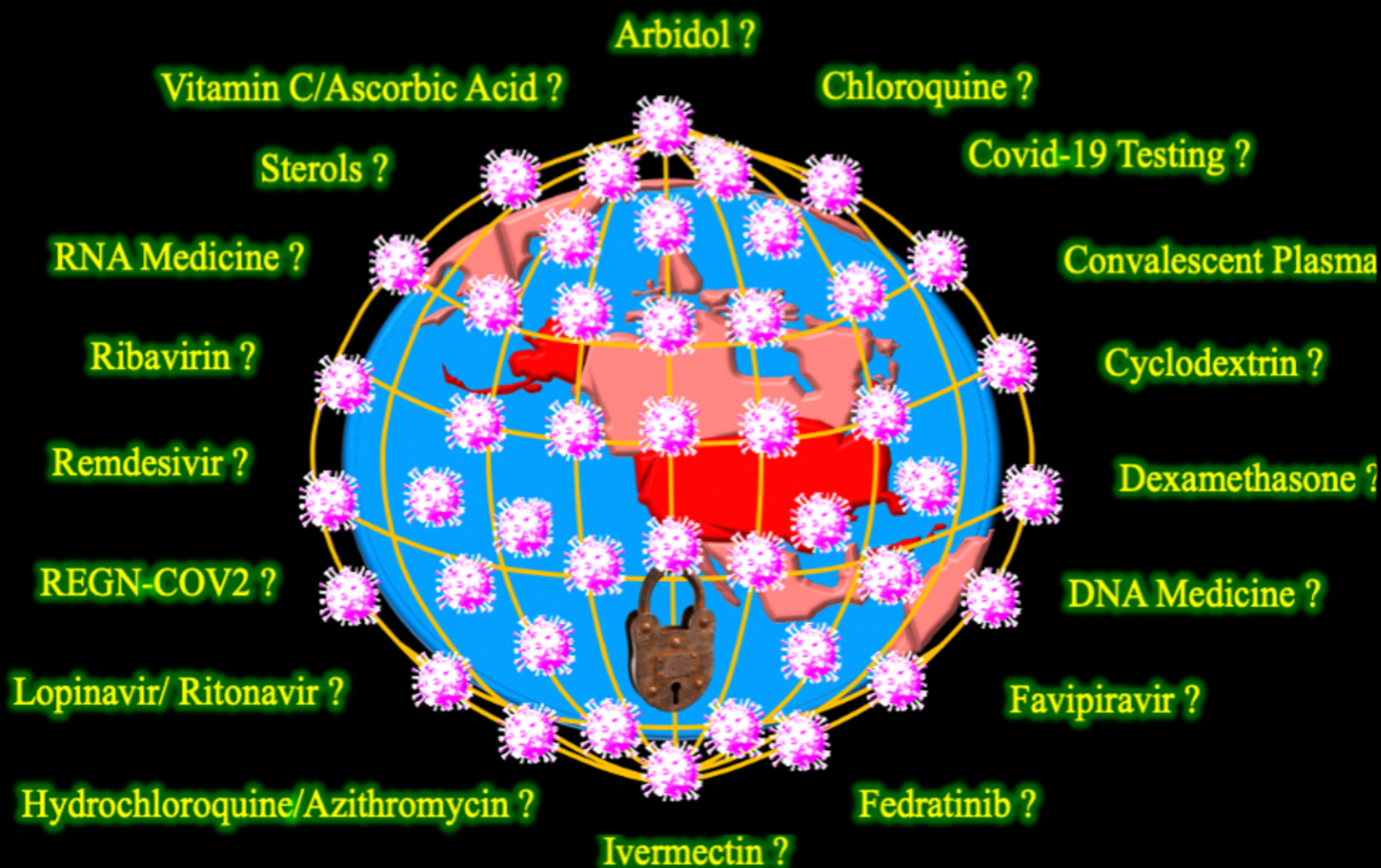




Science Documents®



Fear of coronavirus locks down the world
and resets activities on the earth

COVID-19 and alcohol: a review from patient to population

Shahid Mohammad^{1#}, Mohammed Danish Akbar¹

¹Center for Neuroscience Research, Children's Research Institute, Children's National Hospital, Washington, DC, USA

[#]Corresponding Author: mshahid@childrensnational.org

Severe acute respiratory syndrome Coronavirus 2 (SARS-CoV-2) is a deadly infectious virus that had been first reported in late 2019, in Wuhan, China. The coronavirus disease 2019 (COVID-19) is having massive impact on public health and well-being worldwide. The virus has rapidly spread across the globe and claimed millions of lives. SARS-CoV-2 causes acute respiratory illness and suppresses the immune system. Similarly, alcohol use disorder patients exhibit impaired immune response, leading to increased susceptibility to respiratory infection and distress. In this context, changes to alcohol consumption related to the COVID-19 pandemic have emerged as a potential health concern. Consumption of alcohol can further weaken the immune system and increase the susceptibility for COVID-19. In this mini-review, we highlight the possible potential outcomes of alcohol abuse and COVID-19 on human health threads and public safety, as well as preventive measures recommended by global authorities to counter this COVID-19 pandemic.

Key words: COVID-19, SARS-CoV-2, Acute respiratory syndrome, alcohol, FASD

Introduction

The world has witnessed several health challenges in the history, but the current ongoing outbreak of COVID-19 has left an exceptional mark on global public health. Millions of lives have been affected. People are quarantined and isolated in their homes to maintain physical distancing. Social isolation can lead to stress and increased depression and frustration that may prompt alcohol consumption to cope with it. Nielsen reported more than 50% increase in the sale of alcohol in the starting of COVID-19 lockdown in USA as compared with year before in the same period. Online sales in 2020 increased more than 250% as compared with 2019.^{1,2} The WHO has warned that the misuse of alcohol can further complicate the significant potential public health issue during the COVID-19 pandemic as well as post-pandemic.

SARS-CoV-2 is a single standard large RNA virus of the family *Coronaviridae* containing a viral genome of 29,903 nucleotides.³ Furthermore, *Coronaviridae* has 4 subfamilies; alpha-, beta-, gamma- and delta-. Genome size varies from 26-32kb. Alpha- and beta- subfamily virus originated from mammals while gamma- and delta- from birds. Among these subtypes of coronavirus, beta-coronavirus can cause severe disease while alpha-subtypes can cause mild asymptomatic infections.^{4,5} SARS-CoV-2 belongs to beta- coronavirus that has around 90% similarity with SARS-like coronavirus (SARS-CoV) that had been previously found in bats in China.⁶ Hoffman et al. reported that SARS-CoV-2 uses the receptor-binding domain (RBD) on the spike (S) protein to gain entry into the cell by binding to the ACE (angiotensin-converting enzyme)-2 receptor,; the serine protease TMPRSS2 (transmembrane protease serine 2)

aids entry of SARS-CoV-2 into the cell through S protein priming.^{7,8} In fact, the binding affinity of the spike protein's RBD to the host ACE2 receptor is thought to determine host susceptibility to infection. ACE2 is a type1 transmembrane glycoprotein with single zinc metalloprotease active site. The COVID-19 outbreak highlights the ability of SARS-CoV-2 to spread from animal to severe human disease through binding of coronavirus on ACE2 receptors, which affects the respiratory tract and suppresses the immune system, which can be fatal if precaution/treatment has not been taken on time.

As of January 31, 2021, more than 100 million people have been affected, and more than 2 million deaths have been reported with COVID-19.⁹ Mild to moderate symptoms of COVID-19 are fever, sore throat, cold and cough, but more severe infection can affect the lower respiratory tract and digestive tract through common immune system.¹⁰ The unique symptom that was observed from this COVID-19 in comparison to other viruses is loss of olfactory sensation. SARS-CoV-2 can be transmitted by air droplets from person to person contact, similar to cold and flu. The ideal treatment regimens for COVID-19 are still unclear. Additionally, the emergence of new SARS-CoV-2 variants in the United Kingdom (UK) (known as B.1.1.7), South Africa (known as B.1.351), and Brazil (known as P.1) have spiked the transmissibility of COVID-1.^{11,12} COVID-19 vaccines have been developed by various institutions and pharmaceutical companies, but it will take time to immunize the whole population to protect from SARS-CoV-2; until then, the individual needs to take personal protection such as wearing a mask, social distancing in public and sanitizing hands regularly. In this mini review,

we will summarize the information available in the public domain for the benefit of common public.

Alcohol and COVID-19 pandemic

The rapid spread of COVID-19 has led many governments to institute lockdowns in the name of public safety. Some countries even instituted alcohol bans to reduce alcohol-related hospitalizations as well as social mingling associated with alcohol consumption. In the early days of the pandemic, misinformation regarding the ability of alcohol consumption to combat COVID-19 was unclear. For example, in Iran, misinformation along with a preexisting ban on alcohol consumption led to an increase in methanol poisoning.¹³ Lack of access to alcohol has understandably led to a spate of alcohol withdrawal syndrome (AWS) cases. A study in India found an increase in patients suffering from severe AWS during the total lockdown period.¹⁴ The severity of AWS even drove some patients to suicide.

the closure of alcohol serving venues for social distancing.¹⁵ However, the authors concede that home drinking and the eventual relaxation of social distancing guidelines can lead to a reversal of this phenomenon.

Recent studies have found increased alcohol consumption in response to lockdown. In a survey conducted in Germany, 34.7% of responses indicated drinking “more or much more” alcohol since the start of lockdown.¹⁶ One especially vulnerable population in this instance is alcohol use disorder (AUD) patients. Lockdowns and other measures to combat COVID-19 have significantly disrupted treatment for AUD patients. Another study from the United Kingdom (UK) found that 24% of AUD patients increased their intake following COVID-19 lockdown, and 17% of pre-lockdown abstinent patients relapsed during the lockdown.¹⁷

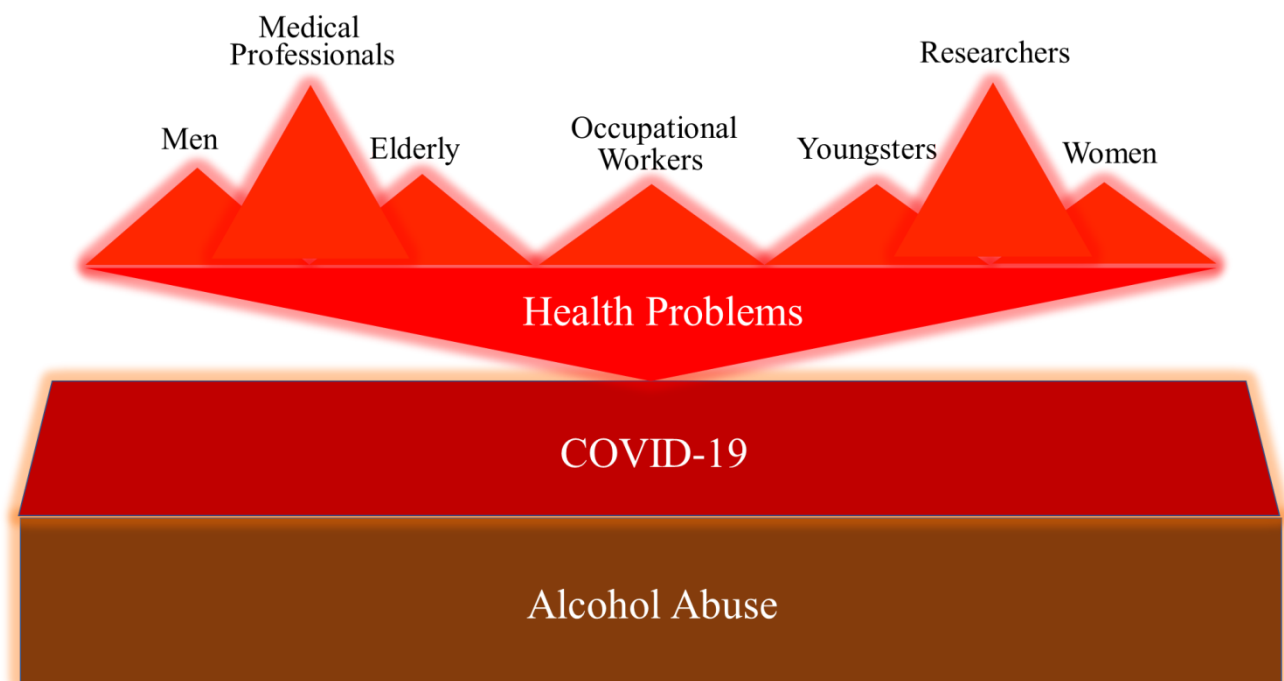


Fig. 1. Representative figure shows the impact of alcohol abuse and COVID-19 on health issues.

In countries without an alcohol ban, COVID-19 lockdown led to significant changes in alcohol consumption. The working model is that depression and loneliness from self-isolation coupled with socioeconomic impacts of COVID-19 would ostensibly lead to increased consumption. However, there are mixed reports thus far concerning the true effect on alcohol consumption. Early data from a study in Australia found a decrease in harmful drinking, especially among younger drinkers, attributed to

In summary, the combination of weakened immune response from chronic alcohol abuse, cardiovascular and pulmonary comorbidities related to this condition, social isolation due to lockdown, and decreased access to medication and treatment programs all coalesced to put patients with alcohol use disorders at higher risk of contracting COVID-19 and suffering poor prognosis. The long-term effects of COVID-19 lockdown on alcohol

consumption, especially in those with alcohol abuse, remain a topic of great interest (Fig. 1).

COVID-19 and alcohol dependent disorders

Contrary to the idea that chronic alcohol use offers protection against COVID-19, alcohol use disorder has been shown to increase susceptibility to COVID-19.¹⁸ Alcohol misuses contribute to pathophysiology of the lung. The effect of chronic alcohol use on lung health and ability to fight infection is well documented. There are a constellation of symptoms that manifest as “alcohol lung”, and the mechanisms behind these symptoms give insight into the increased susceptibility to and severity of COVID-19 in these patients.

Shortening of breath or dyspnea is one of the symptoms of COVID-19. Alcohol dependent disorders may exacerbate dyspnea associated with COVID-19 by

It may be more severe because alcohol intake increases susceptibility to lung infection and increases the severity of acute respiratory distress syndrome (ARDS).¹⁸ Chronic alcohol use predisposes the lung to conditions like ARDS (Fig. 2). In a systematic review of seventeen studies, researchers found increased risk of ARDS in patients with history of chronic alcohol consumption, prompting recommendations for screening for chronic alcohol use.²³ Given that ARDS also occurs in severe cases of COVID-19, it is important for healthcare providers to consider alcohol consumption in their treatment protocols.

FASD and COVID-19

Before birth, alcohol exposure can result in a wide range of behavioral outcomes in children, collectively known as Fetal Alcohol Spectrum Disorders (FASD). FASD is one of the leading developmental disorders globally. It often presents as a mixture of physical and mental health



Fig. 2. Figure shows the relationship between alcohol abuse, COVID-19 and ARDS.

affecting mucociliary clearance of airways through dampening of the ciliary beat frequency.¹⁸ Alcohol lowers the innate immune defense in the lung as well as reducing the number and activity of T-cells and B-cells.¹⁹⁻²¹ Alcohol use disorder also increases the baseline level of pro-inflammatory cytokines in the airway, which exacerbates the SARS-CoV-2 mediated “cytokine storm” and potentially causing systemic organ failure in serious cases.^{18,21} In combination with impaired macrophage action and neutrophil recruitment, these changes can lead to increased risk of viral infection as well as potentially impairing response to vaccination.^{20,22} More likely, substantial intake of alcohol can contribute high risk of COVID-19 especially in those with already comprised immune systems or AUD patients. The critical stage of COVID-19 involves the development of pneumonia, often complicated with pulmonary infection that results in high risk of ARDS.

abnormalities. A mother who drinks any amount of alcohol knowingly or unknowingly during the pregnancy can cause brain damage and growth retardation in their child.²⁴ Neurodevelopmental disorders in children, including attention-deficit hyperactivity disorder (ADHD), autism, learning disabilities, and intellectual disability, have environmental and genetic factors.²⁵ Environmental factors, for example, alcohol are one the major factor that causes cognitive disorders, including motor skill learning disability in FASD.²⁶ These effects may also include mental, behavioral, and/or learning disabilities with possible lifelong implications. Fetal alcohol spectrum disorder among children and youth increased up to 5 percent of all American children.²⁷

FASD cannot be cured or reversed, but it can have a destructive secondary effect on children. Nevertheless, it is preventable. There is concern among FASD researchers

about a potential increase in FASD prevalence rates as a result of COVID-19 pandemic and the impact the pandemic is having on the community. Individuals with FASD and their families can face increased challenges as a result of the COVID-19 pandemic. Social isolation can

lead to an increase in mental health issues, leading to an increased risk of alcohol consumption during pregnancy. Public awareness is mostly focused on the effects of drinking alcohol in adults while ignoring alcohol consumption consequences during pregnancy. We do not have enough data in public domain to evaluate the risk of COVID-19 on pregnant women who drank alcohol, but the post COVID-19 era can provide new insights into the effect of COVID-19 exclusively on FASD.

In addition to the challenges faced by individuals and their families living with FASD, the COVID-19 pandemic has also drawn attention to FASD prevention concerns. Recent global data have suggested that online alcohol sales for beer, wine, and spirits have risen during the COVID-19 pandemic¹ and women report drinking, on

average, more drinks per day than recommended in the USA in low-risk alcohol drinking guidelines.²⁸ Currently, there is no data to quantify if there has been an increase in alcohol use during pregnancy in the COVID-19 pandemic. However, the rise in general alcohol consumption raises concerns about the potential increase in alcohol-exposed pregnancies.

Summary

The COVID-19 pandemic is a uniquely devastating public health phenomenon, which will have far-reaching implications for the future in terms of healthcare, substance abuse, mental health, and policy. In addition, while long term neurological impacts of COVID-19 are unclear, they could play a role in exacerbation of alcohol use disorders. Reducing alcohol exposure could be an important step forward to prevent the consequences of COVID-19 on alcohol abuse disorders.

Conflict of interest

Authors declare no conflict of interest.

References:

- Pollard MS, *et al.*, Green HD: Changes in adult alcohol use and consequences during the COVID-19 pandemic in the US. 2020, *JAMA Netw Open*; 3:e2022942.
- Rebalancing the 'COVID-19 Effect' on Alcohol Sales [Internet]. [cited 2021 Jan 22]. Available from: <https://www.nielsen.com/us/en/insights/article/2020/rebalancing-the-covid-19-effect-on-alcohol-sales>
- Wu F, *et al.*, Zhang Y-Z: A new coronavirus associated with human respiratory disease in China. 2020, *Nature*; 579:265–9.
- Characteristics of SARS-CoV-2 and COVID-19 | Nature Reviews Microbiology [Internet]. [cited 2021 Jan 22]. Available from: <https://www-nature-com.proxygw.wrlc.org/articles/s41579-020-00459-7>
- Velavan TP, Meyer CG: The COVID-19 epidemic. 2020, *Trop Med Int Health*; 25:278–80.
- Hu D, *et al.*, Wang C: Genomic characterization and infectivity of a novel SARS-like coronavirus in Chinese bats. 2018, *Emerg Microbes Infect*; 7:1–10.
- Hoffmann M, *et al.*, Pholmann S: SARS-CoV-2 Cell Entry Depends on ACE2 and TMPRSS2 and Is Blocked by a Clinically Proven Protease Inhibitor. 2020, *Cell*; 181:271–80.
- Davidson AM, Daniel B: Interaction of SARS-CoV-2 and Other Coronavirus With ACE (Angiotensin-Converting Enzyme)-2 as Their Main Receptor. 2020, *Hypertension*. 76:1339–49.
- WHO Coronavirus Disease (COVID-19) Dashboard [Internet]. [cited 2021 Jan 22]. Available from: <https://covid19.who.int>
- Pan L, *et al.*, Tu L: Clinical characteristics of COVID-19 patients with digestive symptoms in Hubei, China: a descriptive, cross-sectional, multicenter study. 2020, *Am J Gastroenterol*; 115:766–73.
- Spike E484K mutation in the first SARS-CoV-2 reinfection case confirmed in Brazil, 2020 - SARS-CoV-2 coronavirus / nCoV-2019 Genomic Epidemiology [Internet]. Virological. 2021 [cited 2021 Jan 30]. Available from: <https://virological.org/t/spike-e484k-mutation-in-the-first-sars-cov-2-reinfection-case-confirmed-in-brazil-2020/584>.
- CDC. Coronavirus Disease 2019 (COVID-19) [Internet]. Centers for Disease Control and Prevention. 2020 [cited 2021 Jan 30]. Available from: <https://www.cdc.gov/coronavirus/2019ncov/more/science-and-research/scientific-brief-emerging-variants.html>
- Shokoohi M, *et al.*, Stranges S: A syndemic of COVID-19 and methanol poisoning in Iran: time for Iran to consider alcohol use as a public health challenge? 2020, *Alcohol*; 87:25–7.

14. Narasimha VL, *et al.*, Murthy P: Complicated Alcohol Withdrawal-An Unintended Consequence of COVID-19 Lockdown. 2020, *Alcohol Alcoholism*; 55:350–3.
15. Callinan S, *et al.*, Kuntsche E: Shifts in alcohol consumption during the COVID-19 pandemic: early indications from Australia. *Addiction* [Internet]. [cited 2021 Jan 22];n/a(n/a). Available from: <http://onlinelibrary.wiley.com/doi/abs/10.1111/add.15275>
16. Koopman C, *et al.*, Matano RA. Relationships of alcohol use, stress, avoidance coping, and other factors with mental health in a highly educated workforce. 2003, *Am J Health Promot*; 17(4):259–68.
17. Kim JU, *et al.*, Lemoine M: Effect of COVID-19 lockdown on alcohol consumption in patients with pre-existing alcohol use disorder. 2020, *Lancet Gastroenterol Hepatol*; 5:886–7.
18. Bailey KL, *et al.*, Wyatt TA: Alcohol use disorder: a pre-existing condition for COVID-19? 2020, *Alcohol*; 90:11–7.
19. Happel KI, Nelson S: Alcohol, immunosuppression, and the lung. 2005, *Proc Am Thorac Soc*; 2:428–32.
20. Molina PE, *et al.*, Nelson S: Focus On: Alcohol and the Immune System. 2010, *Alcohol Res Health*; 33:97–108.
21. Szabo G, Saha B. Alcohol's effect on host defense. 2015, *Alcohol Res*; 37:159–70.
22. Jeyanathan M, *et al.*, Xing Z: Immunological considerations for COVID-19 vaccine strategies. 2020, *Nature Reviews Immunology*; 20:615–32.
23. Simou E, *et al.*, Britton J: The Effect of alcohol consumption on the risk of ARDS: a systematic review and meta-analysis. 2018, *Chest*; 154:58–68.
24. Prenatal Exposure to Alcohol. 2000, *Alcohol Res Health*; 24:32–41.
25. Scandurra V, *et al.*, Canitano R: Neurodevelopmental disorders and adaptive functions: a study of children with autism spectrum disorders (ASD) and/or attention deficit and hyperactivity disorder (ADHD). *Front Psychiatry* [Internet]. 2019 Sep 4 [cited 2021 Jan 23];10. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6737073/>.
26. Mohammad S, *et al.*, Hashimoto-Torii K: Kcnn2 blockade reverses learning deficits in a mouse model of fetal alcohol spectrum disorders. 2020, *Nat Neurosci*; 23:533–43.
27. May PA, *et al.*, Hoyme E: Prevalence of fetal alcohol spectrum disorders in 4 US communities. 2018, *JAMA*; 319:474–82.
28. Publications | National Institute on Alcohol Abuse and Alcoholism | Surveillance Report #115 [Internet]. [cited 2021 Jan 23]. Available from: <https://pubs.niaaa.nih.gov/publications/surveillance-covid-19/COVSALES.htm>.

