Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Progress in Neuropsychopharmacology & Biological Psychiatry 106 (2021) 110070

Contents lists available at ScienceDirect

Progress in Neuropsychopharmacology & Biological Psychiatry

journal homepage: www.elsevier.com/locate/pnp

Addictions in the COVID-19 era: Current evidence, future perspectives a comprehensive review

Jasmina Mallet[a,b,*], Caroline Dubertret[a,b], Yann Le Strat[a,b]

[a] AP-HP, Department of Psychiatry, Louis Mourier Hospital, Université de Paris, Faculté de Médecine, Colombes, France
[b] Institute of Psychiatry and Neurosciences of Paris (IPNP, Inserm U1266), 102 rue de la Santé, 75014 Paris, France

ARTICLE INFO

Keywords:
Addictions
COVID-19
SARS-CoV2
Opioids
Tobacco
Alcohol
Lockdown

ABSTRACT

Background: In the context of the COVID-19 worldwide pandemic, an up-to-date review of current challenges in addictions is necessary. While large scale disasters may have an impact on substance use and addictions, the use of some substances is also likely to modify the risk of COVID-19 infection or course. Many countries have imposed lockdowns. Whether this quarantine or the end of lockdown measures will have an impact on substance use is discussed. The aim of this review is to gather knowledge for clinicians and to guide public health policies during/after lockdown.

Methods: PubMed was reviewed in August 6th (2020), to determine the current evidences and observations concerning the addictions and SARS-CoV2. We used all the names of the severe acute respiratory syndrome of coronavirus 2 (SARS-CoV2 previously 2019 nCoV), the name of the coronavirus disease 2019 (COVID-19), and common substances of abuse. For the physiopathological parts, searches were conducted using key words such as "infection" or "pneumonia". For the lockdown effects, key words such as "quarantine", "disaster" or "outbreak" were used.

Results: Overall, pathophysiological data showed an increased risk of infections for individuals with Substance Use Disorders (SUD) and a possible protective role of nicotine. During lockdown, there is a substantial risk of increasing SUDs. Individuals with opioid use disorder are particularly at risk of relapse or of involuntary withdrawal. After lockdown, increase of use may be observed as far as years after. Individuals with addictions are at higher risk of multimorbidity and mortality during COVID outbreak.

Conclusion: This review describes useful strategies in clinical practice, including a systematic assessment of addiction comorbidity during this almost worldwide lockdown/pandemic. This review also highlights important areas for future research.

1. Introduction

Large scale disasters are always accompanied by health consequences, including addictions (Galea et al., 2020). In the ongoing coronavirus COVID-19 worldwide pandemic, some unique clinical features have been observed (Mattiuzzi and Lippi, 2020). Addictions are highly prevalent in Western countries (Kyu et al., 2018). Alcohol is a psychoactive molecule ingested by 2.4 billion people globally, and alcohol use disorders are the most prevalent substance use disorder (SUD) (GBD 2016 Alcohol and Drug Use Collaborators, 2018). Alcohol is the drug that causes the most harm in Western countries (Kypri and McCambridge, 2018). There is also a high prevalence of tobacco smoking (around 25% in Europe) (Gallus et al., 2020). Tobacco being associated with chronic lung diseases (Ni et al., 2020), physicians may expect more smokers in severe COVID-19 forms. However, current smoking appears to be a protective factor against SARS-CoV2 infection (Changeux et al., 2020). Opiate use disorders have been the focus of recent expert editorials (GBD 2016 Alcohol and Drug Use Collaborators, 2018; Volkow, 2020). Health and social consequences of the pandemic are not clearly known. Lockdown policies aim at limiting the pandemic, but may have an impact on substance use, and therefore interfere with global prognosis. Social distancing guidelines and telehealth may also interfere with usual care, especially in elder with SUD who may find themselves cut off from support if they are unable to effectively use online treatment and self-help resources (Satre et al., 2020). Overall, the association of COVID-19 and SUDs raises several questions in medical practice, and from a public health perspective.

In the above-mentioned context, a timely, up-to-date picture of the

* Corresponding author at: CHU Louis Mourier, 178 rue des Renouillers, 92700 Colombes, France.
E-mail address: Jasmina.mallet@aphp.fr (J. Mallet).

https://doi.org/10.1016/j.pnpbp.2020.110070
Received 4 June 2020; Received in revised form 7 August 2020; Accepted 9 August 2020
Available online 12 August 2020

bilateral impact of substance use and COVID-19 is required. Effective interventions should be scaled up to prevent and reduce substance use disease burden associated with the COVID-19 crisis.

2. Methods

We conducted a review of literature for studies concerning main addictions and COVID-19 on August 6th, 2020. We focused on each of the following substances: alcohol, tobacco, cannabis, opiates, cocaine/crack, and gambling. We used all the names of the severe acute respiratory syndrome of coronavirus 2 (SARS-CoV2 previously 2019 nCoV) and the name of the coronavirus disease 2019, namely COVID-19 (Testino and Pellicano, 2020). An electronic search was conducted in Medline (PubMed interface), using the MESH (Medical Subject Headings) search terms ("coronavirus 2019" OR "COVID-19" OR "2019-nCoV" OR "SARS-CoV-2") AND "substance use" OR "SUD" OR "tobacco smoking" OR "cigarette "OR 'smoking' OR 'nicotine'/'alcohol'/'cannabis' OR 'THC'/"opiates" OR "opioid"; between 2019 and the present time (i.e., June 4, 2020), with language restriction (English or French). The title, abstract and full text of all documents were scrutinized and selected if relevant. The reference list of the identified studies was also analyzed for detecting other potentially eligible articles.

For the physiopathological parts, Medline searches were conducted for each substance and key word such as "infection" or "pneumonia" were used. For the lockdown effects, key words such as "quarantine", "disaster" or "outbreak" were used.

Finally, an electronic search was conducted using the previously mentioned keywords and the word "addictions", "stimulants", "gambling", "crack", and "cocaine", to increase the chances to find relevant information.

3. Results and observations

3.1. Alcohol

Sixty articles were found, thirty-seven of them were excluded after title, abstract or full text reading since they did not deal with alcohol consumption. Many of them were comments or editorials. Rumors on social media have initially proliferated on a preventive effect of alcohol, leading to dangerous behaviors across the world (Delirrad and Mohammadi, 2020; Mungmungpuntipantip and Wiwanitkit, 2020). Publicity about alcohol-containing hand sanitizing to protect the spread of the virus may have contributed to the erroneous belief that consuming alcohol might protect against COVID-19 (Chick, 2020). With the lockdown, some hospitals closed their alcohol-detox beds, and attendance at outpatient clinics was also curtailed. Patients with alcohol use disorder usually have a limited access to care, with less than one in five being adequately treated (Finlay and Gilmore, 2020). The COVID-19 crisis reinforces the need to adequately support individuals with alcohol use disorder.

3.1.1. Pathophysiology

Consumers that exceed the limit of 20–40 g/day of pure alcohol for females and 30–60 g/day for males are considered harmful drinkers (chronic heavy drinking or CHD) and have an increased risk of infections (Testino and Pellicano, 2020). Authors report a dose-dependent correlation between viral infections and alcohol consumptions in their previous study (hepatitis C) (Testino et al., 2016). Furthermore, alcohol consumption increases pneumonia according to a systematic review and a meta-analysis (Simou et al., 2018). This risk is mediated through an action on immune system, but also through an increased risk of pneumonia, malnutrition and, on a long-term basis, advanced alcohol-related liver diseases (Simou et al., 2018; Testino and Pellicano, 2020). More specifically, an early study demonstrated a correlation between alcohol consumption (for participants without alcohol use disorder) and the amount of ACE2 present in the body (in particular in the respiratory site)(Okuno et al., 1986). The *ACE2* gene encodes the angiotensin-converting enzyme-2 (ACE2), which is a target receptor/enzyme for SARS-CoV2. ACE2 is a critical mediator of the renin-angiotensin system (RAS) signaling in the body and can be affected by ibuprofen or diabetes condition (Cai, 2020a).

Overall, and as recently postulated (Testino and Pellicano, 2020), harmful drinking may increase the risk of pulmonary infection and worsen COVID-19 prognosis, although this remains hypothetical and unconfirmed by a recent clinical study on lifestyle risk factors (Hamer et al., 2020). In this cohort study, on 387.109 individuals, 760 were hospitalized for COVID-19. Heavy alcohol use (assessed several years before) was not associated with an increased risk of hospitalization for COVID (OR = 1.12 (0.93–1.35)). Heavy alcohol use (assessed several years before) was not associated with an increased risk of COVID-19 infection or COVID-19 related hospitalization (OR = 1.12 (0.93–1.35)). It should be noted that participants had often stopped drinking due to prescribed medication and underlying health conditions.

3.1.2. Clinical presentation in the context of COVID-19

Clinicians must focus on risk factors of infections, among them alcohol is frequent and easy to assess (using questionnaires such as the WHO's AUDIT or its short form in three questions (Bohn et al., 1995) or recent validated tools for telephone administration during the pandemic (Deacon et al., 2020)). The current crisis requires unusual therapeutic adaptations to prevent encephalopathy for heavy drinkers (Columb et al., 2020). When facing an alcohol use disorder (previously known or not), physicians must be aware of the risk of increasing consumption to alleviate anxiety symptoms, especially during lockdown (Brooks et al., 2020). The absence of structured professional environment or social activity increases the risk of lapse and relapse to alcohol use (Da et al., 2020). Entities encouraging the use of alcohol such as "zoom happy hour" or "boozing at home" have become popular in social media. A Chinese online survey examining 1074 individuals during lockdown showed higher rates of anxiety, depression, hazardous and harmful alcohol use (assessed with the AUDIT), and lower mental wellbeing (Ahmed et al., 2020). Temporary bans on alcohol were decided, mainly with the aim of decreasing potential domestic and other types of violence (Rehm et al., 2020). While South Africa or Thailand decided to ban alcohol, other countries preferred to avoid the social stigma that may decrease the access to medical care and lead to an increased risk of complicated withdrawals, as reported in India (Balhara et al., 2020; Narasimha et al., 2020; Varma, 2020). According to Google, South African queries on the search for alcohol distillation at home has risen by 500% over the lockdown period (COVID-19 Lockdown: South Africans are Asking Google How to Make Their Own Alcohol as Booze Ban Bites [WWW Document], 2020). In other countries, lockdown might lead to an increased use of alcohol. In the US, alcohol sales have increased of 55% in one week (Associated Press, 2020). In France, a large on-line survey reports an increase of alcohol use in 31% of participants (Rolland et al., 2020). The main factors associated were being aged 30–49 years, having a high level of education or a current psychiatric treatment. This raise of alcohol use might increase the development of alcohol use disorder for some individuals, placing further strain on addictions services, and health services in general, during and after the pandemic (Clay and Parker, 2020; Da et al., 2020; Rehm et al., 2020).

3.1.3. After lockdown

The immediate effect might be an increasing consumption (of alcohol) for subjects (easy access to alcohol in pubs or restaurants). The effect of quarantine may also increase the risk of abuse and dependency symptoms years after the outbreak. In a study three years after the 2003 SARS outbreak, authors identified as separate factors quarantine, symptoms of post-traumatic stress, depression, and having used drinking as a coping method, as associated with increased alcohol abuse/dependence symptoms (Wu et al., 2008). Finally, as all past

economic crises were associated with increased long-term alcohol-related problems (especially for men and low socio-economic strata) (de Goeij et al., 2015), we might expect important effects of the COVID-19 pandemic in the next decade.

3.2. Tobacco

A total of ninety-five articles were found, including a large number of letters related to the paradoxical links between tobacco or nicotine and COVID-19. A total of 40 articles was included for this review (after exclusions of doublons and non-related abstracts). Ten were reviews (Engin et al., 2020; Gasmi et al., 2020; Olds and Kabbani, 2020; Vardavas and Nikitara, 2020) or meta-analysis or letters with pooled analysis (Alqahtani et al., 2020; Emami et al., 2020; Farsalinos et al., 2020b; Lippi and Henry, 2020; Zhao et al., 2020; Zheng et al., 2020). Smoking could be a key predisposing factor for COVID-19-related illness severity and mortality based on a recent study of 1590 patients from 575 hospitals across China (Guan et al., 2020a). The first publications reported a link between male sex and COVID-19, possibly underpinned by cigarette smoking (which prevalence is higher for Chinese males (around 50%, against around 3% for females) (Guan et al., 2020a; Wang et al., 2020). Tobacco use was associated with a more severe form of the disease (16.9% of tobacco use in severe cases vs 11.8% in less severe cases) (Guan et al., 2020a). On the other hand, in a large US sample, current smoking was almost ten times lower than the prevalence in the general population (CDCMMWR, 2020), consistent with data from China (Farsalinos et al., 2020b). Low smoking prevalence among hospitalized COVID-19 patients in China were consistent across all studies and in agreement with case series from USA (Farsalinos et al., 2020b). The estimated prevalence of tobacco smoking in hospitalized patients is around 7% according to different meta analyses (Emami et al., 2020; Farsalinos et al., 2020b; Tindle et al., 2020). Still, recent US data report that tobacco is associated with the risk of hospitalization(Killerby et al., 2020).

In a review of five studies, tobacco was associated with the negative progression and negative outcomes of COVID-19 (Vardavas and Nikitara, 2020) but Lippi's preliminary meta-analysis on these five studies concluded to a non significant association (Lippi and Henry, 2020), albeit with several statistical caveat (Lo and Lasnier, 2020)(Guo, 2020). Active smoking increased the risk of severe COVID-19 in an 11 studies meta-analysis (Zhao et al., 2020), but the result was heavily influenced by one study (Guan et al., 2020b), which was the largest one and also the only one to distinguish current and ex-smokers. Finally, a large meta-analysis (on 19 studies, 9 peer-reviewed papers with a total of 11,590 COVID-19 patients) showed a significant association between smoking (current and ex) and progression of COVID-19 (OR 1.91, 95% CI1.42–2.59, p = .001) (Patanavanich and Glantz, 2020). Berlin et al. underlined the symptoms similarities between the COVID-19 and the coronavirus outbreak in 2013, wherein tobacco smoking was involved in prevalence and fatality rates (Berlin et al., 2020). Smokers, especially former smokers, may be more susceptible to 2019-nCoV and have different infection paths than non-smokers'(Cai, 2020b). These findings were replicated in the last and largest meta-analysis (including European and US data) available among peer-reviewed literature (Reddy et al., 2020). Data from low/middle-income countries are still lacking. In a retrospective case series using a Mexican nation-level dataset, current smokers were 23% less likely to be diagnosed with COVID-19 compared to non-smokers, and current smoking was not associated with adverse outcomes (Giannouchos et al., 2020). In contrast, in a large sample of Brazilians patients, smoking was associated with the risk of hospitalization and adverse outcomes (Soares et al., 2020). Smoking history may provide valuable information in identifying at-risk populations. However, to clarify this rapidly evolving topic, the smoking history should be systematically recorded in future studies on COVID-19 (Cai, 2020b).

3.2.1. Pathophysiology

Smoking is significantly associated with high mortality rates for infection or respiratory diseases, through a detrimental action on the immune system and direct lung injury. It could also have an impact on the ACE, implicated in COVID-19 (Berlin et al., 2020). In many lung cells, nicotinic receptors are co-expressed with most components of the RAS (Olds and Kabbani, 2020). ACE2-mediated activation drives epigenetic changes that underlie lung damage (Cai, 2020a). These pathways are also activated by nicotinic receptors. Thus, cigarette smoking induces a dose dependent up regulation of the natural SARS-CoV-2 receptor ACE2 in human cells (Cai et al., 2020), and increases the severity of COVID-19 associated inflammatory response (Ab et al., 2020). However, increased expression of ACE2 may also attenuate the risk of developing devastating lung and systemic injuries, characterizing severe and critical forms of COVID-19 (Lippi et al., 2020), and nicotine has also an anti-inflammatory potential (Polosa and Caci, 2020). There are few data concerning the sole effect of nicotine (substitute treatments) and its interaction with the ACE. Studies on the effects of e-cigarettes' electronic nicotine delivery systems (e-cigarettes, vaping) on RAS are inconclusive and also lead to controversies (Leung and Sin, 2020; Majmundar et al., 2020; Pino et al., 2020). Health providers in the US question whether the vaping epidemic might have contributed to the large amount of hospitalizations for COVID-19 among young individuals (Pino et al., 2020). Anyway, nicotinic acetylcholine receptor could play a key role in the pathophysiology of COVID-19 infection and might represent a target for the prevention and control of the disease (Changeux et al., 2020). This idea began to spread and some argue that COVID-19 is a disease of the nicotinic system (Farsalinos et al., 2020a).

3.2.2. Clinical presentation in the context of COVID-19

Lockdown may increase relapses for former smokers or tobacco-smoking behaviors, mental health outcomes and isolation, both inducing tobacco consumption as coping strategies for previous smokers. We found no study related to the side effects of the imposed withdrawal due to tobacco product ban in South Africa (Egbe and Ngobese, 2020). Individuals' harm perception related to the virus may induce changes in tobacco-use behaviors. In France, a large on-line survey reported an increase in tobacco use in 35% of participants. The main factors involved were female gender, having no partner, having and intermediate/low education level, and still working at workplace (Rolland et al., 2020). Last April, a US survey on 366 individuals reported interesting findings on tobacco cigarette (TC) and electronic cigarette (EC). Although almost half reported no change, COVID-19 prompted about a quarter of respondents to reduce their TC and EC use, and more than a third to increase their motivation to quit. Greater perceived risk was associated with increased motivation to quit both products, and over 20% of respondents reported a quit attempt to reduce risk of harm from COVID-19. A Turkish study found converging results, with higher cessation rate during the pandemic (Kayhan Tetik et al., 2020). On the other hand, about 30% of respondents increased their use and about 15% decreased their motivation to quit (Klemperer et al., 2020). These results are in line with a recent US on-line study, showing a increasing intention to quit (71%), contrasting with an increase in tobacco use (40%) rather than decrease (17%)(Kowitt et al., 2020). An on-line study on google trends (not restricted to a country) found no tendency towards increased interest in quitting smoking (Heerfordt and Heerfordt, 2020). Finally, another online survey among a representative sample of Dutch current smokers showed a dose-response effect of stress (both increasing or decreasing smoking)(Bommele et al., 2020), independently from perceived difficulty of quitting and level of motivation to quit.

The COVID-19 associated morbidity could decrease after just four weeks of smoking cessation (as the risk of respiratory complications in a meta-analysis of twenty-five studies on short-term preoperative smoking cessation and postoperative complications) (Eisenberg and

Eisenberg, 2020; Wong et al., 2012). Healthcare providers should encourage substitution treatments and provide information on benefits of quitting smoking, this period being a "teachable moment" (Underner et al., 2020). Withdrawal symptoms are likely to occur, especially when tobacco smoking is associated with social behaviors.

According to experts, electronic cigarette, smokeless tobacco, areca nut and vaping should also be discouraged during the new coronavirus SARS-CoV2 pandemic (Javelle, 2020; Kaur and Rinkoo, 2020). Physicians and public health workers should pay attention to the risk of shared products (vape, waterpipe, etc.) (Majmundar et al., 2020) that could help the spreading of the virus.

3.2.3. After lockdown

An increase of smoking behaviors is likely, related to possible social interactions (e.g. restaurants.). We found no study related to smoking behaviors and quarantine. Smokers exposed to natural disasters tend to smoke more than unexposed smokers (Huh J, Timberlake DS. Do smokers of specialty and conventional cigarettes differ in their dependence on nicotine? Addict Behav 2009; 34:204–11). A Japanese study conducted three years after the 2011 earthquake and tsunami reported an increase of tobacco consumption (Koyama et al., 2020). Former smokers are also more likely to relapse (Lanctot et al., 2008). The actual pandemic may have long-term deleterious effects on smoking behaviors.

3.3. Opiates

Thirty studies were found, twelve were excluded (among them nine were related to the management of pain during the crisis). The remaining results were mostly letters or commentaries concerning the pressing threat to US public health, due the management of the US opioid crisis jointly to the COVID-19 crisis. Persons with opioid use disorders (OUDs), who frequently have pre-existing mental and physical health problems, also have an increased vulnerability to poor health and mental distress (Sun et al., 2020). Most experts fear an ongoing « Opioid Crisis » that could endanger and further marginalize an already at-risk population (Alexander et al., 2020; Becker and Fiellin, 2020; Jenkins et al., 2020; Sun et al., 2020; Wilson et al., 2020). The most important issue is to ensure service continuity and accessibility of Opioid Substitution Treatment (OST) during the pandemic (Sun et al., 2020).

3.3.1. Physiopathology

Individuals with OUD are at increased risk for contracting and spreading COVID-19 since drug procurement and use practices usually require social contact (Jenkins et al., 2020). Furthermore, opioids have an intrinsic immunosuppressive effect (by altering or suppressing the functionality of the various cell types of both innate and adaptive immunity) (Plein and Rittner, 2018; Roy et al., 2011), and a recent study showed that prescribed opioids, especially higher-dose and immunosuppressive opioids, are associated with an increased pneumonia risk (Edelman et al., 2019). Withdrawal could also have an immunosuppressive effect (Roy et al., 2011).

3.3.2. Clinical presentation in the context of COVID-19

Delivery of OST (buprenorphine, methadone) can be a public health issue in many countries, leading to brutal drop-out and discontinued medication. The subsequent opioid involuntary withdrawal can result in relapse to illicit opiate use, and increase the risk for all-cause and overdose mortality (Sordo et al., 2017). Individuals will be vulnerable to resuming illicit opioid use both to handle withdrawal and to self-medicate other comorbid disorders (highly prevalent in OUDs and increased by the outbreak) (Maxwell et al., 2009; Sun et al., 2020). A recent US Kentucky-specific study provides empirical evidence for concerns that opioid overdoses are rising during the COVID-19 pandemic (Slavova et al., 2020). Between January and April 2020, authors report a 17% increase in the number of emergency medical services opioid overdose runs with transportation to an emergency department, a 71% increase in runs with refused transportation, and a 50% increase in runs for suspected opioid overdoses with deaths at the scene. Individuals with opioid overdose may refuse transportation to the hospital for many reasons, including fear of exposure to COVID-19 (Slavova et al., 2020). Efforts are needed to treat individuals with OUD without an initial in person evaluation. Primary care providers try to adapt their practice for individuals with OST (stopping face-to-face visit, avoiding the requirement of urine drug screen, shifting to telemedicine) (Wilson et al., 2020), but isolation or anxiety may require increasing proximal care for these patients. A specific telemedicine assessment of SUD was recently validated (Deacon et al., 2020), and may help clinicians to improve their practice. Persons receiving take-home methadone could be co-prescribed naloxone, an opioid reversal agent that may mitigate the risks of fatal overdose among those at high risk (Alexander et al., 2020). In-home initiation of buprenorphine is a routine in some Western countries (Poloméni and Schwan, 2014) and newer long-acting injectable formulations of buprenorphine may be preferred. Buprenorphine initiation via telemedicine is legally possible in the U.S and has been successfully reported in a case report study (Harris et al., 2020). A retrospective two years study found no difference between telemedicine and face-to-face buprenorphine medication-assisted treatment programs (Zheng et al., 2017). Other strategies, as automated pill dispenser or hotlines may be helpful (Alexander et al., 2020; Becker and Fiellin, 2020; Samuels et al., 2020). In the US, some coalitions of patients, service providers and academics have emerged to act preemptively at early stages of the pandemic, ahead of official initiatives, to develop ameliorative risk reduction solutions(Heimer et al., 2020). Some authors suggest an underutilized source to address these serious challenges in the US, namely community pharmacists (Cochran et al., 2020). US pharmacists are not allowed to prescribe OST for the treatment OUD, contrary to other countries as Canada or Australia.

In case of infection, physician should be aware that patients with comorbid COVID-19 and OUD present specificities, including drug interactions between methadone and other medications such as hydroxychloroquine or antiviral agents. Recently, three plausible biological mechanisms for potentially worsened outcomes were suggested (Schimmel and Manini, 2020): opioid-related respiratory depression (amplify risks of hypoxemia), complex opioid immune modulation (may impact host response to the virus), and finally drug-drug interactions, particularly due to cardiac adverse effects. Based on pre-clinical studies, Coppola et al. recently suggested an efficacy of hesperidin (antiretroviral drug with an affinity for opioid receptor), but it remains to be tested (Coppola and Mondola, 2020).

3.3.3. After lockdown

Experts predict an increased risk of overdose morbidity and mortality, which should be dealt with by both public health and clinical strategies to avoid any disruption (Leppla and Gross, 2020; Moe and Buxton, 2020). Some guidelines might be useful to avoid confusion and long-term effects, as it has been observed after other disasters (Maxwell et al., 2009). Overall, clinicians plead for efforts to reduce barriers to care for individuals with OUD, with permanent changes after the crisis (Davis and Samuels, 2020; Green et al., 2020).

3.4. Cannabis and other addictions

3.4.1. Cannabis

Five studies were found using "THC" OR "cannabis" but three was excluded (unrelated). We found references through reference screening of previous articles. A Canadian e-survey related to adolescent reported an increase in cannabis use (and alcohol), contrary to other substances (Dumas et al., 2020). Adolescents were engaging in solitary substance use (49.3%), with peers via technology (31.6%) and, strikingly, even face-to-face (23.6%). A study reports an increase in sales activity levels

on darknet markets (including social networks) during 2020, mainly related to cannabis products, questioning the impact of COVID-19 pandemic on this form of purchasing (Groshkova et al., 2020). A large French on-line survey conducted at the beginning of the lockdown reported an increase of cannabis use in 31% of participants. The main factor of increase in cannabis use was an intermediate/low level of education (Rolland et al., 2020).

Some editorial mentioned THC (for an increased risk of COVID-19 through lung injuries (Volkow, 2020)), cannabiol as a therapeutic option (Sexton, 2020), and the risk for hookah users (around 100 millions worldwide). A hookah (shisha or waterpipe) is a single or multi-stemmed instrument that has been used for smoking various flavored substances, such as cannabis, tobacco and opium, for centuries, and is popular in the Indian subcontinent, the Arabian peninsula, Kenya, South Africa, Turkey, United States and Canada (Shekhar and Hannah-Shmouni, 2020).

3.4.2. Gambling

A total of five articles were found (one study and four comments or reviews). All authors hypothesized a future increased risk of online gambling/gaming initiation or an exacerbation of gambling during lockdown (Marsden et al., 2020). Social isolation during spatial distancing, and these stressors in conjunction with substantial changes in gambling markets (land-based, online) during the pandemic may significantly influence gambling behaviors (Håkansson et al., 2020). To face this issue, some countries imposed restrictions or have banned online gambling (Columb et al., 2020). Some authors recently proposed a consensus guidance discussing the risks related to the problematic internet use (including gambling) and made some practical recommendations that may help diminish them (Király et al., 2020). A web survey conducted in Sweden did not show a gambling increase (the number of individuals reporting an increase was smaller than those reporting a decrease, with no change in 51% of participants), but increasing gambling was associated with having a higher degree of gambling problems (Håkansson, 2020). However as there was no lockdown in Sweden, these results are not generalizable.

3.4.3. Others

Nine results were found with the keyword “stimulants”, “cocaine” or “crack”, five were comments or editorials (Four were unrelated). When looking for studies concerning addictions, we found fourteen articles, mostly editorial already reviewed. Stimulants (cocaine, crack) might increase the vulnerability to COVID-19 through cardio-vascular effects and greater inflammation of, and damage to, lung tissue (Marsden et al., 2020). Safe inhalations interventions seem required to limit the spreading fo the SARS-CoV2 among marginalized individuals who smoke crack cocaine (Harris, 2020). After lockdown, increase of use is likely, due to increased accessibility.

4. Discussion

Health and social consequences of the COVID-19 pandemic are not clearly known. This pandemic may last several months and involves new way of tackle with addictions. Overall, patients with addictions have an increased risk of infections and developing severe forms of them. There may be a bilateral impact between each substance use disorder and SARS-Cov2 (for review of the bilateral impact, see Table 1). Individuals with addictions are at higher risk at each step of the pandemic, especially those with opioid use disorder.

Concerning tobacco use, data are lacking, and nicotine (but not tobacco) may have a protective effect. Recently, some authors postulated that the nicotinic acetylcholine receptor plays a key role in the pathophysiology of COVID-19 infection (Farsalinos et al., 2020a) and might represent a target for the prevention and control of COVID-19 infection (Changeux et al., 2020). But more evidence is required to postulate that nicotine may prevent from COVID-19 infection.

Table 1
The relationship between COVID-19 and substance use during and after lockdown.

		Alcohol	Tobacco	Cannabis	Opiates
Before and during lockdown	Impact of substance use on COVID-19	Increase	Increase or decrease	Increase	Increase
	Impact of substance use on COVID-19 course and prognosis	Likely to worsen	Probably worsen	Probably worsen	Worsen
	Impact of lockdown on substance use	Likely to increase	Depend on availability	Depend on availability	Depend on availability
	Impact of lockdown on substance use care	Likely to decrease	Likely to decrease, depend on drugstore availability	Likely to decrease	Likely to decrease, depend on OST availability
After lockdown	Impact of lockdown cessation on substance use related issues	Increase	Increase	NA	Increase in overdoses is likely, due to decreased tolerance

Abbreviations: NA, data are not available; OST, *Opioid substitution* therapy.

Recommending its use in this indication is ahead of time, as nicotine may have deleterious effects (from the very common insomnia (up to 10%) to cardiovascular effects). To date, unpublished data on a French sample of more than 11,000 patients with COVID-19 from AP-HP (the Greater Hospital of Paris) show a low prevalence of tobacco smoking (8.5% versus around 25% in the general population). Clinical trials are required before any conclusion on a protective effect of sole nicotine (Changeux et al., 2020).

Several limitations should be underlined. This review is based on few and preliminary data, as COVID-19 crisis is still actual. The number of publications is unbalanced, depending on countries, and some conclusions remain speculative. Finally, given the real-world focus of this review and the rapidity of COVID-19 planning, we adopted a pragmatic approach and did not perform a systematic review on several platforms.

In conclusion, the lack of clinical data limit the generalizability of our findings, and some perspectives remain speculative. All conclusions are based on current literature data and are thus preliminary. However, we offer a framework, after few weeks of pandemic and quarantine. Current strategies should include systematic assessment of addiction comorbidity during this almost worldwide lockdown, to propose adequate and personalized strategies. Clear and accessible information is necessary to prevent COVID-19 and addictions adverse outcomes for these highly vulnerable subjects. This involves access to guidelines for primary caregivers, physicians, and public health managers. Improving telemedicine services will have a significant long-term positive impact on patient care, that will persist even after this pandemic. It will be the only way to mitigate the SUD pandemic.

Author statement

JM, YLS and CD contributed to the design and implementation of the research, to the analysis of the results. JM wrote the first draft. All authors made a substantial contribution to the final draft.

Funding/support

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of Competing Interest

None.

References

Ab, E., Ed, E., A, E., 2020. Two important controversial risk factors in SARS-CoV-2 infection: obesity and smoking [WWW document]. Environ. Toxicol. Pharmacol. https://doi.org/10.1016/j.etap.2020.103411.

Ahmed, M.Z., et al., 2020. Epidemic of COVID-19 in China and associated psychological problems. Asian J. Psychiatr. 51, 102092. https://doi.org/10.1016/j.ajp.2020.102092.

Alexander, G.C., et al., 2020. An epidemic in the midst of a pandemic: opioid use disorder and COVID-19. Ann. Intern. Med. https://doi.org/10.7326/M20-1141.

Alqahtani, J.S., et al., 2020. Prevalence, severity and mortality associated with COPD and smoking in patients with COVID-19: A rapid systematic review and meta-analysis. PLoS One 15, e0233147. https://doi.org/10.1371/journal.pone.0233147.

Balhara, Y.P.S., et al., 2020. Effect of lockdown following COVID-19 pandemic on alcohol use and help-seeking behavior: observations and insights from a sample of alcohol use disorder patients under treatment from a tertiary care center. Psychiatry Clin. Neurosci. 74, 440–441. https://doi.org/10.1111/pcn.13075.

Becker, W.C., Fiellin, D.A., 2020. When epidemics collide: coronavirus disease 2019 (COVID-19) and the opioid crisis. Ann. Intern. Med. https://doi.org/10.7326/M20-1210.

Berlin, I., et al., 2020. COVID-19 and smoking. Nicotine Tob. Res. https://doi.org/10.1093/ntr/ntaa059.

Bohn, M.J., et al., 1995. The alcohol use disorders identification test (AUDIT): validation of a screening instrument for use in medical settings. J. Stud. Alcohol 56, 423–432.

Bommele, J., et al., 2020. The double-edged relationship between COVID-19 stress and smoking: implications for smoking cessation. Tob. Induc. Dis. 18 (63). https://doi.org/10.18332/tid/125580.

Brooks, S.K., et al., 2020. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. Lancet Lond. Engl. 395, 912–920. https://doi.org/10.1016/S0140-6736(20)30460-8.

Cai, G., 2020a. Bulk and single-cell transcriptomics identify tobacco-use disparity in lung gene expression of ACE2, the receptor of 2019-nCov (preprint). In: Infectious Diseases (Except HIV/AIDS), https://doi.org/10.1101/2020.02.05.20020107.

Cai, G., et al., 2020. Tobacco smoking increases the lung gene expression of ACE2, the receptor of SARS-CoV-2. Am. J. Respir. Crit. Care Med. https://doi.org/10.1164/rccm.202003-0693LE.

Cai, H., 2020b. Sex difference and smoking predisposition in patients with COVID-19. Lancet Respir. Med. 8, e20. https://doi.org/10.1016/S2213-2600(20)30117-X.

CDCMMWR, 2020. Preliminary estimates of the prevalence of selected underlying health conditions among patients with coronavirus disease 2019 — United States, February 12–March 28, 2020. MMWR Morb. Mortal. Wkly Rep. 69. https://doi.org/10.15585/mmwr.mm6913e2.

Changeux, J.-P., et al., 2020. A nicotinic hypothesis for COVID-19 with preventive and therapeutic implications. Qeios. https://doi.org/10.32388/FXGQSB.

Chick, J., 2020. Alcohol and COVID-19. Alcohol Alcohol. https://doi.org/10.1093/alcalc/agaa039.

Clay, J.M., Parker, M.O., 2020. Alcohol use and misuse during the COVID-19 pandemic: a potential public health crisis? Lancet Public Health. https://doi.org/10.1016/S2468-2667(20)30088-8.

Cochran, G., et al., 2020. Medication treatment for opioid use disorder and community pharmacy: expanding care during a national epidemic and global pandemic. Subst. Abus. 41, 269–274. https://doi.org/10.1080/08897077.2020.1787300.

Columb, D., Hussain, R., O'Gara, C., 2020. Addiction psychiatry and COVID-19 – impact on patients and service provision. Ir. J. Psychol. Med. 1–15. https://doi.org/10.1017/ipm.2020.47.

Coppola, M., Mondola, R., 2020. Potential pharmacological perspectives for the treatment/prevention of the SARS-COV-2 infection in opioid dependent patients. J. Opioid Manag. 16, 165–166. https://doi.org/10.5055/jom.2020.0564.

COVID-19 Lockdown: South Africans are Asking Google How to Make Their Own Alcohol as Booze Ban Bites [WWW Document]. URL. https://www.iol.co.za/news/south-africa/western-cape/covid-19-lockdown-south-africans-are-asking-google-how-to-make-their-own-alcohol-as-booze-ban-bites-46491513 (accessed 4.15.20).

Da, B.L., et al., 2020. COVID-19 Hangover: A Rising Tide of Alcohol Use Disorder and Alcohol-Associated Liver Disease. Hepatology, Baltimore, MD. https://doi.org/10.1002/hep.31307.

Davis, C.S., Samuels, E.A., 2020. Opioid policy changes during the COVID-19 pandemic – and beyond. J. Addict. Med. https://doi.org/10.1097/ADM.0000000000000679.

de Goeij, M.C.M., et al., 2015. How economic crises affect alcohol consumption and alcohol-related health problems: a realist systematic review. Soc. Sci. Med. 131, 131–146. https://doi.org/10.1016/j.socscimed.2015.02.025.

Deacon, R.M., et al., 2020. Assessing the validity of the Australian treatment outcomes profile for telephone administration in drug health treatment populations. Drug Alcohol Rev. https://doi.org/10.1111/dar.13088.

Delirrad, M., Mohammadi, A.B., 2020. New methanol poisoning outbreaks in Iran following COVID-19 pandemic. Alcohol Alcohol. https://doi.org/10.1093/alcalc/agaa036.

Dumas, T.M., et al., 2020. What does adolescent substance use look like during the COVID-19 pandemic? Examining changes in frequency, social contexts, and pandemic-related predictors. J. Adolesc. Health. https://doi.org/10.1016/j.jadohealth.2020.06.018.

Edelman, E.J., et al., 2019. Association of prescribed opioids with increased risk of community-acquired pneumonia among patients with and without HIV. JAMA Intern. Med. 179, 297–304. https://doi.org/10.1001/jamainternmed.2018.6101.

Egbe, C.O., Ngobese, S.P., 2020. COVID-19 lockdown and the tobacco product ban in South Africa. Tob. Induc. Dis. 18 (39). https://doi.org/10.18332/tid/120938.

Eisenberg, S.-L., Eisenberg, M.J., 2020. Smoking cessation during the COVID-19 epidemic. Nicotine Tob. Res. https://doi.org/10.1093/ntr/ntaa075.

Emami, A., et al., 2020. Prevalence of underlying diseases in hospitalized patients with COVID-19: a systematic review and meta-analysis. Arch. Acad. Emerg. Med. 8, e35.

Engin, A.B., et al., 2020. Two important controversial risk factors in SARS-CoV-2 infection: obesity and smoking. Environ. Toxicol. Pharmacol. https://doi.org/10.1016/j.etap.2020.103411.

Farsalinos, K., et al., 2020a. COVID-19 and the nicotinic cholinergic system. Eur. Respir. J. https://doi.org/10.1183/13993003.01589-2020.

Farsalinos, K., et al., 2020b. Systematic review of the prevalence of current smoking among hospitalized COVID-19 patients in China: could nicotine be a therapeutic option? Intern. Emerg. Med. https://doi.org/10.1007/s11739-020-02355-7.

Finlay, I., Gilmore, I., 2020. Covid-19 and alcohol-a dangerous cocktail. BMJ 369, m1987. https://doi.org/10.1136/bmj.m1987.

Galea, S., et al., 2020. The mental health consequences of COVID-19 and physical distancing: the need for prevention and early intervention. JAMA Intern. Med. https://doi.org/10.1001/jamainternmed.2020.1562.

Gallus, S., et al., 2020. Who smokes in Europe? Data from 12 European countries in the TackSHS survey (2017–2018). J. Epidemiol. https://doi.org/10.2188/jea.JE20190344.

Gasmi, A., et al., 2020. Individual risk management strategy and potential therapeutic options for the COVID-19 pandemic. Clin. Immunol. Orlando Fla. https://doi.org/10.1016/j.clim.2020.108409.

GBD 2016 Alcohol and Drug Use Collaborators, 2018. The global burden of disease attributable to alcohol and drug use in 195 countries and territories, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet Psychiatry 5, 987–1012. https://doi.org/10.1016/S2215-0366(18)30337-7.

Giannouchos, T.V., et al., 2020. Characteristics and risk factors for COVID-19 diagnosis and adverse outcomes in Mexico: an analysis of 89,756 laboratory-confirmed COVID-

19 cases. Eur. Respir. J. https://doi.org/10.1183/13993003.02144-2020.
Green, T.C., et al., 2020. Opioid use disorder and the COVID 19 pandemic: A call to sustain regulatory easements and further expand access to treatment. Subst. Abus. 41, 147–149. https://doi.org/10.1080/08897077.2020.1752351.
Groshkova, T., et al., 2020. Will the current COVID-19 pandemic impact on long-term Cannabis buying practices? J. Addict. Med. https://doi.org/10.1097/ADM.0000000000000698.
Guan, W.-J., et al., 2020a. Comorbidity and its impact on 1590 patients with COVID-19 in China: a nationwide analysis. Eur. Respir. J. https://doi.org/10.1183/13993003.00547-2020.
Guan, W.-J., et al., 2020b. Clinical characteristics of coronavirus disease 2019 in China. N. Engl. J. Med. https://doi.org/10.1056/NEJMoa2002032.
Guo, F.R., 2020. Active smoking is associated with severity of coronavirus disease 2019 (COVID-19): an update of a meta-analysis. Tob. Induc. Dis. 18. https://doi.org/10.18332/tid/121915.
Håkansson, A., 2020. Changes in gambling behavior during the COVID-19 pandemic-a web survey study in Sweden. Int. J. Environ. Res. Public Health 17. https://doi.org/10.3390/ijerph17114013.
Håkansson, A., et al., 2020. Gambling during the COVID-19 crisis – a cause for concern? J. Addict. Med. https://doi.org/10.1097/ADM.0000000000000690.
Hamer, M., et al., 2020. Lifestyle risk factors, inflammatory mechanisms, and COVID-19 hospitalization: a community-based cohort study of 387,109 adults in UK. Brain Behav. Immun. https://doi.org/10.1016/j.bbi.2020.05.059.
Harris, M., 2020. An urgent impetus for action: safe inhalation interventions to reduce COVID-19 transmission and fatality risk among people who smoke crack cocaine in the United Kingdom. Int. J. Drug Policy 102829. https://doi.org/10.1016/j.drugpo.2020.102829.
Harris, M., et al., 2020. Low barrier tele-buprenorphine in the time of COVID-19: a case report. J. Addict. Med. https://doi.org/10.1097/ADM.0000000000000682.
Heerfordt, C., Heerfordt, I.M., 2020. Has there been an increased interest in smoking cessation during the first months of the COVID-19 pandemic? a Google trends study. Public Health 183, 6–7. https://doi.org/10.1016/j.puhe.2020.04.012.
Heimer, R., McNeil, R., Vlahov, D., 2020. A community responds to the COVID-19 pandemic: a case study in protecting the health and human rights of people who use drugs. J. Urban Health Bull. N. Y. Acad. Med. 1–9. https://doi.org/10.1007/s11524-020-00465-3.
Javelle, E., 2020. Electronic cigarette and vaping should be discouraged during the new coronavirus SARS-CoV-2 pandemic. Arch. Toxicol. https://doi.org/10.1007/s00204-020-02744-z.
Jenkins, W.D., et al., 2020. COVID-19 during the opioid epidemic – exacerbation of stigma and vulnerabilities. J. Rural. Health. https://doi.org/10.1111/jrh.12442.
Kaur, J., Rinkoo, A.V., 2020. Public health perspectives of smokeless tobacco and Areca nut use in the COVID-19 era. Nicotine Tob. Res. https://doi.org/10.1093/ntr/ntaa081.
Kayhan Tetik, B., et al., 2020. The effect of the COVID-19 pandemic on smoking cessation success. J. Community Health. https://doi.org/10.1007/s10900-020-00880-2.
Killerby, M.E., et al., 2020. Characteristics associated with hospitalization among patients with COVID-19 – metropolitan Atlanta, Georgia, March–April 2020. MMWR Morb. Mortal. Wkly Rep. 69, 790–794. https://doi.org/10.15585/mmwr.mm6925e1.
Király, O., et al., 2020. Preventing problematic internet use during the COVID-19 pandemic: consensus guidance. Compr. Psychiatry 100, 152180. https://doi.org/10.1016/j.comppsych.2020.152180.
Klemperer, E.M., et al., 2020. Change in tobacco and electronic cigarette use and motivation to quit in response to COVID-19. Nicotine Tob. Res. https://doi.org/10.1093/ntr/ntaa072.
Kowitt, S.D., et al., 2020. Tobacco quit intentions and Behaviors among cigar smokers in the United States in response to COVID-19. Int. J. Environ. Res. Public Health 17. https://doi.org/10.3390/ijerph17155368.
Koyama, S., et al., 2020. Determinants of increased tobacco consumption following a major disaster. Disaster Med. Public Health Prep. 1–5. https://doi.org/10.1017/dmp.2019.160.
Kypri, K., McCambridge, J., 2018. Alcohol must be recognised as a drug. BMJ, k3944. https://doi.org/10.1136/bmj.k3944.
Kyu, H.H., et al., 2018. Global, regional, and national disability-adjusted life-years (DALYs) for 359 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990–2017: a systematic analysis for the global burden of disease study 2017. Lancet 392, 1859–1922. https://doi.org/10.1016/S0140-6736(18)32335-3.
Lanctot, J.Q., et al., 2008. Effects of disasters on smoking and relapse: an exploratory study of hurricane Katrina victims. Am. J. Health Educ. 39, 91–94. https://doi.org/10.1080/19325037.2008.10599020.
Leppla, I.E., Gross, M.S., 2020. Optimizing medication treatment of opioid use disorder during COVID-19 (SARS-CoV-2). J. Addict. Med. https://doi.org/10.1097/ADM.0000000000000678.
Leung, J.M., Sin, D.D., 2020. Smoking, ACE-2, and COVID-19: ongoing controversies. Eur. Respir. J. https://doi.org/10.1183/13993003.01759-2020.
Lippi, G., Henry, B.M., 2020. Active smoking is not associated with severity of coronavirus disease 2019 (COVID-19). Eur. J. Intern. Med. https://doi.org/10.1016/j.ejim.2020.03.014.
Lippi, G., et al., 2020. Active smoking and COVID-19: a double-edged sword. Eur. J. Intern. Med. https://doi.org/10.1016/j.ejim.2020.04.060.
Lo, E., Lasnier, B., 2020. Active smoking and severity of coronavirus disease 2019 (COVID-19): the use of significance testing leads to an erroneous conclusion. Eur. J. Intern. Med. https://doi.org/10.1016/j.ejim.2020.05.003.
Majmundar, A., et al., 2020. Public health concerns and unsubstantiated claims at the intersection of vaping and COVID-19. Nicotine Tob. Res. https://doi.org/10.1093/ntr/ntaa064.
Marsden, J., et al., 2020. Mitigating and learning from the impact of COVID-19 infection on addictive disorders. Addiction. https://doi.org/10.1111/add.15080.
Mattiuzzi, C., Lippi, G., 2020. Which lessons shall we learn from the 2019 novel coronavirus outbreak? Ann. Transl. Med. 8, 48. https://doi.org/10.21037/atm.2020.02.06.
Maxwell, J.C., et al., 2009. Lessons learned from the deadly sisters: drug and alcohol treatment disruption, and consequences from hurricanes Katrina and Rita. Subst. Use Misuse 44, 1681–1694. https://doi.org/10.3109/10826080902962011.
Moe, J., Buxton, J.A., 2020. Don't forget our dual public health crises. CJEM 1–2. https://doi.org/10.1017/cem.2020.369.
Mungmungpuntipantip, R., Wiwanitkit, V., 2020. Sharing alcoholic drinks and a COVID-19 outbreak. Alcohol Alcohol. https://doi.org/10.1093/alcalc/agaa028.
Narasimha, V.L., et al., 2020. Complicated alcohol withdrawal-an unintended consequence of COVID-19 lockdown. Alcohol Alcohol. https://doi.org/10.1093/alcalc/agaa042.
Ni, Y., et al., 2020. Indoor PM2.5, tobacco smoking and chronic lung diseases: a narrative review. Environ. Res. 181, 108910. https://doi.org/10.1016/j.envres.2019.108910.
Okuno, F., et al., 1986. Mild but prolonged elevation of serum angiotensin converting enzyme (ACE) activity in alcoholics. Alcohol Fayettev. N 3, 357–359. https://doi.org/10.1016/0741-8329(86)90053-4.
Olds, J.L., Kabbani, N., 2020. Is nicotine exposure linked to cardiopulmonary vulnerability to COVID-19 in the general population? Smoking and COVID19-infection. FEBS J. https://doi.org/10.1111/febs.15303.
Patanavanich, R., Glantz, S.A., 2020. Smoking is associated with COVID-19 progression: a meta-analysis. Nicotine Tob. Res. https://doi.org/10.1093/ntr/ntaa082.
Pino, L.E., et al., 2020. Electronic nicotine delivery systems (ECs) and COVID-19: the perfect storm for young consumers. Clin. Transl. Oncol. https://doi.org/10.1007/s12094-020-02391-x.
Plein, L.M., Rittner, H.L., 2018. Opioids and the immune system – friend or foe. Br. J. Pharmacol. 175, 2717–2725. https://doi.org/10.1111/bph.13750.
Poloméni, P., Schwan, R., 2014. Management of opioid addiction with buprenorphine: French history and current management. Int. J. Gen. Med. 7, 143–148. https://doi.org/10.2147/IJGM.S53170.
Polosa, R., Caci, G., 2020. COVID-19: counter-intuitive data on smoking prevalence and therapeutic implications for nicotine. Intern. Emerg. Med. 1–4. https://doi.org/10.1007/s11739-020-02361-9.
Press, Associated, 2020. U.S. Online Alcohol Sales Jump 243% During Coronavirus Pandemic.
Reddy, R.K., et al., 2020. The effect of smoking on COVID-19 severity: a systematic review and meta-analysis. J. Med. Virol. https://doi.org/10.1002/jmv.26389.
Rehm, J., et al., 2020. Alcohol use in times of the COVID 19: implications for monitoring and policy. Drug Alcohol Rev. 39, 301–304. https://doi.org/10.1111/dar.13074.
Rolland, B., et al., 2020. Global Changes and Factors of Increase in Caloric/Salty Food, Screen, and Substance Use, during the Early COVID-19 Containment Phase in France: A General Population Online Survey. JMIR Public Health Surveillhttps://doi.org/10.2196/19630.
Roy, S., et al., 2011. Opioid drug abuse and modulation of immune function: consequences in the susceptibility to opportunistic infections. J. NeuroImmune Pharm. 6, 442–465. https://doi.org/10.1007/s11481-011-9292-5.
Samuels, E.A., et al., 2020. Innovation during COVID-19: improving addiction treatment access. J. Addict. Med. https://doi.org/10.1097/ADM.0000000000000685.
Satre, D.D., et al., 2020. Addressing problems with alcohol and other substances among older adults during the COVID-19 pandemic. Am. J. Geriatr. Psychiatry. https://doi.org/10.1016/j.jagp.2020.04.012.
Schimmel, J., Manini, A.F., 2020. Opioid use disorder and COVID-19: biological plausibility for worsened outcomes. Subst. Use Misuse 55, 1900–1901. https://doi.org/10.1080/10826084.2020.1791184.
Sexton, M., 2020. Cannabis in the time of coronavirus disease 2019: the Yin and Yang of the endocannabinoid system in immunocompetence. J. Altern. Complement. Med. N. Y. N 26, 444–448. https://doi.org/10.1089/acm.2020.0144.
Shekhar, S., Hannah-Shmouni, F., 2020. Hookah smoking and COVID-19: call for action. CMAJ Can. Med. Assoc. J. 192, E462. https://doi.org/10.1503/cmaj.75332.
Simou, E., et al., 2018. Alcohol and the risk of pneumonia: a systematic review and meta-analysis. BMJ Open 8, e022344. https://doi.org/10.1136/bmjopen-2018-022344.
Slavova, S., et al., 2020. Signal of increased opioid overdose during COVID-19 from emergency medical services data. Drug Alcohol Depend. 214, 108176. https://doi.org/10.1016/j.drugalcdep.2020.108176.
Soares, R. de C.M., et al., 2020. Risk factors for hospitalization and mortality due to COVID-19 in Espírito Santo State, Brazil. Am. J. Trop. Med. Hyg. https://doi.org/10.4269/ajtmh.20-0483.
Sordo, L., et al., 2017. Mortality risk during and after opioid substitution treatment: systematic review and meta-analysis of cohort studies. BMJ 357, j1550. https://doi.org/10.1136/bmj.j1550.
Sun, Y., et al., 2020. Editorial: challenges to opioid use disorders during COVID-19. Am. J. Addict. https://doi.org/10.1111/ajad.13031.
Testino, G., Pellicano, R., 2020. Alcohol consumption in the COVID-19 era. Minerva Gastroenterol. Dietol. https://doi.org/10.23736/S1121-421X.20.02698-7.
Testino, G., et al., 2016. Alcoholic liver disease and the hepatitis C virus: an overview and a point of view. Minerva Med. 107, 300–313.
Tindle, H.A., et al., 2020. Beyond smoking cessation: investigating medicinal nicotine to prevent and treat COVID-19. Nicotine Tob. Res. https://doi.org/10.1093/ntr/ntaa077.
Underner, M., Peiffer, G., Perriot, J., Jaafari, N., 2020. Tabagisme et maladie à coronavirus 2019 (COVID-19). Rev. Mal. Respir. https://doi.org/10.1016/j.rmr.2020.04.001.

Vardavas, C.I., Nikitara, K., 2020. COVID-19 and smoking: a systematic review of the evidence. Tob. Induc. Dis. 18 (20). https://doi.org/10.18332/tid/119324.
Varma, R.P., 2020. Alcohol withdrawal management during the COVID-19 lockdown in Kerala. Indian J. Med. Ethics V 105–106. https://doi.org/10.20529/IJME.2020.042.
Volkow, N.D., 2020. Collision of the COVID-19 and addiction epidemics. Ann. Intern. Med. https://doi.org/10.7326/M20-1212.
Wang, R., Pan, M., Zhang, X., Fan, X., Han, M., Zhao, F., Miao, M., Xu, J., Guan, M., Deng, X., Chen, X., Shen, L., 2020. Epidemiological and clinical features of 125 hospitalized patients with COVID-19 in Fuyang, Anhui, China. Int. J. Infect. Dis. https://doi.org/10.1016/j.ijid.2020.03.070.
Wilson, C.G., et al., 2020. A primary care response to COVID-19 for patients with an opioid use disorder. J. Rural. Health. https://doi.org/10.1111/jrh.12438.
Wong, J., et al., 2012. Short-term preoperative smoking cessation and postoperative complications: a systematic review and meta-analysis. Can. J. Anaesth. 59, 268–279. https://doi.org/10.1007/s12630-011-9652-x.
Wu, P., et al., 2008. Alcohol abuse/dependence symptoms among hospital employees exposed to a SARS outbreak. Alcohol Alcohol 43, 706–712. https://doi.org/10.1093/alcalc/agn073.
Zhao, Q., et al., 2020. The impact of COPD and smoking history on the severity of COVID-19: a systemic review and meta-analysis. J. Med. Virol. https://doi.org/10.1002/jmv.25889.
Zheng, W., et al., 2017. Treatment outcome comparison between telepsychiatry and face-to-face buprenorphine medication-assisted treatment for opioid use disorder: a 2-year retrospective data analysis. J. Addict. Med. 11, 138–144. https://doi.org/10.1097/ADM.0000000000000287.
Zheng, Z., et al., 2020. Risk factors of critical & mortal COVID-19 cases: a systematic literature review and meta-analysis. J. Inf. Secur. https://doi.org/10.1016/j.jinf.2020.04.021.