = 4.96 years	s = 3.47 years	
<b>Geographical area of origin</b>					<b>p = 0.8263</b>
	<i>Central Africa</i>	<b>1.57% (1)</b>	0% (0)	2.86% (1)	
	<i>East Africa</i>	<b>3.13% (2)</b>	0% (0)	5.71% (2)	
	<i>North Africa</i>	<b>7.81% (5)</b>	10.35% (3)	5.71% (2)	
	<i>West Africa</i>	<b>53.13% (34)</b>	51.72% (15)	54.29% (19)	
	<i>Middle-East</i>	<b>18.75% (12)</b>	20.69% (6)	17.14% (6)	
	<i>East Europe</i>	<b>1.57% (1)</b>	3.45% (1)	0% (0)	
	<i>West Europe</i>	<b>1.57% (1)</b>	3.45% (1)	0% (0)	
	<i>France</i>	<b>7.81% (5)</b>	6.90% (2)	8.57% (3)	
	<i>Overseas France territories</i>	<b>4.69% (3)</b>	3.45% (1)	5.71% (2)	
<b>Time past on French territory</b>					<b>p = 0.06344</b>

	<i>m = 5.37 years</i>	m = 4.38 years	m = 6.06 years
	<i>s = 7.52 years</i>	s = 7.23 years	s = 7.75 years
<b>Education level</b>			<b>p = 0.04083</b>
<i>Without diploma</i>	<b>32.81% (21)</b>	41.38% (12)	25.71% (9)
<i>Middle school</i>	<b>54.69% (35)</b>	58.62% (17)	51.43% (18)
<i>High school</i>	<b>7.81% (5)</b>	0% (0)	14.29% (5)
<i>University</i>	<b>4.69% (3)</b>	0% (0)	8.57% (3)
<b>Type of occupation</b>			<b>p = 0.01304</b>
<i>No professional activity</i>	<b>20.31% (13)</b>	31.04% (9)	11.43% (4)
<i>Student</i>	<b>54.69% (35)</b>	62.07% (18)	48.57% (17)
<i>Factory worker</i>	<b>1.56% (1)</b>	0% (0)	2.86% (1)
<i>Artisan</i>	<b>6.25% (4)</b>	3.45% (1)	8.57% (3)
<i>Employee</i>	<b>17.19% (11)</b>	3.45% (1)	28.57% (10)
<b>Type of accommodation</b>			<b>p = 0.0002112</b>
<i>Single room</i>	<b>54.69% (35)</b>	44.83% (13)	62.86% (22)
<i>Single apartment</i>	<b>10.94% (7)</b>	17.24% (5)	5.71% (2)
<i>Shared room</i>	<b>17.19% (11)</b>	3.45% (1)	28.57% (10)
<i>Shared apartment</i>	<b>17.19% (11)</b>	34.48% (10)	2.86% (1)
<b>Conjugal status</b>			<b>p = 0.451</b>

<i>Single</i>	<b>87.50% (56)</b>	82.76% (24)	91.43% (32)	
<i>In a relationship</i>	<b>12.50% (8)</b>	17.24% (5)	8.57% (3)	
<b>Number of dependent children</b>				$p \approx 1$
<i>No dependent children</i>	<b>90.63% (58)</b>	89.66% (26)	91.43% (32)	
<i>1 dependent child</i>	<b>6.25% (4)</b>	6.90% (2)	5.71% (2)	
<i>2 dependent children</i>	<b>3.12% (2)</b>	3.45% (1)	2.86% (1)	
<b>Social support</b>				$p \approx 1$
<i>No social support</i>	<b>3.12% (2)</b>	3.45% (1)	2.86% (1)	
<i>State Medical Assistance</i>	<b>7.81% (5)</b>	6.90% (2)	8.57% (3)	
<i>Usual social support</i>	<b>89.06% (57)</b>	89.65% (26)	88.57% (31)	

### 3.1 Care pathways

Almost all users benefit from social care (96.88%, n=62/64), with a large majority of usual social support beneficiaries (89.06%, n=57/64). (Table 2) State Medical Assistance refers to a special type of social support reserved for people in an irregular situation and asylum seekers.

Almost a quarter of users said they had been in hospital between January 2020 and May 2020 (23.44%, n=15/64). The average delay between hospital presence and onset of symptoms equal to 59.64 days ( $CI_{95\%} = [51.68 ; 67.60]$ ). A large proportion of users were able to benefit from tuberculosis screening in 2019 or 2020 (61.02%, n=36/59) and among them only 5.56% (2/36) were declared positive, there is not significant difference between case and control.

A significant portion of users have felt sadness (32.81%, n=21/64), anxiety (42.19%, n=27/64) or have experienced insomnia (32.81%, n=21/64). Univariate analyze highlighted a tendency for users in the "Case" group to be more anxious than those in the "Control" group before the onset of the first symptoms. However, an important part of the psychological follow-ups were able to be maintained during the confinement (32.81%, n=21/64). (Table 3) Also, hetero-aggressive behavior and respect for social

distancing are correlated, with an odd ratio significantly lower than 1. The reasons for consultation are fewer but still varied despite the confinement. However, we detect a significant difference in consultation times between users presenting symptoms suggestive of Covid-19 (5.65 days) and others (20 days). (Fig.2) Around half of them, because of medical history of risk factors (chronic pathologies or multi-morbidity), were at risk of contracting a severe form of Covid-19 (51.56%, n=33/64). Nevertheless, no severe form was observed within the structure. Concerning compliance with barriers measures, 60.9% (n=39/64) of users was wearing a mask, 79.69% (51/64) have applied social distancing, 85.94% (n=55/64) was washing their hands regularly, and 75% (n=48/64) complied with confinement measures. (Table 4)

Among users who are carriers or suspected of being carriers of SARS-CoV2, we counted 20.69% (n=6/29) of asymptomatic cases, 51.72% (n=15/29) presenting a mild form and 27.59% (8/29) a moderate forms. Symptomatic users were largely able to benefit from medical advice (78.26%, n=18/23), treatment (86.96%, n=20/23) and accommodation allowing strict isolation (82.61%, n=19/23). A moderate share of the users were present during the screening sessions by PCR (79.69%, n=51/64) and serological tests (15.63%, n=10/64). PCR tests were performed 28.29 days on average after the onset of symptoms and only 6.9% (n=2/29) of users had a chest scan. Besides, only 65% (n=13/20) of potentially carriers users complied with the isolation measure (Table 5).

***Table 3 – Situation of users during confinement (Between march 2020 et may 2020) by study group***

<b>Variables</b>	<b>Modalities</b>	<b>AAJT users (n=64)</b>	<b>Case group (n = 29)</b>	<b>Control group (n = 35)</b>	<b>Univariate analysis (<math>\alpha = 0.05</math>)</b>
<b>Psychological support</b>					<b>p <math>\approx</math> 1</b>
	<b>Yes</b>	<b>32.81% (21)</b>	34.48% (10)	31.43% (11)	
	<b>No</b>	<b>67.19% (43)</b>	65.52% (19)	68.57% (24)	
<b>Decompensation observed in the user</b>					
	<b>Yes</b>	<b>4.69% (3)</b>	6.90% (2)	2.86% (1)	
	<b>No</b>	<b>95.31% (61)</b>	93.10% (27)	97.14% (34)	
<b>Anxiety felt by the user</b>					<b>p = 0.007421</b>
	<b>Yes</b>	<b>42.19% (27)</b>	62.07% (18)	25.71% (9)	
	<b>No</b>	<b>57.81% (37)</b>	37.93% (11)	74.29% (26)	
<b>Sadness felt by the user</b>					<b>p = 0.2886</b>
	<b>Yes</b>	<b>32.81% (21)</b>	41.38% (12)	31.43% (9)	
	<b>No</b>	<b>67.19% (43)</b>	58.62% (17)	68.57% (26)	
<b>Insomnia experienced by the user</b>					

				p = 0.2811
	<b>Yes</b>	<b>32.81%</b> <b>(21)</b>	24.14% (7)	40% (14)
	<b>No</b>	<b>67.19%</b> <b>(43)</b>	75.86% (22)	60% (21)
<b>Delirium observed in the user</b>				p = 0.4531
	<b>Yes</b>	<b>1.56%</b> <b>(1)</b>	3.45% (1)	0% (0)
	<b>No</b>	<b>98.44%</b> <b>(63)</b>	96.55% (28)	100% (35)
<b>Hetero-aggressive behavior observed in the user</b>				p = 0.0401
	<b>Yes</b>	<b>10.94%</b> <b>(7)</b>	20.69% (6)	2.86% (1)
	<b>No</b>	<b>89.06%</b> <b>(57)</b>	79.31% (23)	97.14% (34)
<b>Self-aggressive behavior observed in the user</b>				p = 0.4531
	<b>Yes</b>	<b>1.56%</b> <b>(1)</b>	3.45% (1)	0% (0)
	<b>No</b>	<b>98.44%</b> <b>(63)</b>	96.55% (28)	100% (35)
<b>Overdose observed in the user</b>				p = 0.5859
	<b>Yes</b>	<b>4.69%</b> <b>(3)</b>	6.90% (2)	2.86% (1)
	<b>No</b>	<b>95.31%</b> <b>(61)</b>	93.10% (27)	97.14% (34)

<b>Nutrition</b>					p = 0.3127
	<i>Sufficient/Healthy</i>	<b>66.56%</b> <b>(49)</b>	69.97% (20)	82.86% (29)	
	<i>Insufficient/Unhealthy</i>	<b>23.44%</b> <b>(15)</b>	31.03% (9)	17.14% (6)	
<b>Sleep</b>					p = 0.8432
	<i>Sufficient/Healthy</i>	<b>53.97%</b> <b>(34)</b>	57.14% (16)	51.43% (18)	
	<i>Insufficient/Unhealthy</i>	<b>46.03%</b> <b>(29)</b>	42.86% (12)	48.57% (17)	
<b>Body hygiene</b>					p = 0.002512
	<i>Sufficient/Healthy</i>	<b>89.06%</b> <b>(57)</b>	75.86% (22)	100% (35)	
	<i>Insufficient/Unhealthy</i>	<b>10.94%</b> <b>(7)</b>	24.14% (7)	0% (0)	
<b>Physical activity</b>					p = 0.5726
	<i>Sufficient/Healthy</i>	<b>64.06%</b> <b>(41)</b>	58.62% (17)	68.57% (24)	
	<i>Insufficient/Unhealthy</i>	<b>35.94%</b> <b>(23)</b>	41.38% (12)	31.43% (11)	
<b>Social life</b>					p = 0.3795
	<i>Sufficient/Healthy</i>	<b>59.38%</b> <b>(38)</b>	51.72% (15)	65.71% (23)	
	<i>Insufficient/Unhealthy</i>	<b>40.62%</b> <b>(26)</b>	48.28% (14)	34.29% (12)	
<i>*AAJT : Association for Helping Young Workers</i>					

*Table 4 – Compliance to prevention (Between january 2020 et may 2020) by study group*

<b>Variables</b>	<b>Modalities</b>	<b>AAJT users (n=64)</b>	<b>Case group (n = 29)</b>	<b>Control group (n = 35)</b>	<b>Univariate analysis (<math>\alpha = 0.05</math>)</b>
<b>Wearing a mask</b>					<b>p = 0.1026</b>
	<b>Yes</b>	<b>60.94% (39)</b>	48.28% (14)	71.43% (25)	
	<b>No</b>	<b>39.06% (25)</b>	51.72% (15)	28.57% (10)	
<b>Compliance with confinement measures</b>					<b>p = 0.05947</b>
	<b>Yes</b>	<b>75% (48)</b>	62.07% (18)	85.71% (30)	
	<b>No</b>	<b>25% (16)</b>	37.93% (11)	14.29% (5)	
<b>Compliance with social distancing</b>					<b>p = 0.004016</b>
	<b>Yes</b>	<b>79.69% (51)</b>	62.07% (18)	94.29% (33)	
	<b>No</b>	<b>20.31% (13)</b>	37.93% (11)	5.71% (2)	
<b>Regular hand washing</b>					<b>p = 0.06688</b>
	<b>Yes</b>	<b>85.94% (55)</b>	75.86% (22)	94.29% (33)	
	<b>No</b>	<b>14.06% (9)</b>	24.14% (7)	5.71% (2)	
<b>Acces to a hydroalcoholic solution</b>					

				$p \approx 1$
	<b>Yes</b>	<b>50% (32)</b>	48.28% (14)	51.43% (18)
	<b>No</b>	<b>50% (32)</b>	51.72% (15)	48.57% (17)
<b>Presence of suspected persons in the close entourage</b>				
	<b>Yes</b>	<b>17.19% (11)</b>	37.93% (11)	0% (0)
	<b>No</b>	<b>82.81% (53)</b>	62.07% (18)	100% (35)
<b>Presence at the hospital</b>				
	<b>Yes</b>	<b>23.44% (15)</b>	20.69% (6)	25.71% (9)
	<b>No</b>	<b>76.56% (49)</b>	79.31% (23)	74.29% (26)
<b>Time between the last hospital visit and the onset of symptoms</b>				
		<b><math>m = 59.64</math> days</b>	$m =$ 36.67 days	$m =$ 76.88 days
		<b><math>s = 32.50</math> days</b>	$s = 30.94$ days	$s = 22.05$ days

\*AAJT : Association for Helping Young Workers

Table 5 – Supports for users by study group

<b>Variables</b>	<b>Modalities</b>	<b>AAJT users (n=64)</b>	<b>Case group (n = 29)</b>	<b>Control group (n = 35)</b>	<b>Univariate analysis (<math>\alpha = 0.05</math>)</b>
<b>Time between the onset of symptoms and the consultation</b>					<b>p = 0.04</b>
		<b>m = 7.31 days</b>	m = 5.65 days	m = 20 days	
		<b>s = 8.59 days</b>	s = 7.06 days	s = 10 days	
<b>Demonstration of denial about the possibility of being COVID-positive</b>					
	<b>Yes</b>		<b>39.13% (9)</b>		
	<b>No</b>		<b>60.87% (14)</b>		
<b>Strict isolation measure in place for the user</b>					
	<b>Yes</b>		<b>82.61% (19)</b>		
	<b>No</b>		<b>17.39% (4)</b>		
<b>Compliance by the user about isolation</b>					
	<b>Yes</b>		<b>65% (13)</b>		
	<b>No</b>		<b>35% (7)</b>		
<b>Modification of accommodation for the user</b>					

<i>Yes</i>	<b>8.70%</b> <b>(2)</b>
<i>No</i>	<b>91.30%</b> <b>(21)</b>
<b>Hospitalization following the onset of symptoms</b>	
<i>Yes</i>	<b>4.35%</b> <b>(1)</b>
<i>No</i>	<b>95.65%</b> <b>(22)</b>
<b>Prescription of treatment</b>	
<i>Yes</i>	<b>86.96%</b> <b>(20)</b>
<i>No</i>	<b>13.04%</b> <b>(3)</b>
<b>Duration of symptoms suggestive of COVID</b>	
<i>1-2 days</i>	<b>17.39%</b> <b>(4)</b>
<i>2-3 days</i>	<b>21.74%</b> <b>(5)</b>
<i>3-5 days</i>	<b>13.04%</b> <b>(3)</b>
<i>5-9 days</i>	<b>30.44%</b> <b>(7)</b>
<i>9-14 days</i>	<b>17.39%</b> <b>(4)</b>
<b>Time between the onset of symptoms and the nasopharyngeal sample for PCR test</b>	

*m =*  
**28.29**  
*days*

*s =*  
**23.82**  
*days*

**PCR test results**

*Positive*                      **3.92% (2)**

*Negative*                      **96.08%**  
**(49)**

**Serological test results**

*Positive*                      **0% (0)**

*Negative*                      **100% (10)**

**Conclusion regarding the COVID suspicion**

*Non-carrier*                      **53.13%**                      97.14%  
**(34)**                                      **(34)**

*Not suspected of carrying*                      **1.56% (1)**                      2.86%  
**(1)**

*Suspected of carrying*                      **42.19%**                      93.10%  
**(27)**                                      **(27)**

*Carrier*                                      **3.12% (2)**                      6.90%  
**(2)**

**Form of COVID symptomatology observed**

*No symptoms*                      **3.45%**  
**(1)**

*Mild symptoms*                      **68.97%**  
**(20)**

\*AAJT : Association for Helping Young Workers ; PCR : Polymerase chain reaction

### **3.2 Factors associated with morbidity attributable to SARS-CoV2**

The univariate analyzes shows a significant difference between the users of the “Case” group and those of the “Control” group on the following factors : Age, education level, type of occupation, type of accommodation, compliance with social distancing measure, feeling of anxiety, hetero-aggressive behavior, and quality of personal hygiene. However, multivariate analyzes reveal that only type of accommodation and respect for social distancing are in fact significantly associated with being a SARS-CoV2 carrier. The variables kept in the final multivariate model (AIC = 62.236) are "Compliance with social distancing", "Type of accommodation" and "Body hygiene". (Table 6) To assess this model, we studied other correlations and we find that respect for social distancing is not impacted by age. There is a correlation between the level of education and the profession practiced. In particular, we find that not exercising a professional activity is strongly correlated with the level of study "Middle school".

The logistic regression of our final model revealed that users living in shared accommodation are significantly more at risk of being affected by Covid-19. These represent 34.48% (n=10/29) of the “Case” group against 2.86% (n=1/35) in the “Control” group. Failure to respect social distancing is also significantly associated with it. For both of these correlations, odds ratio are significantly greater than 1. The quality of body hygiene also appears in our model, and the "Insufficient" modality has a odds ratio higher than 1. However, the confidence interval of this odds ratio is largely extended around 1. (Table 6)

We can also note the presence of trends close from significance for the following variables: Duration of presence on French territory (p = 0.06), wearing of a mask (p = 0.1), compliance with confinement measures (p = 0.06) and regular hand washing (p = 0.07). (Table 2, Table 3)

Table 6 – Final multivariate model (AIC = 62,24)

<b>Variables</b>	<b>Modalités</b>	<b>Multivariate analysis</b> <b>(<math>\alpha = 0.05</math>)</b>	<b>OR</b>	<b>IC<sub>95%</sub> OR</b>
<b>Type of accommodation</b>				
	<i>Single room</i>	<i>1</i>		
	<i>Single apartment</i>	<b>0.09003</b>	<b>15</b>	<b>0,81 - 50,67</b>
	<i>Shared room</i>	<b>0.47187</b>	<b>0,43</b>	<b>2,11.10<sup>-2</sup> - 3,19</b>
	<i>Shared apartment</i>	<b>0.00761</b>	<b>23,45</b>	<b>3,18 - 496,79</b>
<b>Compliance with social distancing</b>				
	<i>Yes</i>	<i>1</i>		
	<i>No</i>	<b>0.02410</b>	<b>8,53</b>	<b>1,50 - 71,36</b>
<b>Body hygiene</b>				
	<i>Sufficient/Healthy</i>	<i>1</i>		
	<i>Insufficient/Unhealthy</i>	<b>0.99242</b>	<b>1,99.10<sup>8</sup></b>	<b>3,11.10<sup>-76</sup> - <math>\infty</math></b>

## 4. Discussion

We found that the main associated risk factors to COVID-19 infection were living in a shared apartment and not complying with social distancing. Our analyzes aim to identify and explain these factors.

Indeed, users living in shared apartment are more affected than others. This can be explained by the difficulties to restrict proximity within the common areas. In addition, we know that SARS-CoV2 can stay airborne for up to 3 hours and survive on surfaces.[26] If one of the roommates is a carrier, the circulation of each within the accommodation may be sufficient to transmit the virus, even if an effort to maintain physical distancing is made. On the other hand, according to the results of multivariate analyzes, users living in shared rooms do not seem to be more at risk of contracting Covid-19. This difference could be explained by the fact users living in collective rooms are more aware of the risk for themselves but also for their roommates and make more efforts to apply barrier gestures outside and inside their accommodation.

Age appeared as a significant factor in the univariate analyzes probably because underage users benefit more from the medical surveillance offered by the AAJT. Indeed, they are more asking for cares and the intervention teams pay more attention to the youngest.[31] They are therefore more likely to be diagnosed as potential carriers of SARS-CoV2. Besides, users apply social distancing with the same forcefulness regardless of age. Despite the generally young age of the users, barrier measures were generally understood and respected.

On the contrary, users showing hetero-aggressive behavior have a tendency to disregard social distancing. The AAJT intervention teams said the confinement measure was difficult to apply for some of their users. An important part of the users experienced psychosocial stress linked to the confinement measures.[32] Indeed, the confinement and the climate were described by some users as "anxiety-provoking". So, they sometimes had to deal with aggressive and protesting behavior. We can consider that possibly some symptoms observed had a somatic origin in these people.[33]

The fact that almost all users are beneficiaries of a health care plan has ensured treatment for each patient and free screening for those wishing to be tested. Among the PCR tests carried out, we obtained only 2 positive results. However, the important delay and the discontinuity of these tests performance may be the cause of an underestimation of SARS-CoV2 carriers.[37] Overall, despite the problems raised by collective accommodation, the containment of the epidemic was effectively ensured by the AAJT among its users, which also could explain the low rate of positive PCR results. [38]

Due to the complexity of the epidemic context and the modesty of the number of people mobilized within the dedicated health team, the implementation of the study encountered several difficulties. The study was able to benefit from a questionnaire prepared especially to fit with the survey and having the other vocation of supporting caregivers in their diagnosis and treatment. Our study includes all users suspected or proven to be carriers of SARS-CoV2, but the logistics did not allow the caregivers to complete the questionnaires for all other users taken in charge. However, the diversity of the support services included ensures the representativeness of our sample and limits the selection bias. The disparities concerning the level of certainty concerning SARS-CoV2 infection could be a source of classification bias, the results obtained should therefore be interpreted taking this risk into account.

## 5. Conclusion

It appears the constraints linked to the accommodation conditions and the very long delay of screening tests availability undoubtedly represent a major concern for both associations and their users. The risk inherent to collocations justifies the attribution of individual housing for social structures. At the same time, some users are affected by significant and potentially worsening co-morbidities. Also, by being able to detect infected persons early, it is then possible to implement a truly effective isolation strategy and thus protect other users.[39] Observing the problem through this prism, the allocation of housing and screening tests to structures involved with the most precarious people appears to be a decisive factor in the fight against the spread of SARS-CoV2 and therefore deserves more attention from public authorities. Moreover, associations must also take into account the psychological vulnerabilities and sensitivities of the audiences for which they are responsible, which further complicate the implementation of barrier measures. Perhaps it would be necessary to study the issue in more depth and to propose adapted psychological care programs so that the barrier measures are better perceived and experienced.

## Abbreviations

SARS-CoV2 : *Severe Acute Respiratory Syndrome Coronavirus 2*

Covid-19 : Coronavirus Disease 2019

AAJT : Association of Aid to Young Workers

PRAPS : Regional Program for Access to Prevention and Care for the most Deprived People

RT-PCR : Reverse Transcription Polymerase Chain Reaction

AME : State Medical Assistance

CNIL : National Commission for Information Technology and Liberties

WHO : World Health Organization

NSAID : Non Steroidal Anti-Inflammatory Drugs

AIC : Akaike Information Criterion

## Declarations

### Ethics approval and consent to participate

The study was approved by the Aix-Marseille University institutional review board (*Comité de Protection des Personnes d'Aix Marseille Université, n° 2020-10-09-012*). The database was anonymized and declared to the French regulatory commission (*Commission Nationale Informatique et Libertés, CNIL, n°*

0020010420). Each included subject must have consented to the data concerning him being used in the context of this study. Anyone who did not meet this criteria could not have been included in the study. **Consent for publication**

Not applicable.

### **Availability of data and materials**

The datasets generated and analyzed during the current study are not publicly available due to special authorization to transfer databases given by the CNIL. Upon prior authorization by the CNIL, the dataset would be available from corresponding author on reasonable request.

### **Competing interests**

The authors declare that they have no competing interests.

### **Funding**

The AAJT is the promoter of this care pathway analysis project. The research carried out for this purpose represents one of the components of the PRAPS in which the AAJT is committed and for which the association receives funding. This study is therefore part of a process of leveraging the funding allocated by the PACA Regional Health Agency.

### **Authors' contribution**

**Conceptualization** : EM, IA

**Supervision** : EM, FD, GG

**Regulatory proceedings** : IA, EM

**Methodology** : IA, EM

**Bibliographic reviewing** : IA, EM

**Data collection** : IA, EJ, BP

**Data curation** : IA

**Statistical analysis** : IA

**Interpretations** : IA, FD, GG, EJ, BP, AT

**Writing** : IA

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