The impact of COVID-19 on alcohol consumption and alcohol drinking behavior. A systematic review and meta-analysis.

Anna Maria Maina
SN: s2312255

Master Degree Program: Clinical Psychology
Supervisor: Marc Molendijk
Institute of Psychology
Universiteit Leiden
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1. Abstract

Objectives: To conduct a systematic review and meta-analysis investigating the effects of COVID-19 on alcohol consumption. Studies were included if they reported results on two measures of the short version of the Alcohol Use Disorder Identification Test (AUDIT-C), pre and post pandemic. The databases that were used were PubMed and Web of Science for articles published in English. Data were extracted on demographics and details of measures used to assess alcohol consumption. A random-effects meta-analyses was performed and calculated the standardized mean difference in scores on the AUDIT-C questionnaire. Results: The effect size was low, 0.1993 (95% CI: -0.0442 to 0.4429) and of none statistical significance (p= 0.109, > 5%). Conclusion: The results may be the outcome of the only six studies that were included in the analysis. It is also possible that alcohol consumption did not increased significantly due to the COVID-19 pandemic, or that for some populations has instead, decreased.

2. Introduction

The impact of the pandemic on alcohol use and abuse.

The pandemic of COVID-19 which first appeared internationally in 2020, constitutes a epidemiological crisis which affected all nations. In an effort to manage the COVID-19 pandemic and ensure public health, governments implemented policies which suggested keeping distances between citizens, but also isolation (quarantine) (Clay & Parker, 2020). During periods with major life-threatening events, physical and mental health are seriously affected and people often face substance use difficulties.

According to the World Health Organization, in 2018, 8.1 million people in the US abused alcohol and other substances while the condition of epidemiological crisis, seems according to the literature to have intensified the above percentages (Murphy, Yoder, Pathak, & Avery, 2021). The consequences are broad and the situation of everyday life has changed substantially in many different domains (Killgore, Cloonan, Taylor, Lucas, & Dailey, 2021). The pandemic, as a life threatening condition, as well as the measures taken by governments to mitigate the spread of the virus, can lead to deterioration of mental health. The application of the specific measures aimed at reducing the spread of the virus, brought millions people to the condition of isolation for long periods of time.

Substance and alcohol abuse is a multifactorial problem that is often caused, among others, by social factors and treated also through social support. Hence social distancing and isolation can be considered factors that could affect mental well-being and lead people to seek relief through non-adaptive strategies (Calina et al., 2021; Clair, Gordon, Kroon, & Reilly, 2021). This condition, based on international research, has increased the anxiety and stress levels of individuals while at the same time the consumption of substances such as alcohol may have also changed. Measures related to alcohol use, such as the ban of sales and the quarantine, can lead to different patterns consumption, as social alcohol drinking is limited. Still, people with pre-existing problems of alcohol misuse are likely to change their patterns of alcohol consumption and have different consequences than the rest population, such as withdrawal syndrome, alcohol poisoning and relapse (Aguilar, et al., 2021; Kouimtsidis, Pauly, Parkes, Stockwell, & Baldacchino, 2021). It seems that in periods of high stress, as in disasters, it is more likely for people who already have problems with alcohol use to increase it (Neill, et al., 2020). According to preliminary findings, alcohol abuse is expected to have increased since the onset of COVID-19 (Gonçalves, Moura, do Amaral, Castaldelli-Maia, &

Malbergier, 2020). This increase could possibly be due to the use of alcohol as a coping mechanism of managing stress (Sarangi, & Alexander, 2021). On the other hand, there is the possibility of reducing alcohol and other substances due to the lower availability of alcohol, quarantine and financial difficulties (Aguilar, et al., 2021) but it is also possible that the effects are still not evident (Panagiotidis, Rantis, Holeva, Parlapani, & Diakogiannis, 2020).

Alcohol abuse is one of the leading causes of death since it causes about 3 million deaths worldwide. At the same time, stress is an important risk factor, which is associated with excessive alcohol consumption. Under the circumstances of long-term social isolation such as that during the period 2020-2021, they are particularly observed increased stress levels. The conditions of intense stress and anxiety during the isolation is likely to lead to an increase in substance abuse, in the beginning of substance use but also in relapse after a period of abstainment (Clay & Parker, 2020; Rogers, Shepherd, Garey, & Zvolensky, 2020). Also, according to the international literature, people with existing alcohol dependence, which constitute a vulnerable population even before the pandemic, are at particularly high risk of increasing alcohol abuse both because of possible mental and physical comorbidities and because of the long-term social isolation (Zastepa, Sun, Clune, & Mathew, 2020). Some preliminary estimates suggest that overdoses of substances (lethal and non-lethal) increased in the US during social isolation of the epidemiological crisis. More specifically, according to Wan and Long (as mentioned in Murphy, Yoder, Pathak, & Avery, 2021) the percentages increased by 18%, 29% and 42% in March, April and May 2020, in relation to the same period of 2019, while the deaths related to substance use increased by 13% in July 2020 to in relation to July 2019.

On the other hand, it seems that although substance users is a vulnerable population that could potentially face many health problems during the pandemic, their utilization of healthcare for appropriate treatment, remained in very low levels (Kalin, 2020; Murphy et. al., 2021). According to international research, it seems that the pandemic has a negative effect on seeking treatment for drug users because of fear getting sick from the virus, when coming into contact with a hospital setting. So, although many times substance abusers tend to fall in the high-risk category, they often avoid visiting healthcare facilities in order to avoid exposure to COVID-19, which further aggravates the already fragile situation of their health (Murphy et al., 2021).

At the same time, according to a 2020 survey, COVID-19, has brought dramatic changes in the daily lives of people not only regarding their health but also socially and emotionally (Stanton, Khalesi, Williams, Alley, Thwaite & Vandelanotte, 2020). The effects

of the pandemic are multi-level and at the same time financial, physical and mental while the impact on levels of stress and discomfort are crucial. In a study with 1491 adults in Australia, significant changes were reported during the period of the pandemic in physical activity, in sleep, in consumption of alcohol and nicotine. More specifically, a few months later after the beginning of the pandemic, participants reported a statistically significant increase consumption of alcohol and nicotine, while their physical exercise decreased and the quality of their sleep has worsen. These results were connected respectively, without this constituting necessarily a linear cause-and-effect relationship, with high levels of anxiety and depressive symptoms in participants. In particular, regarding alcohol use, nearly a quarter of the participants reported alcohol consumption four or more times per week (Stanton et al., 2020).

Literature on past pandemics and natural disasters suggests the association with substance abuse (Esterwood, & Saeed, 2020). The research by Cerda, Tracyb, and Galea (2011) highlighted the effect of exposure to traumatic events such as Hurricanes Katrina and Rita at stress levels and alcohol use in 439 adults aged 18–85. Specifically, they used data before and after the hurricanes but also potentially stressful situations caused by the hurricane disaster. They concluded that exposure to the traumatic event of the hurricane was associated with increased consumption and higher chances of excessive alcohol consumption for more days in the last year, while factors that cause additional stress after hurricanes (such as lack of food and water, loss of electricity or fear of crime) are associated with increased alcohol use and are associated with excessive alcohol consumption. However, they also found that social support in the next two months after the disaster is related to reduced frequency of alcohol use.

Social support in the times of COVID-19 may also not be feasible for everyone, leading to alarming consequences for mental health and substance use. The changes in the amount of alcohol consumed during the pandemic are not yet fully understood but the patterns of consumption has considerably changed. Drinking patterns can be categorized by moderate to heavy drinking patterns, social drinking, and binge drinking (Saha, Stinson, & Grant, 2007). Since there are restrictions due to COVID-19 it is possible that drinking patterns but also motives for alcohol consumption have changed with regards to social drinking.

In addition, since COVID-19 brought changes in the way people seek or receive therapy, it is important to adopt treatment strategies that can be applied in periods of crisis. It is possible that alcohol users are likely to be in increased need for treatment in the midst of this crisis of COVID-19, hence access to services despite the exceptional and adverse

conditions that brings the pandemic, should be promoted. The impact of the ongoing COVID-19 pandemic on people who use alcohol or other substances has raised serious concerns (Yazdi, Fuchs-Leitner, Rosenleitner, & Gerstgrasser, 2020) about the association of pandemic and quarantine with substance and alcohol abuse and the question this study aims to answer is how has alcohol drinking behavior has been affected from COVID-19.

3. Research objectives and Implications

It is the purpose of this study to estimate the impact of COVID-19 on substance use and drinking behavior. Specifically, to compare the amount of alcohol consumption in two different time periods, before and during the pandemic. Furthermore, to discuss based on previous research how drinking behavior has changed due to quarantine, and if people who used to drink before the pandemic are affected differently than others. This study contributes to the literature by identifying some risk factors for alcohol misuse, such as stress, quarantine and social isolation. It is important to consider those implications since mental health is expected to worsen after the pandemic and knowing how people has being affected could lead to suitable interventions.

3.1 Hypotheses

It is expected that COVID-19 is related to higher alcohol consumption and different patterns of alcohol behavior.

4. Methods

A systematic review and meta-analysis which, followed the Preferred Reporting Items for Systematic reviews and Meta-Analyses guidelines was conducted on data regarding the association between alcohol and drug use before and during COVID-19 pandemic. Two electronic databases Web of Science and Pubmed, were searched using predefined search terms to identify relevant studies which provided 3,688 records. Appendix A, lists the search strings used for Web of Science and Pubmed. Furthermore, studies from 1/1/2020 until 1/4/2021, were included. The articles were first collected based on the relevant title and abstract from four persons. Then, full articles were screened and relevant data were extracted from the articles included in the study based on the inclusion and exclusion criteria.

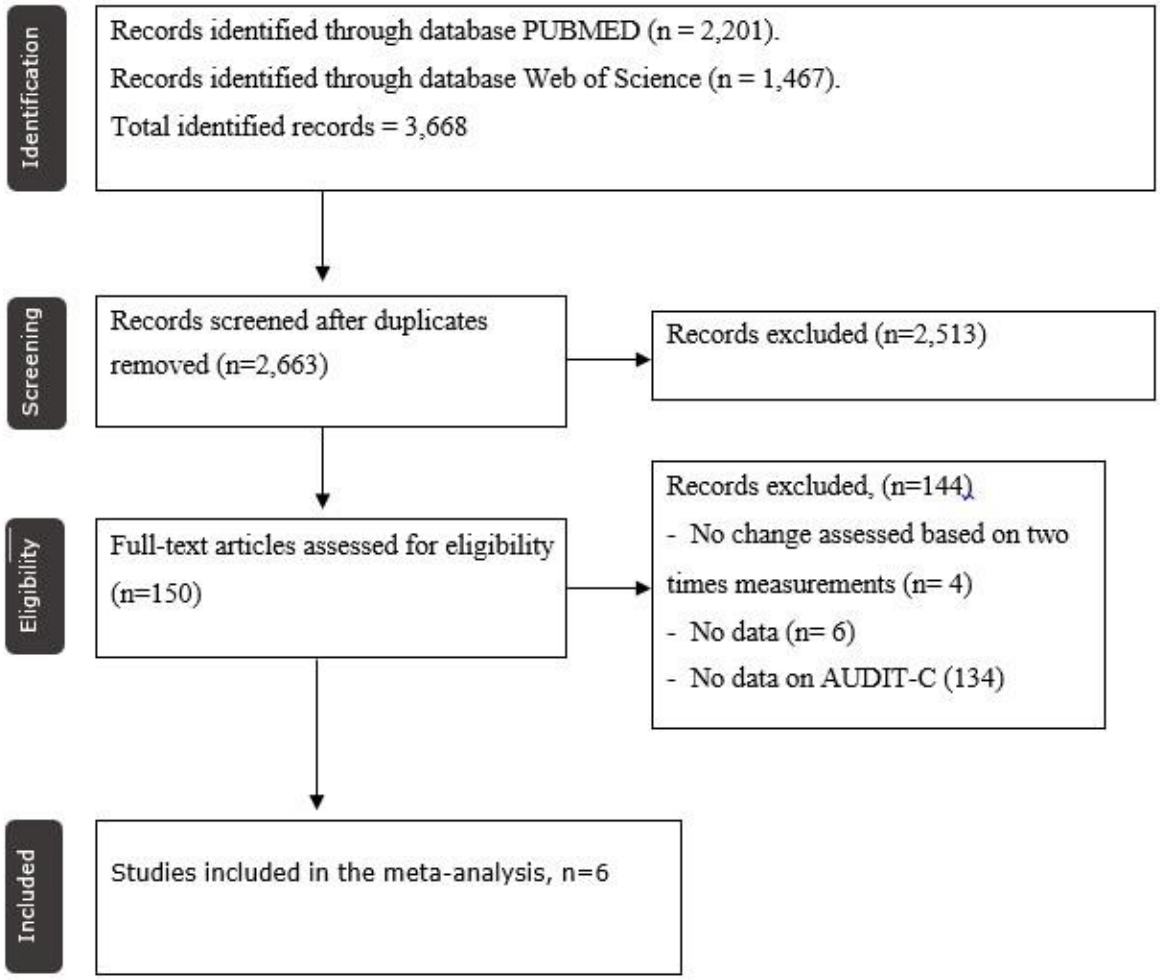
4.1. Inclusion and exclusion criteria:

Several kinds of study designs, cross-sectional, longitudinal, RCTs and surveys, except reviews, editorials and case reports were eligible for this systematic review and meta-analysis. Studies that are eligible should include data that allow comparisons between the scores of the AUDIT-C questionnaire (version with three questions) before and during the pandemic. The AUDIT-C is a brief, modified version of the full AUDIT questionnaire with 10 questions. This version was chosen because it is more specific to alcohol consumption and frequency and has high validity and reliability (Meneses-Gaya, Zuardi, Loureiro, & Crippa, 2009). The scale has three questions: How often the individual had a standard drink (never, monthly or less, 2–4 times per month, 2–3 times per week or 4 or more times per week), How many standard drinks on a typical day, and how often they had 6 or more drinks on one occasion (never, less than monthly, monthly, weekly, daily or almost daily). Possible scores range from 0 to 12 points (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001).

No restrictions were placed on participants' gender, ethnicity, or other demographic characteristics. The outcome variable of alcohol use was operetionalyzed as the difference in the total score of AUDIT-C as measured before and during the pandemic period.

5. Flowchart of included studies

Figure 1. Flowchart on identification, screening and inclusion of eligible publications



5.1. Table of included studies

Table 1: Characteristics of included studies and samples.

Study	*N*	mean age	% Female	Country	Outcome measure
Evans, S. et al. 2021	246	19.76	219	UK	Mean score on AUDIT-C
Haydon & Salvatore, 2021	236	30.3	78	US	Mean score on AUDIT-C
Lawrence, S. A. et al. 2021	88	28.97	93	US	Mean score on AUDIT-C
Oksanen, A. et al. 2021	1042	19-65	48.22	Finland	Mean score on AUDIT-C
Rantis, K. et al 2021	705	43.04	77.4	Greece	Mean score on AUDIT-C
Villanueva, V.J., et al 2021	3779	45	56	Spain	Mean score on AUDIT-C

Ethics

There is no need of ethical approval for the study.

6. Statistical analyses

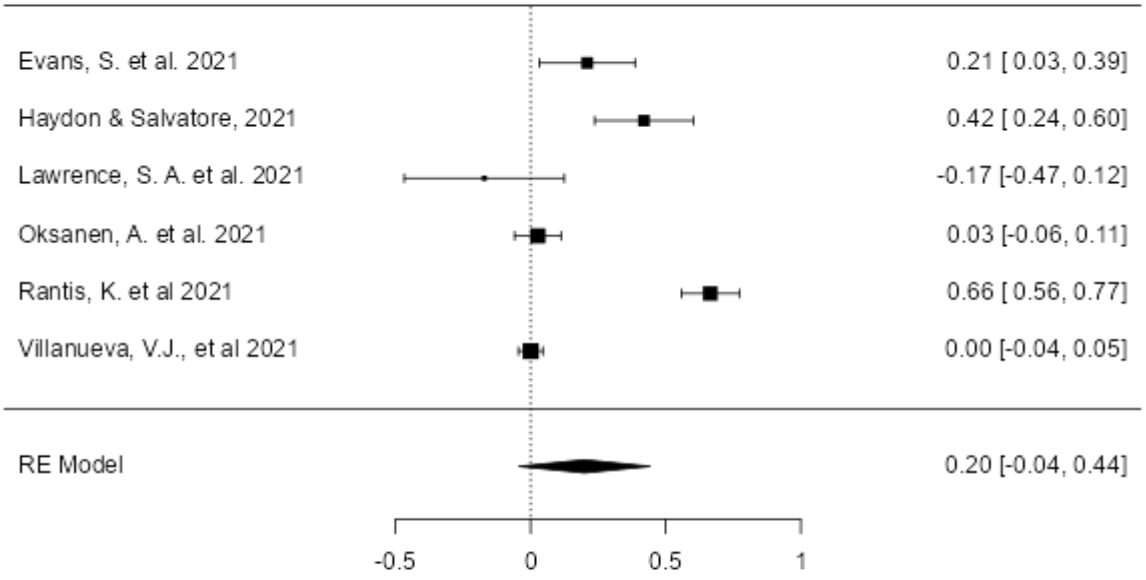
Jamovi software was used for the statistical analysis of the data. Data were pooled through random effects model. Cohen's d was used to indicate the standardized difference between the two means, with 95% confidence interval. A standarized mean difference of less than 0.20 was considered to be a very small effect, 0.20 a small effect, 0.50 a medium effect and 0.80 a large effect. I^2 test will be used to quantify the degree of heterogeneity in the analysis. Potential publication bias which is a threat to the validity and generalization of the conclusions, was assessed by funnel plots and Egger's test.

7. Results

The final analysis included six studies (figure 1) and data extracted from the studies were the first author's name and year of publication, the samples included in each study as well as the mean ages, the proportion of female population, the country of origin of each study and the outcome measures (table 1). The overall population of the studies included, was 6.096 mostly represented by females and young ages, as the final six studies provided, based on the inclusion criteria.

As can be observed from the forest plot (figure 2) the analysis provided a low effect size which is not statistically significant, ($p= 0.109$, $> 5\%$). The observed standardized mean differences ranged from -0.1713 to 0.6649, with the majority of estimates being positive (83%). The estimated average standardized mean difference based on the random-effects model was 0.1993 (95% CI: -0.0442 to 0.4429). There was no evidence for publication bias based on Egger's regression-based test ($p=0.679$). Regarding heterogeneity, according to the Q-test, the true outcomes appear to be heterogeneous ($Q= 144.6061$, $p < 0.0001$, $tau^2 = 0.0857$, $I^2 = 96.6991\%$). An examination of the studentized residuals revealed that none of the studies had a value larger than ± 2.6383 and hence there was no indication of outliers. According to the Cook's distances, none of the studies could be considered to be overly influential. Neither the rank correlation nor the regression test indicated any funnel plot asymmetry ($p = 0.4694$ and $p = 0.6787$, respectively).

7.1 Forest Plot. Figure 2



8. Discussion

As a primary objective, the present study aims to explore changes in alcohol consumption behaviour before and during the pandemic. According to the results of the analysis the hypothesis of increase of alcohol use due to COVID-19 is not supported. Specifically, in the five of the six studies the mean AUDIT-C scores were lower when assessed after the onset of the pandemic. These results are in line with other studies that report alcohol reduction due to the ban of sales or the quarantine measures. Possible explanations involve limited alcohol availability and socialization, changes in daily routine and downsized income, because of unemployment and reduced working hours, leading to tighter budgets for alcohol (de Goeij et al. 2015; Dom et al. 2016). As social distancing regulations have applied firmy to all countries it is possible that social drinking has been reduced. Another explanation could be that COVID-19 is a health-related crisis raising people's concern about their health,

resulting in moderate drinking. Timing should also be considered, as some of the pandemic's effects may be immediate, while others long-term. (Lau et al. 2005; Wu et al. 2008). (Panagiotidis, et al. 2020; Wang, et. al. 2020). It was suggested that during COVID-19, an alcohol use decrease may be expected in the immediate future (Rehm et al. 2020), while in the long term, an increase could appear. It is important also to note that all the studies in the analysis include young ages while other studies, which used the full AUDIT questionaire have found that middle-aged adults report significant increase in alcohol consumption during the pandemic. Other studies that have examined drinking behavior before and after lockdown in older people using either the full version of the AUDIT questionnaire or the AUDIT-C. According to the study of Dali, & Robinson (2020), 7,327 were assed with the AUDIT. There were increases of 8.5% and 5.6% in the 50–64 and 65+ age groups for drinking at least 4 times a week.

Additionally, the changes in alcohol consumption may follow another trend when considering different populations. The study of Kim et al. (2020) found that the lockdown period represents a risk factor for increasing alcohol consumption in people with pre-existing alcohol use disorder and relapse for those who were previously abstinent. In addition, reports of other studies indicate that pre-pandemic heavy drinking is associated with higher drinking consumption during the pandemic (Koopmann, Georgiadou, Kiefer, & Hillemacher, 2020).

Moreover, it is also possible that the long-terms effects of the pandemic on substance use and mental health in general, are yet not detectable. A study of 1346 adults in the UK, which used a timescale-adapted version of the full AUDIT, provided also results of overall decrease in alcohol consumption and problematic use which are possibly explained by the stringent lockdown period, the availability of alcoholic beverages, the limited exposure to alcohol cues that may trigger urges, or the preference of social alcohol consumption (Sallie, Ritou, Bowden-Jones, & Voon, 2020). Accordingly, the study of Chodkiewicz, Talarowska, Miniszewska, Nawrocka, & Bilinski (2020) provided similar result of decrease in alcohol consumption. Specifically, the decrease was moderated by age since people that were younger had reduced the amount of drinking. Moreover, only those with previous high levels of alcohol consumption have achieved higher results on current use related to COVID-19, signifying that their alcohol consumption is also moderated by previous hazardous drinking patterns. The study of Panagiotidis et al. (2020) has also reported decreased levels of alcohol consumption measured during the pandemic, explaining that the results are justified due to a number of factors, such us unemployment and reduced working hours, leading to tighter budgets for alcohol. Also, COVID-19, as a health-related crisis provokes increased concerns

about health and general well-being, resulting in moderate drinking. The quarantine restrictions and the staying at home orders have may resulted in the reports of inaccessibility to substances and reduced alcohol consumption since social distancing and limited socialization may have also reduce the possibility of peer pressure for substance use (Kar et al., 2020).

McPhee et al. (2020) assessed in their study the self-reported changes in alcohol consumption, and highlighted the differences in alcohol drinking patterns. Specifically, the participants reported a greater frequency of binge drinking and frequency of solitary drinking, but no change in the quantity and frequency of alcohol use. This, is possible to be the outcome of quarantine measures and social distancing.

The impact of the ongoing COVID-19 pandemic on individuals who use alcohol or other substances has raised serious concerns (Yazdi et al., 2020) without yet providing a clear picture of whether it has led to an increase in addictions. There is a mixed picture of the association of pandemic and quarantine with substance and alcohol abuse especially if we look at different populations such as people who are already under heavy use. Use of alcohol or other substances is considered coping mechanism that responds to stressful situations and the literature indicates the consumption of alcohol as a mean of reducing the unpleasant emotions, in the absence of adaptive coping strategies (Sudraba, et al., 2015).

Alcohol use disorder affects not only individuals and their families, but also society in general, being an important cause and risk factor for various health and social difficulties (Iranpour & Nakhaee, 2019). Alcohol consumption is considered a major risk factor for chronic diseases such as alcohol dependence, liver cirrhosis, diabetes, cardiovascular diseases, cancers, and injuries. The estimates of the Organisation for Economic Cooperation and Development (pre-dating COVID-19) suggest that drinking more than 1/1.5 drinks per day contributes to about 1.1 billion new cases of alcohol dependence (88% of all the cases), 37 million cases of injury (4%), 5 million cases of cirrhosis (38%) and 10 million cases of cancer related to alcohol (4%) and millions of cases of other diseases over the next 30 years in 52 countries (OECD 2021).

Given the need of effective prevention, but also the low rates of individuals who eventually seek help for alcohol abuse (Blankers, Koeter, & Schippers, 2011), it is important to identify common barriers to treatment and relapse factors as well as to consider alternative therapies choices. Alcohol abuse usually causes personal imbalances in social and professional life, therefore a holistic intervention, could offer some tools for developing coping skills that will promote the well-being of the individual. In addition, it is important to

consider that one does not just choose to get addicted, but there are often social factors and circumstances that lead a person to seek relief in alcohol or other substances. Alcohol dependence is caused by various not only personal but also social factors that should be taken into account when implementing the interventions that is accessible and available especially in times of crisis such as COVID-19. Since the pandemic has considerably changed everyday life for everyone, there are serious secondary effects, including the increased rates of unemployment. The long-term effects will be obvious by future data and research on psychiatric symptoms, such as depression, anxiety and substance use disorders (Sarvey, & Welsh, 2021).

The characteristics of the pandemic and the quarantine can lead the person to experience a constant state of intense and prolonged stress. Stress can lead to different coping mechanisms for populations of different ages (Cummings, Ackerman, Wolfson, & Gearhardt, 2021). It is possible that the differences in alcohol consumption for older adults that have been provided from the studies mentioned, to be explained by the lack of intimacy due to social distancing.

Regarding the limitations of this systematic review and meta-analysis, it is important to consider the limited amount of studies included . Hence the interpretation of the result does not provide adequate information regarding the impact of COVID-19 on alcohol consumption. Future research should focus more on how different aged groups are affected in order for appropriate preventing interventions to be implemented by governments. Moreover, research should also focus on the different coping mechanisms in periods of crisis among people with already established substance use disorders.

9. Conclusion

In general, the results of this study can be described as rather unexpected. The majority of the literature predicts diverse outcomes on mental health due to COVID-19 and an increase in the use of alcohol and other substances. On other hand it is possible that specific protective factors to be present in different populations and that the crisis of the pandemic does not affect everyone the same way. It remains to be explored what moderates the influence of COVID-19 on the overall mental health and well-being and how societies can build-up the resilience of people.

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Apendix A

Search string Web of Science:

(ALL = (covid OR COVID-19 OR coronavirus OR "corona virus" OR SARSCoV-2 OR "severe acute respiratory syndrome coronavirus 2") AND ALL = ("Alcohol-Related Disorders" OR Alcohol* OR Prescription Drug* OR substance use OR substance misuse OR substance abuse OR opioid OR Opiate OR Heroin OR Opium OR Cannabis OR Marijuana OR Cocaine OR sedatives OR tranquilizers OR major tranquilizers OR Amphetamine OR Tobacco OR Nicotine OR benzodiazepines OR psychoactive OR psychotropic OR psychopharmacology OR psychiatric medication* OR anticonvulsant* OR antidepressant* OR antipsychotic* OR anxiolytic* OR recreational drug* OR stimulant medication* OR self-medication OR mental health drug* OR anti-anxiety medication* OR sleep aid)) AND ((PY==("2021" OR "2020") AND DT==("ARTICLE" OR "EARLY ACCESS")) NOT (DT==("REVIEW" OR "LETTER" OR "EDITORIAL MATERIAL")))

Search string PubMed:

(((covid OR COVID-19 OR coronavirus OR "corona virus" OR SARSCoV-2 OR "severe acute respiratory syndrome coronavirus 2") AND ("Alcohol-Related Disorders"[Mesh] OR Alcohol OR Prescription Drugs OR substance use OR substance misuse OR substance abuse OR substance-related disorders OR SubstanceRelated Disorders OR Opioid-Related Disorders OR Opiate OR Opioid OR Prescription Opiate OR Prescription Opioid OR Opiate Overdose OR Heroin OR Opium OR Cannabis OR Marijuana OR Cocaine Hydrochloride OR Cocaine-Related Disorders OR sedatives OR tranquilizers OR major tranquilizers OR Amphetamine OR Tobacco OR Nicotine OR benzodiazepines OR psychoactive OR psychotropic OR psychopharmacology OR "psychiatric medications" OR anticonvulsant* OR

antidepressant* OR antipsychotic* OR anxiolytic* OR recreational drug* OR stimulant medication* OR self-medication OR mental health drug* OR anti-anxiety medication* OR sleep aid)) AND (("2020"[Date - Publication] : "2021"[Date - Publication]))) NOT ("comment"[Publication Type] OR "editorial"[Publication Type] OR "letter"[Publication Type] OR "review"[Publication Type] OR "systematic review"[Publication Type] OR "meta analysis"[Publication Type])