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Effects of the 2020 health crisis on acute alcohol intoxication: A nationwide retrospective observational study

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ABSTRACT

Background: Recent data suggest that the COVID-19 pandemic and associated restrictions may have influenced alcohol use and promoted addictive behavior. We aimed to investigate the impact of the pandemic on acute alcohol intoxication (AAI) in France.

Methods: We identified all hospital stays related to alcohol abuse in 2018–2020. Differences in number of hospitalizations between 2019 and 2020 were tested using Poisson regressions. Differences between observed and expected deliveries of drugs used in alcohol dependence in 2020 were also studied.

Results: There was a decrease in the number of hospitalizations for AAI between 2019 and 2020 (−9677 [−11.4%], RR: 0.89 [0.88–0.89]). This decrease was observed among men and women of all age groups, except women ≥ 85 years. We observed an increase in in-hospital mortality during 2020 and more hospitalizations for AAI with certain medical complications, especially during the first 2020 lockdown. There was a drop in observed deliveries of drugs used in alcohol dependence during the first 2020 lockdown.

Conclusions: The decrease in the number of hospitalizations for AAI in 2020 could be explained by several factors: fewer available hospital beds due to COVID-19, individuals with AAI delaying or avoiding medical care due to COVID-19 fears, and decreases driven by younger age groups returning to live with parents and socializing less. While alcohol consumption patterns have changed with the implementation of social distancing measures and lockdowns, the increase in mortality and the share of hospitalizations with complications suggest that these measures had an impact on event severity in a context of strained access to healthcare.

1. Introduction

The COVID-19 pandemic has challenged the health care system and public health policy. In France and worldwide, various measures have been implemented since March 2020 to curb the spread of COVID-19, including lockdowns, curfews, mask wearing, social distancing and

teleworking. However, there has been a phenomenon of psychosocial stress induced by the social measures linked to the containment of the pandemic, financial difficulties, and uncertainty about the future. Studies have generally shown that social isolation and feelings of loneliness were associated with excessive alcohol and/or drug use during the pandemic (Rubin, 2020; Tzu-Hsuan Chen, 2020). Market analyses have

Abbreviations: AAI, acute alcohol intoxication; SARS-CoV-2, Severe Acute Respiratory Syndrome Coronavirus 2; PMSI-MCO, (Programme de Médicalisation des Systèmes d'Information in Medicine, Surgery, Obstetrics); DAS, discharge abstracts; PD, primary diagnosis; RD, related diagnosis; AD, associated diagnosis; ICD-10, International Classification of Diseases Tenth Revision; MILDECA, Mission Interministérielle de Lutte contre les Drogues et les Conduites Addictives; ICU, intensive care unit; ER, emergency room.

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been performed to assess alcohol consumption in 20 key markets (including France), which represented more than 75% of total global alcohol consumption. As a result of government bans and lockdowns, the consumption of alcoholic beverages in these countries declined by an estimated 8% in 2020, rather than by the double digit losses originally expected. A study analyzing the content of the social network Twitter (3301 tweets captured between January 31 and April 23, 2020) highlighted difficulties in coping with alcohol abuse in a context of increasing alcohol sales (Glowacki et al., 2021).

Alcohol use is a very common issue in France. It is the second leading cause of preventable death, after tobacco, resulting in 41,000 deaths per year (Andler et al., 2017). The impact of alcohol consumption on global health is substantial. It contributes to a wide range of problems including acute intoxication, seizures, cancer, delirium, confusion, liver diseases, domestic violence, child abuse, depression and suicide. Among the tools for monitoring alcohol consumption habits, Public Health France (PHF) has implemented a periodic survey system that has been collecting data since 1992. In 2017, the data revealed that alcohol use remained stable compared to previous years, particularly among young adults (under 25 years), following a decade of increases, notably regular drunkenness (Andler et al., 2017). However, while the damage associated with alcohol use is well known, its burden in terms of number of hospitalizations directly related to acute abuse is not clear on a national scale. In France, it is also unclear whether the different territories have been equally affected by these hospitalizations. These questions are particularly important considering that recent data suggest that the COVID-19 pandemic and the imposed and associated restrictions may have influenced alcohol use (Daly and Robinson, 2021). We therefore aimed to explore how the COVID-19 crisis influenced hospitalization trends in France, in terms of both rates and spatial distribution.

At the beginning of the pandemic, PHF launched a study on the trends in the consumption-related behavior of the French population (Santé Publique France (SPF), 2020), focused particularly on the influence of the first national lockdown (from March 17 to May 11, 2020) on alcohol use. They found an increase in alcohol use in individuals aged 18–49 years who were living in larger cities (more than 100,000 inhabitants), with a high socio-professional category and a depressed mood (Guignard et al., 2021). The preliminary results of Global Drug Survey (June 2020), including 6000 French people, showed that alcohol use appeared to increase slightly in number of days of drinking per week. At the same time, binge drinking (five or more drinks on one occasion) declined (Ammar et al., 2020; Tavalacci et al., 2021). Another study conducted in France during the first lockdown showed that nearly 40% of the population had difficulty controlling their consumption, revealing the characteristics of the most vulnerable populations (Association Addictions France, 2021).

However, all of the studies cited above are based on declarative data, collected by questionnaires. There is still a lack of data on the consequences of alcohol use disorders in terms of care-seeking behaviors, particularly hospitalizations for acute alcohol intoxication (AAI) and deliveries of drugs used in alcohol dependence, during the different periods of the pandemic (different lockdowns and curfew periods). We first aimed to investigate, on a national level, changes in hospitalization rates for AAI in comparison to previous similar periods. We also estimated the variations between expected and observed deliveries of drugs used in alcohol dependence in 2020, based on usage over the same periods of the previous two years. Considering the profound effect of the pandemic on hospital care and the supply of available beds, especially in the regions most affected by SARS-CoV-2, we were also interested in studying potential links between local variations in hospitalization rates for AAI and the level of contamination by SARS-CoV-2 using French postal codes data.

2. Methods

2.1. Study design

This paper presents the results of an observational retrospective study comparing the number and characteristics of hospitalizations for AAI during the first year of the COVID-19 pandemic (2020) and for the previous years (2019, 2018).

2.2. Source of data and selection criteria

Our main source of data was the PMSI-MCO (*Programme de Médicalisation des Systèmes d'Information* in Medicine, Surgery, Obstetrics), a database that includes all hospital stays recorded each year in France (including overseas territories) for public and private hospitals. Hospital discharge abstracts (DAs) contain demographic information, such as patient gender and age, medical information like medical procedures and diagnoses, coded as primary diagnosis (PD), related diagnosis (RD, in case of chronic disease) and associated diagnosis (AD), and administrative information such as patient residence (postal code), type of hospital and medical unit.

We identified all hospitalizations for AAI according to the International Classification of Diseases Tenth Revision (ICD-10) codes F10.0 (“Mental and behavioral disorders due to use of alcohol: acute intoxication”), registered as primary diagnosis (PD) in DA for the years 2020, 2019 and 2018 in the whole France, including overseas territories.

Hospitalizations with a medical complication related to AAI were identified according to the ICD-10 codes recorded as primary, related or associated diagnoses. We considered several complications:

- Trauma: ICD-10 codes S00 to T14
- Convulsions: ICD-10 codes F10.06, F10.31, F10.41, G40, G41, R56.8
- Coma: ICD-10 codes F10.05, R40.28
- Delirium: ICD-10 codes F10.03, F10.4
- Self-harm: ICD-10 codes X60 to X84
- Liver damage: ICD-10 codes K70 (except K70.1)
- Alcoholic hepatitis: ICD-10 codes K70.1

Hospitalizations for AAI with complications were studied by differentiating between several periods in 2020 compared to 2019: Before the first lockdown (weeks 1–10); first lockdown (weeks 11–19); summer (weeks 20–35); before the second lockdown (weeks 36–44); second lockdown and last week of year (weeks 45–53).

Deliveries of drugs used in alcohol dependence (DDUAD) were identified in the French national health insurance database (SNDS). All new deliveries with the Anatomical Therapeutic Chemical (ATC) code N07BB were included.

We also identified all hospitalizations related to COVID-19 in order to investigate a potential spatial overlap between hospitalizations for AAI and the spread of the pandemic during 2020. Hospitalizations for COVID-19 were identified with ICD-10 diagnostic codes U07.10, U07.11, U07.12, U07.14, and U07.15.

2.3. Statistical analysis

Differences in number of hospitalizations for AAI between 2020 and 2019 were estimated using Poisson regression. Relative risks obtained with Poisson regression models were used to compare the number of hospitalizations for AAI by month, gender and age class, number of patients, number of hospitalizations in intensive care unit (ICU) or coming from an emergency service before complete hospitalization, and number of hospitalizations for AAI with a complicating diagnosis. Differences between 2020 and 2019 in average length of stay and mean number of hospitalizations per patient were tested with a Student's T-Test. In-hospital mortality following the hospitalization for AAI in 2020 and 2019 was estimated using a Cox proportional-hazards model, taking

into account the length of stay for patients who died in-hospital.

Variations between expected and observed DDUAD in 2020 were calculated for each 2-week period, based on usage over the same period of the previous two years.

Hospitalization rates for AAI and COVID-19 were calculated for each postal code. The rates were standardized for age and sex using national census data from 2017 (*Institut National de la Statistique et des Études Économiques*) as a reference. For each postal code, we also calculated the variation in the number of hospitalizations for AAI from 2019 to 2020. These three indicators were mapped using a quartile discretization to which we added a class for the top decile of the distribution in order to identify the territories most affected by each of the indicators.

All analyses were performed using SAS software (SAS Institute Inc, Version 9.4, Cary, NC).

3. Results

3.1. Hospitalizations for AAI in 2020 versus 2019 and 2018

Overall hospitalizations for AAI dropped by 9 677 between 2019 and 2020 (−11.4%, RR = 0.89 [95% CI: 0.88–0.89]), and by 12,983 between 2018 and 2020 (−14.8%, RR = 0.85 [0.84–0.86]) (Table 1). However, the decrease varied according to the month of the year. For instance, in 2020 compared to 2019 and 2018, there were more hospitalizations in January (+30 [0.5%], NS), and in February (+351 [6.0%], RR = 1.06 [1.02–1.10]), and there were more hospitalizations in July 2020 compared to 2019 (+71 [0.9%], NS). The difference in the number of hospitalizations for AAI between 2020 and 2019–2018 was significantly lower in all the other months of the year. Overall, hospitalizations for AAI decreased very sharply between 2020 and 2019, especially during the period corresponding to the first French lockdown (from March 17 to May 11, 2020), during which there was a sharp rise in hospitalizations for COVID-19 (Fig. 1). The difference was less marked during the second lockdown (from October 30 to December 15, 2020). During the remainder of 2020, there was no “catching up” to numbers recorded in 2019. Hospitalizations for AAI represented 0.54% of all hospitalizations recorded in the PMSI database in France in 2018 and 0.51% in both 2019 and 2020.

3.2. Hospitalizations for AAI in 2020 versus 2019 by age and sex

Except for women aged 85 years and more, there was a decrease in hospitalizations for AAI between 2020 and 2019 in all age and sex categories (Table 2). Overall, the decrease was −6 709 hospitalizations for AAI in men (−11.1%, RR = 0.89 [0.88–0.90]) and −2 968 in women

(−12.2%, RR = 0.88 [0.86–0.89]). The strongest decreases are observed among both men and women aged 15–24 years (men: −1 963 [−26.6%], RR = 0.73 [0.71–0.76]; women: −1 090 [−27.6%], RR = 0.72 [0.69–0.76]).

3.3. Patient and hospital stay characteristics

The decrease in the number of hospitalizations for AAI was also seen in the number of admitted patients between 2019 and 2020 (−8 118 patients [−12.6%], RR = 0.87 [0.87–0.88]) (Table 3). At the same time, the number of hospital stays per patient and the average length of stay increased significantly (respectively 1.31–1.33 [$p = 0.002$], and 0.94–0.98 [$p = 0.0004$]), and there was an increase in in-hospital deaths (+9 [39.1%], RR = 1.02 [1.01–1.03]). The number of stays in ICU decreased (−136 [−15.9%], RR = 0.84 [0.76–0.93]), but the proportion of admission to ICU among all hospitalization for AAI remained stable between 2019 and 2020 (1% both years). There was also a decrease in hospitalizations following a visit to the emergency room (ER) (−8 912 [−11.2%], RR = 0.89 [0.88–0.90]), without any decrease in their share in all stays between 2019 and 2020 (93.8% of stays for AAI in 2019 vs. 94% in 2020). Hospitalizations with a diagnosis of complications also decreased (−2 303 [−11.6%], RR = 0.88 [0.87–0.90]), but the rate of hospitalizations with a complication remained stable (23.5% in 2019, 23.4% in 2020).

3.4. Complications of alcohol use in hospitalizations for AAI, 2020 versus 2019

However, there was a great variability depending on the specific complications and period of hospitalization in the different periods in 2020 (Fig. 2). Except for coma, there was a higher rate of hospitalizations for AAI with all types of complications during the first French lockdown period. In the summer period, there were higher rates of hospitalizations for AAI with convulsions, delirium or alcoholic hepatitis in 2020 compared with 2019. During the second French lockdown, there were higher rates of hospitalization with convulsions, delirium, liver damage and alcoholic hepatitis.

3.5. Comparison of DDUAD between 2019 and 2020

There was an overall drop in DDUAD during the first national lockdown. Although deliveries increased by 16% during the first two weeks, they then decreased by 8.5% in week14–15, by 8.5% in W16–17, by 2.5% in W18–19 and by 13.5% in the first fortnight after lockdown (Table 4). There was an increase in DDUAD during the second national

Table 1
hospitalizations with an alcohol-related primary diagnosis in France, 2018–2020 differences.

	2020		2019			2018			
	N	N	Diff. 2020–2019	% change	Risk Ratio (95% CI)	N	Diff. 2020–2018	% change	Risk Ratio (95% CI)
January	6533	6503	30	0.5	1.00 (0.97–1.04)	6438	95	1.5	1.02 (0.98–1.05)
February	6182	5831	351	6.0	1.06 (1.02–1.10)**	6155	27	0.4	1.00 (0.97–1.04)
March	5042	7166	−2124	−29.6	0.70 (0.68–0.73)***	6571	−1529	−23.3	0.77 (0.74–0.80)***
April	4506	7002	−2496	−35.6	0.64 (0.62–0.67)***	7429	−2923	−39.3	0.61 (0.59–0.63)***
May	6738	7398	−660	−8.9	0.91 (0.88–0.94)**	7794	−1056	−13.5	0.87 (0.84–0.89)**
June	7493	7772	−279	−3.6	0.96 (0.93–1.00)*	8245	−752	−9.1	0.91 (0.88–0.94)**
July	7758	7687	71	0.9	1.01 (0.98–1.04)	8409	−651	−7.7	0.92 (0.90–0.95)**
August	7232	7867	−635	−8.1	0.92 (0.89–0.95)**	7703	−471	−6.1	0.94 (0.91–0.97)**
September	6552	7240	−688	−9.5	0.91 (0.88–0.94)**	7763	−1211	−15.6	0.84 (0.82–0.87)**
October	5895	6911	−1016	−14.7	0.85 (0.82–0.88)**	7447	−1552	−20.8	0.79 (0.77–0.82)**
November	5368	6443	−1075	−16.7	0.83 (0.80–0.86)**	6709	−1341	−20.0	0.80 (0.77–0.83)**
December	5707	6863	−1156	−16.8	0.83 (0.80–0.86)**	7326	−1619	−22.1	0.78 (0.75–0.81)**
Total	75,006	84,683	−9677	−11.4	0.89 (0.88–0.89)***	87,989	−12,983	−14.8	0.85 (0.84–0.86)***

CI: Confidence Interval;

* $p \leq 0.05$;

** $p \leq 0.01$;

*** $p \leq 0.0001$.

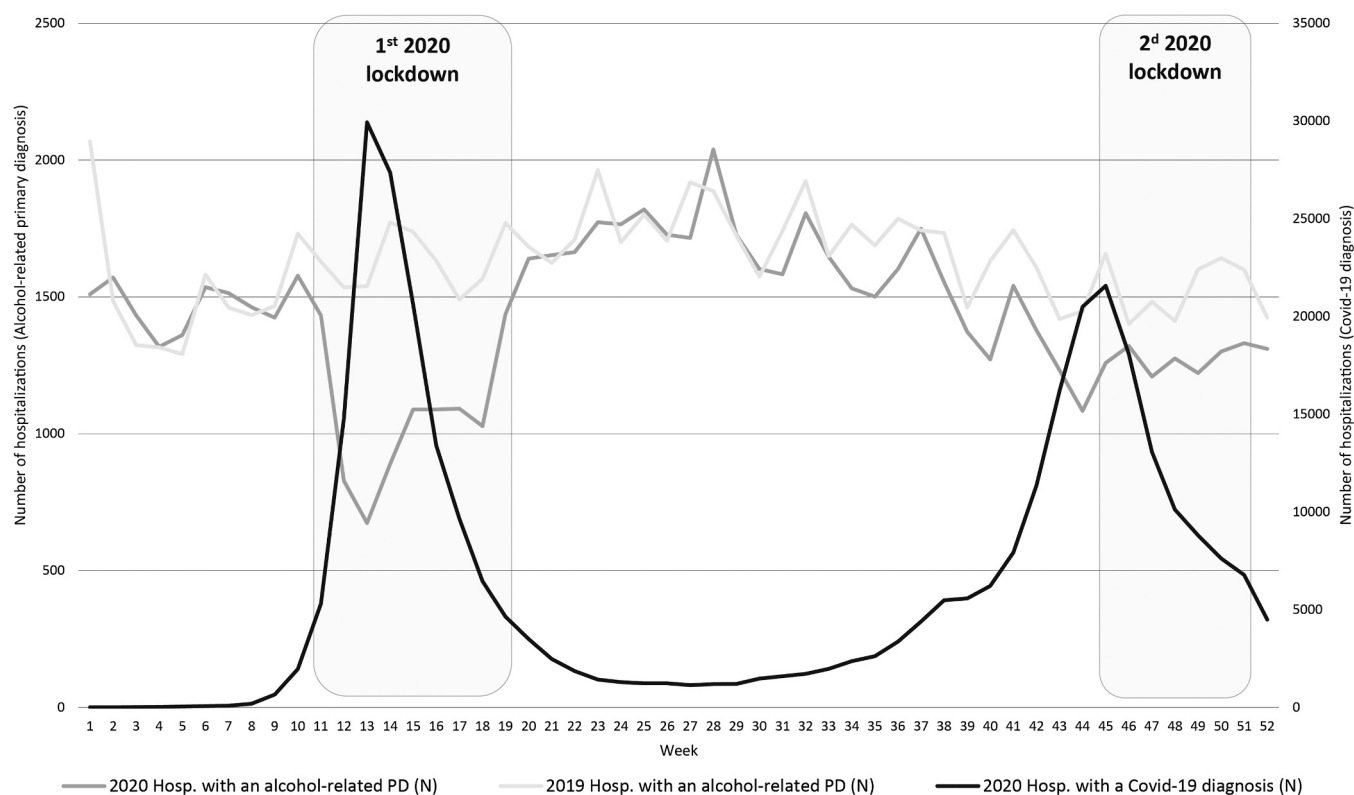


Fig. 1. Hospitalizations for acute alcohol intoxication (2020 versus 2019) and for Covid-19 (2020) in France.

lockdown (W44–45: +10.9%; W46–47: +2.8%; W48–49%: +5.7%; W50–51: +5.4%). For 2020 as a whole, DDUAD increased by 9 555.

3.6. Spatial analysis of the rates of hospitalization for AAI

The hospitalization rates for AAI per 10,000 inhabitants in 2018–2020 were clearly higher in the western, northern and central parts of France (for instance in Brittany, North Limousin and Champagne-Ardenne regions) (Fig. 3). Fig. 4 shows that the variation in the number of hospitalizations for AAI in 2019–2020 was not the same everywhere and that all French regions recorded increases and decreases. There were no obvious spatial trends or association with the spatial spread of COVID-19 (Fig. 5).

4. Discussion

Alcohol was the seventh leading cause of lost healthy years of life worldwide in 2016. In France, the consequences of excessive alcohol use remain a major public health issue with considerable human and economic costs. Heavy drinking is the root cause of a great number of hospitalizations, to treat either the addictive behavior or the physical and psychiatric complications (Andler et al., 2017). National and international studies have confirmed an increase in alcohol use during the COVID-19 pandemic and the associated lockdown periods (Guignard et al., 2021; Jacob et al., 2021). In France in September 2020, a survey carried out by the *Mission Interministérielle de Lutte contre les Drogues et les Conduites Addictives* (MILDECA) and various institutional structures, via the Ipsos institute, focused on the working conditions and use of psychoactive substances in close to 4 000 employees and public officials over the period since the first lockdown. During the 12 months preceding the survey, which was in part the pandemic, alcohol was by far the most used substance, reported by 65% of subjects. During the lockdown period, tobacco (30%) and psychotropic drug use (20%; mainly anxiolytics and hypnotics) were also on the rise (MILDECA,

2020). Association Addictions France published the results of a survey conducted in February 2021 by the BVA Institute on the addictive behaviors of French people. Keeping in mind that 10% of the French population has already consulted for a substance use disorder, more than 30% of substance users significantly increased their consumption of tobacco, cannabis and/or psychotropic drugs during the first year of the COVID-19 crisis (Association Addictions France, 2021). A French study carried out a few years before the pandemic showed that the consequences of excessive alcohol consumption are one of the leading reasons for hospitalization in France (Paille and Reynaud, 2015). However, our data suggest that these trends did not translate into increased hospitalizations for AAI during the pandemic. On the contrary, the number of hospitalizations decreased by 11.4% between 2019 and 2020, and a decrease was also found compared to 2018. Moreover, the decrease started precisely at the beginning of the first lockdown and persisted after its end. The situation was similar, though to a lesser degree, during the second lockdown until the end of the observation period in December 2020.

A number of non-exclusive hypotheses may be put forward. Our first hypothesis is that the constant presence of several individuals within the same home during lockdown may have limited the risk of developing an alcohol use disorder requiring treatment, including hospitalization. Social distancing may also have had some effects on stressors that influence alcohol use in some people. Imposed and associated restrictions during the first national lockdown may have influenced alcohol consumption, as described in the UK (Daly and Robinson, 2021), in different ways depending on the socio-demographic group and their mental health. Among alcohol users in France, 10.7% increased their consumption and 24.4% reported a decrease, while it remained stable for 64.8% of subjects (Guignard et al., 2021). It is also important to keep in mind that many people with an AAI may have stayed at home due to fears about the epidemic. In many countries, the general population has experienced a significant increase in fear and anxiety during the COVID-19 crisis as a direct result of the virus and the measures taken to

Table 2

Number of hospitalizations with an alcohol-related primary diagnosis in France, 2019–2020 differences by gender and age.

Gender and age group (year)	N in 2020	N in 2019	Difference (2020–2019)		Risk Ratio (95% CI)
			N	% change	
Men					
15–24	5426	7389	-1963	-26.6	0.73 (0.71–0.76)***
25–34	7014	7826	-812	-10.4	0.90 (0.87–0.93)***
35–44	10742	11959	-1217	-10.2	0.90 (0.88–0.92)***
45–54	14424	15892	-1468	-9.2	0.91 (0.89–0.93)***
55–64	10416	11141	-725	-6.5	0.93 (0.91–0.96)***
65–74	4406	4674	-268	-5.7	0.94 (0.90–0.98)**
75–84	952	1158	-206	-17.8	0.82 (0.75–0.90)***
85+	189	239	-50	-20.9	0.79 (0.65–0.96) *
Total	53,569	60,278	-6709	-11.1	0.89 (0.88–0.90)***
Women					
15–24	2853	3943	-1090	-27.6	0.72 (0.69–0.76)***
25–34	2324	2674	-350	-13.1	0.87 (0.82–0.92)***
35–44	3729	4038	-309	-7.7	0.92 (0.88–0.97)**
45–54	5819	6211	-392	-6.3	0.94 (0.90–0.97)**
55–64	3715	4192	-477	-11.4	0.89 (0.85–0.93)***
65–74	2114	2363	-249	-10.5	0.89 (0.84–0.95)**
75–84	701	785	-84	-10.7	0.89 (0.81–0.99) *
85 +	182	199	-17	-8.5	0.91 (0.75–1.12)
Total	21,437	24,405	-2968	-12.2	0.88 (0.86–0.89)***
Total	75,006	84,683	-9677	-11.4	0.89 (0.88–0.89)***

CI: Confidence Interval;

* $p \leq 0.05$;

** $p \leq 0.01$;

*** $p \leq 0.0001$.

prevent widespread infection (Shafraan et al., 2021). In France, fear of going to the ER may have been exacerbated during the pandemic even though access to medical care was maintained. An American retrospective multicenter study in 20 ERs demonstrated the effect of “stay at home” orders on behavioral health complaints, including suicidal ideation and alcohol use in patients presenting to the ER (Smalley et al., 2021). Reports from ERs in Paris showed a 42% decrease in consultations for suicide attempts during the first lockdown (Pignon et al., 2020). Decreasing levels of self-harm hospitalization was weakly correlated with higher rates of COVID-19 hospitalizations across administrative departments. Therefore, it cannot be excluded that COVID-19 may have negatively impacted the usual care given to suicide attempters, as observed for overall hospitalizations for self-harm in France during the first months of 2020 (Jollant et al., 2021). It is also unclear whether patients with AAI were simply not seeking medical care, using alternative methods of obtaining health care through tele-visits, were refusing to be hospitalized because of the context or could not be hospitalized due to reduced availability of beds. Again, it cannot be excluded that COVID-19 may have negatively impacted the usual care provided to people with AAI.

Our cartography shows that there was no spatial overlap between the

Table 3

Number of hospitalizations with a substance abused-related primary diagnosis (PD) in France, stays characteristics and 2019–2020 difference.

	Hosp. with an alcohol-related PD (2020, N = 75,006)		Hosp. with an alcohol-related PD (2019, N = 84,683)		2019–2020 difference Risk Ratio (95% CI)
	N	%	N	%	
Characteristics of hospital stays					
Patients (N)	56,500		64,618		0.87 (0.87–0.88) ^{***} £
Hospital stays per patient	1.33 (± 1.31)		1.31 (± 1.23)		T-Test = −2.33, p = 0.02 \$
Average length of stay	0.98 (± 2.25)		0.94 (± 2.05)		T-Test = −3.56, p = 0.0004
Hospitalization in intensive care	719	1.0	855	1.0	0.84 (0.76–0.93) ^{**} £
Death at discharge	32	0.04	23	0.03	1.02 (1.01–1.03) ^{***} µ
Origin					
Emergency services	70,485	94.0	79,397	93.8	0.89 (0.88–0.90) ^{***} £
Medical complications					
Any complication	17,556	23.4	19,859	23.5	0.88 (0.87–0.90) ^{***} £
Trauma	11,382	15.2	13,039	15.4	0.87 (0.85–0.90) ^{***}
Convulsions	1666	2.2	1652	2.0	1.01 (0.94–1.08)
Coma	1534	2.0	1884	2.2	0.81 (0.76–0.87) ^{***}
Delirium	698	0.9	663	0.8	1.05 (0.95–1.17)
Self-harm	2978	4.0	3382	4.0	0.88 (0.84–0.93) ^{***}
Liver damage	694	0.9	701	0.8	0.99 (0.89–1.10)
Alcoholic hepatitis	169	0.2	202	0.2	0.84 (0.68–1.03)

CI: Confidence Interval;

\$ T-Test

£ Poisson regression

μ Cox model

* $p \leq 0.05$;

** $p \leq 0.01$;

*** $p \leq 0.0001$.

variation in the number of hospitalizations for AAI in 2019–2020 and the spread of COVID-19, and we can therefore assume that the pandemic did not have a territorial impact on hospitalizations for alcohol use disorders overall. While the regions most affected by COVID-19 experienced bed closures in addictology to cope with the influx of patients, and considering that a stressful context could have encouraged addictive behavior, it did not result in a noticeable increase or decrease in hospitalizations for AAI. Local variations expressed in percentages can be equated to fluctuations in small numbers of hospitalizations. The areas most affected by hospitalizations for AAI are the areas most associated with alcohol use disorders in France (Paille and Reynaud, 2015), so mapping using postal codes (Fig. 3) provides information that could be used in the future for the implementation of targeted prevention programs in the higher-risk territories.

When we look at the number of hospitalizations for AAI by gender and age group, there was a significant overall decrease between 2019 and 2020. In France, men are typically more likely to be hospitalized than women, which could be explained by the fact that men are also more inclined to consume alcohol, and that complications induced by alcohol consumption occur earlier (Paille and Reynaud, 2015). The strongest decreases were observed among men and women aged 15–24 years. For students, social distancing and living with parents has been shown to be a protective factor against excessive alcohol consumption (White et al., 2020). An American study including 1958 students showed that those with fewer depressive and anxious symptoms in the previous

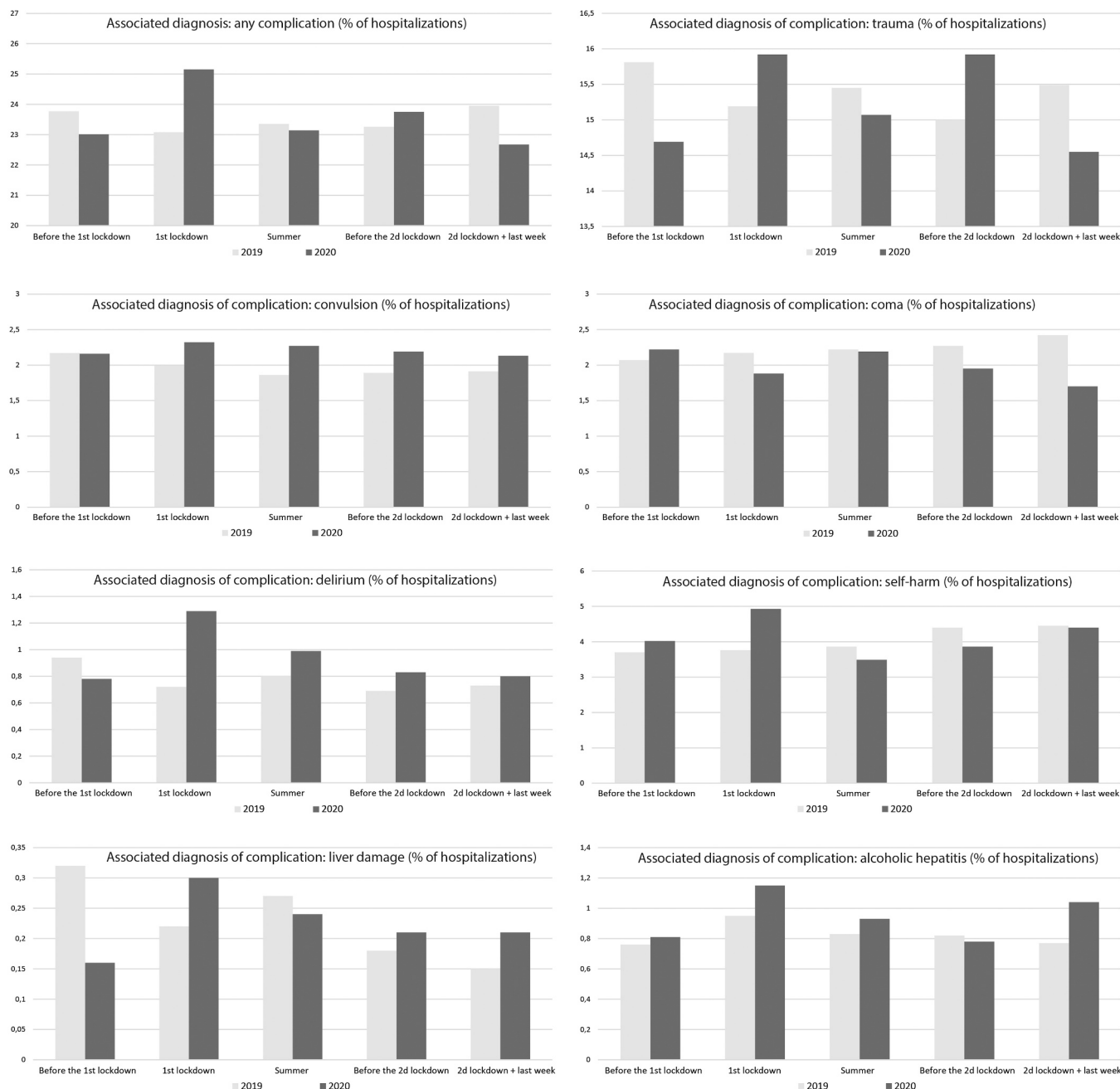


Fig. 2. Proportion of hospitalizations for acute alcohol intoxication with a complication diagnosis in France (2020 versus 2019).

30 days reported a decrease in their alcohol use. In addition, students with better social support reported less alcohol consumption (Lechner et al., 2020). In individuals aged 65 and older, the number of hospitalizations also decreased in both men and women, but to a lesser extent than for the other age groups. It must be noted that older adults are the most impacted by the COVID-19 both in terms of hospitalizations and mortality. Older adults with alcohol use disorders may also have particularly suffered from COVID-19-related restrictions, which heightened social isolation and reduced access to medical care. In nursing homes, a strict lockdown with a full ban on visitors and group dining was ordered by the government, with potentially devastating consequences in terms of suicidal behaviors (Jollant et al., 2021). Studies have found that, unlike in other age groups, there was not a significant drop in the number of hospitalizations for self-harm in men and women aged 65 and older.

Regarding access to hospital care, our first observation was that

hospital stays per patient and average length of stay increased significantly at the same time even though the number of hospitalizations for AAI decreased between 2019 and 2020. This trend suggests that the events resulting in hospital stays were more severe. In France, the protocols for the management of AAI are codified and have been the subject of recommendations. In the presence of aggravating factors or comorbidities, a specialized intervention is systematically carried out by an addictology team, a psychiatry team, or an emergency team trained in addictology. It is usually recommended to hospitalize any individual with AAI presenting one of the following criteria: any health complications; and/or blood alcohol level above 3 g/L; and/or lack of reliable monitoring at home or in a place of residence far from a hospital; and/or any pathological alcohol intoxication and/or existence of an associated psychiatric disorder. Moreover, individuals who are comatose with inhalation pneumonia, with repeated convulsive seizures or deep hypothermia must be hospitalized in the ICU (Sureau et al., 2006; ANAES,

Table 4

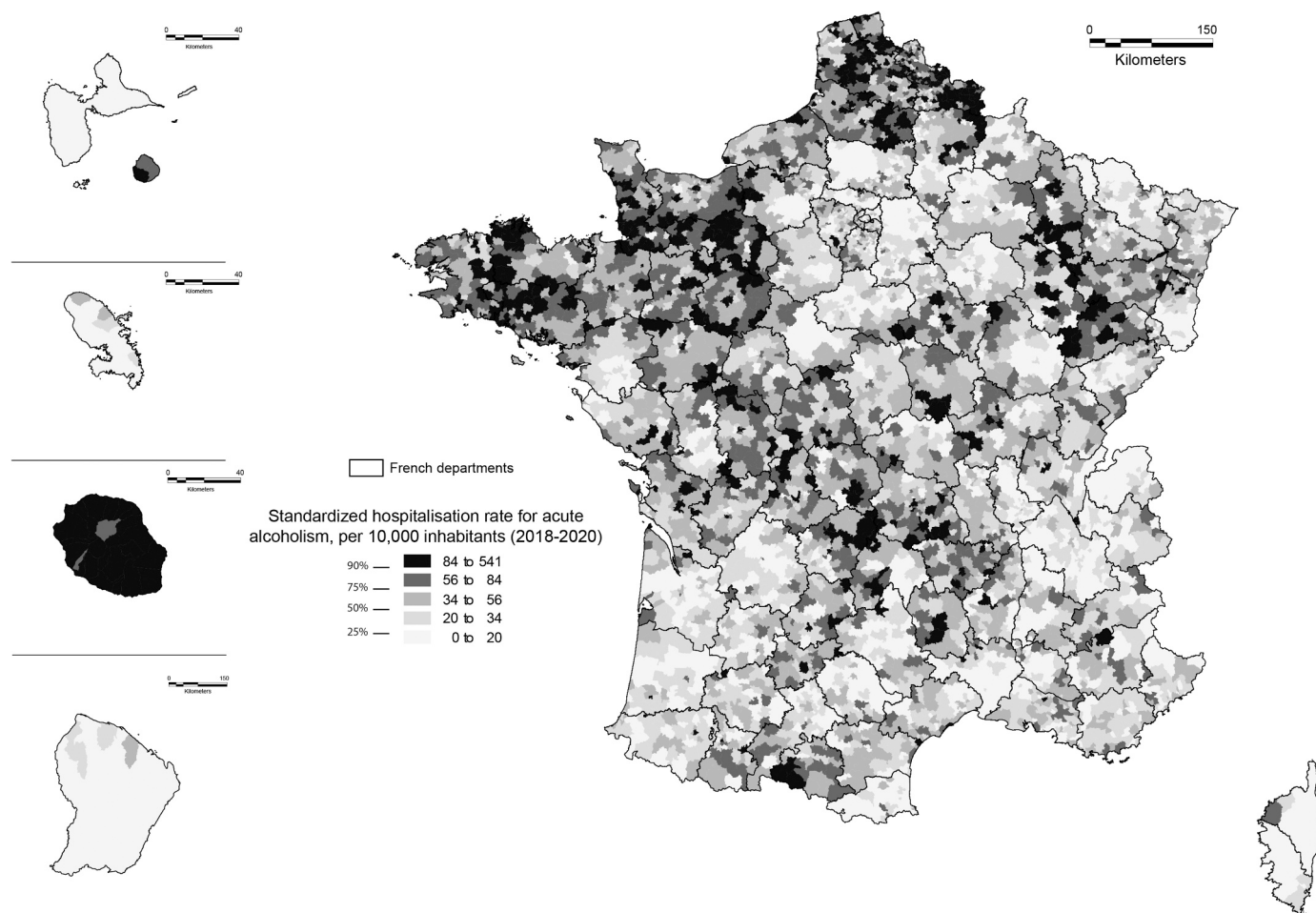
differences between observed and expected deliveries of drugs used in alcohol-dependence (DDUAD) during the Covid-19 epidemic in France.

Period	Weeks	DDUAD: difference between observed and expected (2020)
1st lockdown (week 12–19)	W12–13	+16.0%
	W14–15	-8.5%
	W16–17	-8.5%
	W18–19	-2.5%
	W20–21	-13.5%
	W22–23	+2.4%
	W24–25	+7.2%
	W26–27	+1.5%
	W28–29	-3.3%
	W30–31	+12.2%
	W32–33	+10.9%
	W34–35	-4.4%
	W36–37	+1.7%
	W38–39	+1.9%
	W40–41	+2.1%
2d lockdown (week 44–51)	W42–43	+0.7%
	W44–45	+10.9%
	W46–47	+2.8%
	W48–49	+5.7%
	W50–51	+5.4%

2001). In our study, we observed a decreased number of ICU stays and a decrease in hospitalizations following a visit to the ER. Specific protocols and the number of ICU beds reserved for patients with COVID-19

may have limited the options for delivering appropriate supportive care for other patients (Liu et al., 2021). However, while the number of hospitalizations in the ICU following a visit to the ER decreased between 2019 and 2020, their share remained stable in all hospitalizations for AAI. This could mean that the most severe patients were able to access ICU care and that the emergency system held up during the early months of the pandemic.

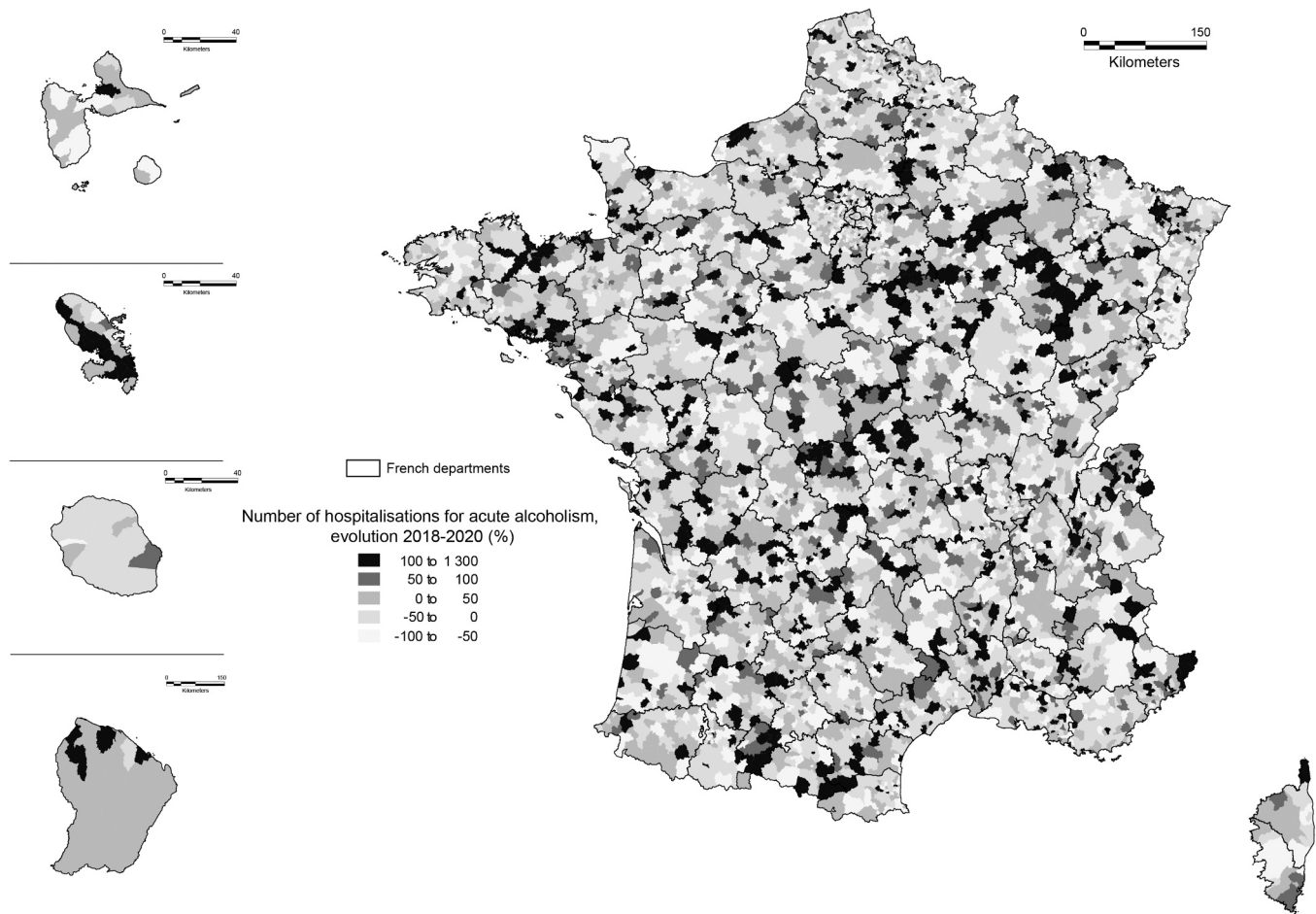
Regarding public health issues related to alcohol use, it is often stated that disease and injury conditions mostly or partially due to alcohol use are more problematic than alcohol-specific conditions. A wide range of diseases and injury categories are affected by alcohol use disorders, including trauma, convulsions, coma, delirium, self-harm, and long term complications such as liver damage, and alcoholic hepatitis (Rehm, 2011). In our data from 2020, the proportion of stays with complications varied over time. Except for coma, there was a higher rate of hospitalizations for AAI with convulsion, delirium, and alcoholic hepatitis during the two French lockdowns and the summer period compared with 2019. The increase in the share of stays for AAI with complications during both lockdowns suggests that access to hospitalization was guaranteed for the most severe AAI during the first waves of the pandemic. Moreover, we observed that pharmacy delivery of drugs for alcohol dependence remained relatively stable in 2020. The delivery of drugs was also analyzed in a study conducted by the French national health insurance system (Weill et al., 2021), which revealed that the rates have increased sharply since the beginning of 2021 (+18,300 deliveries between January and April 2021). This increase may reflect the major psychological impact of the COVID-19 epidemic on the



A. Roussot, 2021

Sources : French national agency for hospital data (ATIH), French national census institut (INSEE, 2017 population census)

Fig. 3. Map of hospitalization rates for acute alcohol intoxication in France (2018–2020).



A. Roussot, 2021

Sources : French national agency for hospital data (ATIH), French national census institut (INSEE, 2017 population census)

Fig. 4. Map of the variation in number of hospitalizations for acute alcohol intoxication in France (2019–2020).

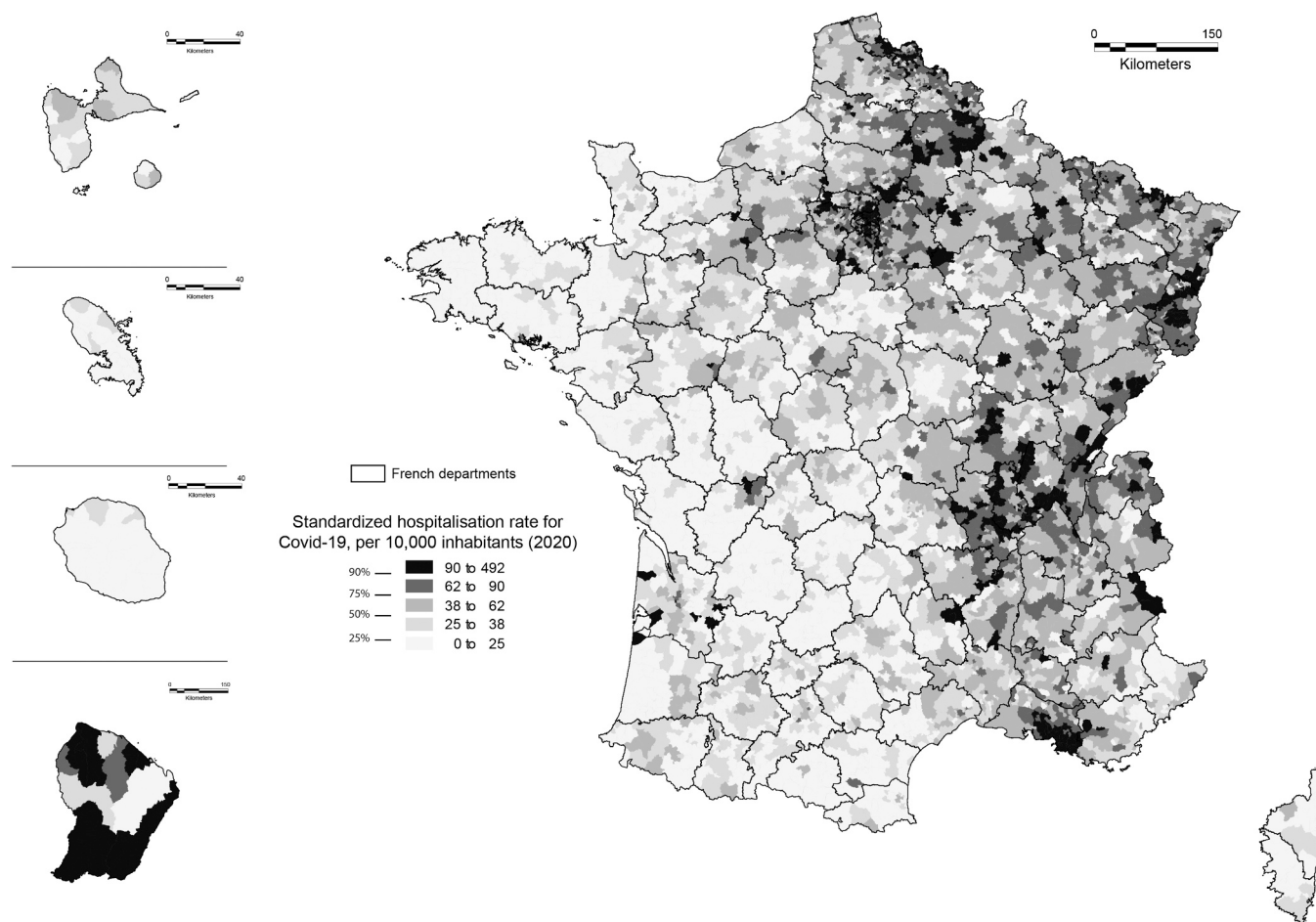
population and its social, occupational and economic consequences.

Regarding hospital mortality, in-hospital deaths related to alcohol use increased during the early months of the COVID-19 pandemic in France. This may suggest that access to beds was restricted to the most severe patients. Patients therefore had to meet higher severity criteria in order to be hospitalized compared to previous years. For this reason, an indication bias by severity should be considered to interpret our results. Lockdown was thus not a protective context but rather a time during which only the most severe patients were admitted to hospital. The analysis of non-COVID-19 causes of death could include more misdiagnosed complications of AAI compared to previous years. There may also have been an overlap between COVID-19 and alcohol or other substance use disorders. Individuals with a substance use disorder are considered to be at-risk populations. Because of direct challenges to respiratory health, they may be especially susceptible to infection by the virus that causes COVID-19 and associated complications, including death (Volkow, 2020). Moreover, at the start of the pandemic, nearly 60% of COVID-19 patients admitted to intensive care died. Up to 31 May 2020, mortality in patients admitted to ICU with COVID-19 was 41.6%. Of course, there have been improvements in the management of COVID-19 patients since then. The situation in the ICU may therefore have changed, as indicated by a systematic review and meta-analysis of 52 observational studies including 43,128 patients (Armstrong et al., 2021). Finally, we have to take into account that mortality attributable to alcohol is higher in France than elsewhere in Europe (41,000 deaths per year; 30,000 men and 11,000 women).

The present study has several strengths. To our knowledge, this is the

first study on AAI during the COVID-19 pandemic. Administrative data collection may be hindered by delays in data collection, but the data collected over the entire year 2020 have been already validated before its transmission for budgetary allocation. Data pertaining to medicine, surgery, and obstetrics in all French primary and comprehensive public and private hospitals were included, so the data is nationally exhaustive. The possible influence of a seasonal effect was also reduced by comparing data from 2020 with data from the two previous years for each month. However, several limitations have to be underlined. This nationwide study is a descriptive, retrospective, observational study, and there was no evaluation of type of alcohol use disorder or its intensity. A potential misclassification-related or under-detection-related bias may have occurred, especially for comorbidities. Even so, this misclassification bias is likely to be non-differential for the majority of the comorbidities seeing as it would likely have affected data collection in the same way during the previous years. Under-detection of AAI is possible but likely minimal thanks to the long post-lockdown period studied, resulting in more complete data capture. In fact, the PMSI-MCO is used for the allocation of hospital budgets and encourages high levels of data coherence, accuracy, and exhaustiveness. Another limitation is the restriction to hospital data, so we did not have access to out-of-hospital mortality and its causes to see if there was an increase in at-home deaths in individuals who were likely unable or unwilling to access care.

To conclude, we observed an overall decrease in the number of hospitalizations for AAI in France during the COVID-19 pandemic, which could be explained by several factors: exacerbated fear of going to



A. Roussot, 2021

Sources : French national agency for hospital data (ATIH), French national census institut (INSEE, 2017 population census)

Fig. 5. Map of hospitalization rates for Covid-19 in France (2020).

the ER, difficulties in finding transportation to go to the hospital, the priority given to patients with COVID-19 in the ER, specific protocols and the number of ICU beds reserved for patients with COVID-19, and the public messages to stay at home in order to avoid COVID-19 contamination and additional pressure on hospitals. We also observed an increased number in-hospital deaths related to alcohol use during the early months of the COVID-19 pandemic. This is in accordance with the increased severity of hospitalized patients with an increase of the proportion of complications of alcohol use recorded in the hospital stays for AAI. In this context of selected and restricted access to beds, hospitalized patients for AAI had very severe health conditions. Being admitted to hospital for AAI certainly required a more severe state compared to previous years. However, these results may be misleading, and vulnerable populations may need extra attention and care. Overall, the prevention of alcohol use disorders should remain a priority.

Ethics approval and consent to participate

The access to the ATIH (*Agence Technique de l'Information sur l'Hospitalisation*) hospital data platform was approved by the National Committee for data protection (registration CNIL number 2204633) and therefore was conducted in accordance with the Declaration of Helsinki. Written consent was not needed for this study.

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CRediT authorship contribution statement

Laurent Karila, Yann Mikaeloff and Catherine Quantin were involved in the conception and design of the study. Catherine Quantin was the coordinator of the study. Adrien Roussot, Anne-Sophie Mariet, Catherine Quantin were responsible for the data collection, Laurent Karila, Adrien Roussot, Catherine Quantin and Anne-Sophie Mariet wrote the first draft. Adrien Roussot was in charge of the analysis. Adrien Roussot, Anne-Sophie Mariet and Catherine Quantin accessed and verified the data. Laurent Karila, Anne-Sophie Mariet, Amine Benyamina, Bruno Falissard, Yann Mikaeloff and Catherine Quantin were involved in the interpretation, critically reviewed the first draft, and approved the final version.

Declaration of Interests

All authors have nothing to declare.

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