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Research Article

Alcohol and Substance Abuse in the General Population during the COVID-19 Pandemic: Results of the COMET-G International Study

Elias Tzavellas[1*], Vasilopoulos Efthimios[1], Panagiota Bompori[2], Seri Abraham[3-5], Kristina Adorjan[6], Helal Uddin Ahmed[7], Renato D Alarcón[8,9], Kiyomi Arai[10], Sani Salihu Auwal[11,12], Michael Berk[13,14], Sarah Bjedov[15], Julio Bobes[16,17], Teresa Bobes-Bascaran[18,19], Julie Bourgin-Duchesnay[20], Cristina Ana Bredicean[21], Laurynas Bukelskis[22], Akaki Burkadze[23,24], Indira Indiana Cabrera Abud[25], Ruby Castilla-Puentes[26], Marcelo Cetkovich[27,28], Hector Colon-Rivera[29], Ricardo Corral[30,31], Carla Cortez-Vergara[32], Piirika Crepin[33], Domenico De Berardis[34-36], Sergio Zamora Delgado[37], David De Lucena[38], Avinash De Sousa[39,40], Ramona Di Stefano[41], Seetal Dodd[13,14,42], Livia Priyanka Elek[43], Anna Elissa[44], Berta Erdelyi-Hamza[43], Gamze Erzin[45,46], Martin J Etchevers[47], Peter Falkai[6], Adriana Farcas[48], Ilya Fedotov[49], Viktoriia Filatova[50], Nikolaos K Fountoulakis[51], Iryna Frankova[52], Francesco Franza[53,54], Pedro Frias[55], Tatiana Galako[56], Cristian J Garay[47], Leticia Garcia-Álvarez[19], Maria Paz García-Portilla[16,57], Xenia Gonda[43], Tomasz M Gondek[58], Daniela Morera González[59], Hilary Gould[60], Paolo Grandinetti[34], Arturo Grau[37,61], Violeta Groudeva[62], Michal Hagin[63], Takayuki Harada[64], Tasdik M Hasan[65,66], Nurul Azreen Hashim[67], Jan Hilbig[22], Sahadat Hossain[68], Rossitza Iakimova[69], Mona Ibrahim[70], Felicia Iftene[71], Yulia Ignatenko[72], Matias Irarrazaval[73], Zaliha Ismail[74], Jamila Ismayilova[75], Asaf Jacobs[76,77], Miro Jakovljević[78], Nenad Jakšić[15], Afzal Javed[79-81], Helin Yilmaz Kafali[82], Sagar Karia[39], Olga Kazakova[83], Doaa Khalifa[70], Olena Khaustova[52], Steve Koh[60], Korneliia Kosenko[86], Sotirios A Koupidis[87], Alisha Lalljee[40], Justine Liewig[20], Abdul Majid[88], Evgeniia Malashonkova[20], Khamelia Malik[44], Najma Iqbal Malik[89], Gulay Mammadzada[90], Bilvesh Mandalia[40], Donatella Marazziti[91-93], Darko Marčinko[15,78], Stephanie Martinez[60], Eimantas Matiekus[22], Gabriela Mejia[60], Roha Saeed Memon[94], Xarah Elenne Meza Martínez[95], Dalia Mickevičiūtė[96], Roumen Milev[71], Muftau Mohammed[97], Alejandro Molina-López[98], Petr Morozov[99], Nuru Suleiman Muhammad[100], Filip Mustač[15], Mika S Naor[101], Amira Nassieb[70], Alvydas Navickas[22], Tarek Okasha[70], Milena Pandova[69], Anca-Livia Panfil[102], Liliya Panteleeva[103], Ion Papava[21], Mikaella E Patsali[104,105], Alexey Pavlichenko[72], Bojana Pejuskovic[106,107], Mariana Pinto Da Costa[108-110], Mikhail Popkov[111], Dina Popovic[112], Nor Jannah Nasution Raduan[67], Francisca Vargas Ramírez[37,61], Elmars Rancans[113,114], Salmi Razali[67], Federico Rebok[115,116], Anna Rewekant[117], Elena Ninoska Reyes Flores[118], María Teresa Rivera-Encinas[119], Pilar Saiz[16,18], Manuel Sánchez de Carmona[120], David Saucedo Martínez[121], Jo Anne Saw[67], Görkem Saygili[122], Patricia Schneidereit[123], Bhumika Shah[124], Tomohiro Shirasaka[125], Ketevan Silagadze[23], Satti Sitanggang[126], Oleg Skugarevsky[127], Anna Spikina[128], Sridevi Sira Mahalingappa[129], Maria Stoyanova[69], Anna Szczegielniak[130], Simona Claudia Tamasan[102], Giuseppe Tavormina[54,131,132], Maurilio Giuseppe Maria Tavormina[54], Pavlos N Theodorakis[133], Mauricio Tohen[134], Eva Maria Tsapakis[135,136], Dina Tukhvatullina[137], Irfan Ullah[138], Ratnaraj Vaidya[139], Johann M Vega-Dienstmaier[140], Jelena Vrublevska[113,114,141], Olivera Vukovic[106,142], Olga Vysotska[143], Natalia Widiasih[44], Anna Yashikhina[84,144], Konstantinos N Fountoulakis[51] and Daria Smirnova[84,144]

[1]Department of Psychiatry, Eginition Hospital, University of Athens, Greece
[2]3rd Department of Psychiatry, School of Medicine, Aristotle University of Thessaloniki Greece, Thessaloniki, Greece
[3]Pennine Care NHS Foundation Trust, United Kingdom
[4]Manchester Metropolitan University, Manchester, United Kingdom
[5]Core Psychiatry training, Health Education England North West, United Kingdom
[6]Department of Psychiatry, Ludiwig-Maximilians-University, Munich, Germany
[7]Child Adolescent and Family Psychiatry, National Institute of Mental Health, Dhaka, Bangladesh
[8]Section of Psychiatry and Mental Health, Universidad Peruana Cayetano Heredia, Facultad de Medicina Alberto Hurtado, Lima, Peru
[9]Department of Psychiatry and Psychology, Mayo Clinic School of Medicine, Rochester, MN, USA
[10]School of Medicine and Health Science, Institute of Health Science Shinshu University, Matsumoto, Japan
[11]Department of Psychiatry, Bayero University, Kano, Nigeria
[12]Aminu Kano Teaching Hospital, Kano, Nigeria
[13]IMPACT – the Institute for Mental and Physical Health and Clinical Translation, Deakin University, School of Medicine, Barwon Health, Geelong, Australia
[14]Orygen the National Centre of Excellence in Youth Mental Health, Centre for Youth Mental Health, Florey Institute for Neuroscience and Mental Health and the Department of Psychiatry, The University of Melbourne, Melbourne, Australia
[15]Department of Psychiatry and Psychological Medicine, University Hospital Centre Zagreb, Zagreb, Croatia
[16]Psychiatry Area, Department of Medicine, University of Oviedo, Oviedo, ISPA, INEUROPA. CIBERSAM, Spain
[17]Department of Psychiatry, Hospital Universitario Central de Asturias, Oviedo, ISPA, INEUROPA. CIBERSAM, Spain
[18]Mental Health Center of La Corredoria, Oviedo, ISPA, INEUROPA. CIBERSAM, Spain
[19]Department of Psychology, University of Oviedo, Oviedo, Spain, ISPA, INEUROPA. CIBERSAM, Spain
[20]Division of Child and Adolescent Psychiatry, Department of Psychiatry, Groupe Hospitalier Nord Essonne, Orsay, France
[21]Department of Neuroscience, Discipline of Psychiatry, "Victor Babes" University of Medicine and Pharmacy, Timisoara, Romania
[22]Clinic of Psychiatry, Institute of Clinical Medicine, Medical Faculty, Vilnius University, Vilnius, Lithuania
[23]Mental Hub, Tbilisi, Georgia
[24]NGO Healthcare Research and Quality Agency, Tbilisi, Georgia
[25]Hospital San Juan de Dios Hospital, Guadalajara, Mexico
[26]Janssen Research and Development, Johnson & Johnson, American Society of Hispanic Psychiatry and WARMI Women Mental Health, Cincinnati, Ohio, USA
[27]Institute of Translational and Cognitive Neuroscience (INCyT), INECO Foundation, Favaloro University, Buenos Aires, Argentina
[28]National Scientific and Technical Research Council (CONICET), Buenos Aires, Argentina
[29]APM Board Certified in General Psychiatry and Neurology, Addiction Psychiatry, & Addiction Medicine, UPMC, DDAP, Philadelphia, USA
[30]Department of Teaching and Research, Hospital Borda, Buenos Aires, Argentina
[31]University of Buenos Aires, Buenos Aires, Argentina
[32]Universidad Peruana Cayetano Heredia, Clínica AngloAmericana, Lima, Perú
[33]Sanitaire and Social Union for Accompaniment and Prevention, Center of Ambulatory Psychiatry of Narbonne and Lezigan, Narbonne, France
[34]Department of Mental Health, Psychiatric Service of Diagnosis and Treatment, Hospital "G. Mazzini", ASL Teramo, Teramo, Italy
[35]School of Nursing, University of L'Aquila, Italy
[36]Department of Neuroscience and Imaging, School of Psychiatry, University of Chieti, Chieti, Italy
[37]Child and Adolescent Psychiatry Department, Hospital Luis Calvo Mackenna, Santiago, Chile
[38]Departamento de Fisiología e Farmacología, Universidade Federal do Ceará, Fortaleza, Ceará, Brazil
[39]Department of Psychiatry, Lokmanya Tilak Municipal Medical College, Mumbai, India
[40]Desousa Foundation, Mumbai, India
[41]Department of Biotechnological and Applied Clinical Sciences, Section of Psychiatry, University of L'Aquila, L'Aquila, Italy
[42]University Hospital Geelong, Barwon Health, Geelong, Victoria, Australia
[43]Department of Psychiatry and Psychotherapy, Semmelweis University, Budapest, Hungary
[44]Department of Psychiatry, Faculty of Medicine, Universitas Indonesia, Cipto Mangunkusumo National Referral Hospital, Jakarta, Indonesia
[45]Psychiatry department, Ankara dışkapı training and research hospital, Ankara, Turkey
[46]Department of Psychiatry and Neuropsychology, School for Mental Health and Neuroscience, Maastricht University Medical Center, Maastricht, The Netherlands
[47]Faculty of Psychology, University of Buenos Aires (UBA), Buenos Aires, Argentina
[48]Centre of Neuroscience, Queen's University, Kingston, Ontario, Canada
[49]Department of Psychiatry and Narcology, Ryazan State Medical University n.a. academician I.P. Pavlov, Ryazan, Russia
[50]State Budgetary Institution of the Rostov Region "Psychoneurological Dispensary", Rostov-on-Don, Russia
[51]Faculty of Medicine, Medical University of Sofia, Bulgaria
[52]Medical Psychology, Psychosomatic Medicine and Psychotherapy Department, Bogomolets National Medical University, Kyiv, Ukraine
[53]"Villa dei Pini" Psychiatric Rehabilitation Center, Avellino, Italy
[54]Psychiatric Studies Centre, Provaglio d'Iseo, Italy
[55]Hospital Magalhães Lemos, Porto, Portugal
[56]Department of Psychiatry, Medical Psychology and Drug Abuse, Kyrgyz State Medical Academy, Bishkek, Kyrgyz Republic
[57]Mental Health Center of La Ería, Oviedo, ISPA, INEUROPA. CIBERSAM, Spain
[58]Specialty Training Section, Polish Psychiatric Association, Wroclaw, Poland

[59]Instituto Nacional de Psiquiatría Ramón De la Fuente Muñiz, Mexico City, Mexico
[60]Department of Psychiatry, University of California San Diego, San Diego, USA
[61]Universidad Diego Portales, Santiago, Chile
[62]Department of Diagnostic Imaging, University Hospital Saint Ekaterina, Sofia, Bulgaria
[63]Forensic Psychiatry Unit, Abarbanel Mental Health Center, Israel
[64]Faculty of Human Sciences, Education Bureau of the Laboratory Schools, University of Tsukuba, Tokyo, Japan
[65]Department of Primary Care & Mental Health, University of Liverpool, Liverpool, United Kingdom
[66]Public Health Foundation, Dhaka, Bangladesh
[67]Department of Psychiatry, Faculty of Medicine, Universiti Teknologi MARA, Sungai Buloh, Selangor, Malaysia
[68]Department of Public Health & Informatics, Jahangirnagar University, Dhaka, Bangladesh
[69]Second Psychiatric Clinic, University Hospital for Active Treatment in Neurology and Psychiatry "Saint Naum", Sofia, Bulgaria
[70]Okasha Institute of Psychiatry, Faculty of Medicine, Ain Shams University, Cairo, Egypt
[71]Department of Psychiatry, Queens University, Kingston, Ontario, Canada
[72]Education center, Mental Health Clinic No 1 n.a. N.A. Alexeev of Moscow Healthcare Department, Moscow, Russia
[73]Ministry of Health, Millenium Institute for Research in Depression and Personality, Santiago, Chile
[74]Department of Public Health Medicine, Faculty of Medicine, Universiti Teknologi MARA, Sungai Buloh, Selangor, Malaysia
[75]National Mental Health Center of the Ministry of Health of the Republic of Azerbaijan, Baku, Azerbaijan
[76]Department of Psychiatry, Westchester Medical Center Health System, Valhalla, NY, USA
[77]New York Medical College, Valhalla, NY, USA
[78]School of Medicine, University of Zagreb, Zagreb, Croatia
[79]Institute of Applied Health Research, University of Birmingham, United Kingdom
[80]Warwick Medical School, University of Warwick, United Kingdom
[81]Pakistan Psychiatric Research Centre, Fountain House, Lahore, Pakistan
[82]Child Psychiatry Department, Ankara city hospital, Ankara, Turkey
[83]Faculty of Medicine, Lund University, Malmö, Sweden
[84]International Centre for Education and Research in Neuropsychiatry (ICERN), Samara State Medical University, Samara, Russia
[85]Kirov State Medical University, Kirov, Russia
[86]Psychiatry, Drug abuse and Psychology Department, Odessa National Medical University, Odessa, Ukraine
[87]Occupational & Environmental Health Sector, Public Health Policy
[88]Department of Psychiatry, SKIMS Medical College, Srinagar, India
[89]Department of Psychology, University of Sargodha, Sargodha, Pakistan
[90]Department of Psychiatry, Azerbaijan Medical University, Baku, Azerbaijan
[91]Department of Clinical and Experimental Medicine, Section of Psychiatry, University of Pisa, Pisa, Italy
[92]Unicamillus, Saint Camillus International University of Health Sciences, Rome, Italy
[93]Brain Research Foundation onus, Lucca, Italy
[94]Dow Medical College, Dow University of Health Sciences, Karachi, Pakistan
[95]Postgraduate Program in Psychiatry, National Autonomous University of Honduras, Tegucigalpa, Honduras
[96]Private outpatient clinics "JSC InMedica klinika", Vilnius, Lithuania
[97]Department of Clinical Services, Federal Neuropsychiatric Hospital, Kaduna, Nigeria
[98]General Office for the Psychiatric Services of the Ministry of Health, Mexico City, Mexico
[99]Department of Postgraduate Education, Russian National Research Medical University n.a. N.I. Pirogov, Moscow, Russia
[100]Department of Community Medicine, Ahmadu Bello University Teaching Hospital, Zaria, Nigeria
[101]Sackler School of Medicine New York State American Program, Tel Aviv University, Tel Aviv-Yafo, Israel
[102]Compartment of Liaison Psychiatry, "Pius Brinzeu" County Emergency Clinical Hospital, Timisoara, Romania
[103]Department of Medical Psychology, Psychiatry and Psychotherapy, Kyrgyz-Russian Slavic University, Bishkek, Kyrgyz Republic
[104]School of Social Sciences, Hellenic Open University, Patras, Greece
[105]Department of Internal Medicine, Nicosia General Hospital, Nicosia, Cyprus
[106]Faculty of Medicine, University of Belgrade, Belgrade, Serbia
[107]Clinical Department for Crisis and Affective Disorders, Institute of Mental Health, Belgrade, Serbia
[108]South London and Maudsley NHS Foundation Trust, London, United Kingdom
[109]Institute of Psychiatry, Psychology & Neuroscience, King's College London, London, United Kingdom
[110]Institute of Biomedical Sciences Abel Salazar, University of Porto, Porto, Portugal
[111]Department of the Introduction to Internal Medicine and Family Medicine, International Higher School of Medicine, Bishkek, Kyrgyz Republic
[112]Abarbanel Mental Health Center, Bat-Yam, Israel
[113]Department of Psychiatry and Narcology, Riga Stradins University, Riga, Latvia
[114]Riga Centre of Psychiatry and Narcology, Riga, Latvia
[115]Servicio de Emergencia, Acute inpatient Unit, Hospital Moyano, Buenos Aires, Argentina
[116]Argentine Institute of Clinical Psychiatry (IAPC), Buenos Aires, Argentina
[117]General Psychiatry Unit I, Greater Poland Neuropsychiatric Center, Kościan, Poland

[118]Department of Psychiatry, National Autonomous University of Honduras, Tegucigalpa, Honduras
[119]Centro de Investigación en Salud Pública, Facultad de Medicina, Universidad de San Martín de Porres, Instituto Nacional de Salud Mental "Honorio Delgado – Hideyo Noguchi", Lima, Perú
[120]Faculty of Health Sciences, Anahuac University, Mexico City, Mexico
[121]Department of Psychiatry. Escuela Nacional de Medicina, TEC de Monterrey. Servicio de geriatría. Hospital Universitario "José Eleuterio González" UANL. Monterrey, Nuevo León México
[122]Assistant Professor at Cognitive Science and Artificial Intelligence Department Tilburg University
[123]Klinik für Allgemeine Psychiatrie und Psychotherapie Ost, Psychiatrische Institutsambulanz, Klinikum am Weissenhof, Weissenhof, Germany
[124]DY Patil Medical College, Navi Mumbai, India
[125]Department of Psychiatry, Teine Keijinkai Medical Center, Sapporo, Japan
[126]Psychiatric Unit, Pambalah Batung General Hospital, South Kalimantan, Amuntai, Indonesia
[127]Department of Psychiatry and Medical Psychology, Belarusian State Medical University, Minsk, Belarus
[128]Saint Petersburg Psychoneurological Dispensary No2, Saint Petersburg, Russia
[129]Derbyshire Healthcare NHS Foundation Trust, The Liasion Team, Royal Derby Hospital, Derby, Derbyshire, United Kingdom
[130]Department of Psychiatric Rehabilitation, Department of Psychiatry and Psychotherapy, Faculty of Medical Sciences in Katowice, Medical University of Silesia, Poland
[131]European Depression Association and Italian Association on Depression, Brussels, Belgium
[132]Bedforshire Center for Mental Health Research in association with the University of Cambridge, United Kingdom
[133]Health Policy, WHO Regional Office for Europe
[134]Department of Psychiatry and Behavioral Sciences, School of Medicine, University of New Mexico, Albuquerque, New Mexico, USA
[135]"Agios Charalambos" Mental Health Clinic, Heraklion, Crete, Greece
[136]1st Department of Academic Psychiatry, School of Medicine, Aristotle University of Thessaloniki, Greece
[137]Centre for Global Public Health, Institute of Population Health Sciences, Queen Mary University of London, London, United Kingdom
[138]Kabir Medical College, Gandhara University, Peshawar, Pakistan
[139]Faculty of Medical Sciences, Newcastle University, Newcastle upon Tyne, United Kingdom
[140]Facultad de Medicina Alberto Hurtado, Universidad Peruana Cayetano Heredia, Lima, Perú
[141]Institute of Public Health, Riga Stradins University, Riga, Latvia
[142]Department for Research and Education, Institute of Mental Health, Belgrade, Serbia
[143]Educational and Research Center - Ukrainian Family Medicine Training Center, Bogomolets National Medical University, Kyiv, Ukraine
[144]Department of Psychiatry, Narcology, Psychotherapy and Clinical Psychology, Samara State Medical University, Samara, Russia

More Information

***Address for correspondence:**
Elias Tzavellas, Department of Psychiatry, Eginition Hospital, University of Athens, Greece, Email: etzavell@med.uoa.gr

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Abbreviations: COMET-G: COVID-19 Mental Health International for the General Population; COVID-19: Coronavirus Disease 2019; SARS: Severe Acute Respiratory Syndrome; ANOVA: Analysis of Variance; CES-D: Center for Epidemiologic Studies Depression Scale; STAI-S: State-Trait Anxiety Inventory – State; RASS: Richmond Agitation-Sedation Scale; MFSLRA: Multiple Forward Stepwise Linear Regression Analysis; RR: Relative Risk

Abstract

The global impact of the COVID-19 pandemic on mental health and substance use behaviors has sparked extensive research efforts. The COMET-G international study, organized by the Department of Medicine and the Rectorate of the Aristotle University of Thessaloniki in collaboration with the World Psychiatric Association, delved into these issues. Running from March 2020 to April 2021, the study collected responses from 55,589 individuals across 40 countries. Through a comprehensive questionnaire, participants provided insights into their mental state, attitudes toward the pandemic, and the resultant changes in their personal and daily lives. Findings revealed, among other things, significant patterns of change in substance use, with notable correlations between reduced usage and the severity of lockdown measures among non-binary individuals. Mental health history emerged as a strong predictor of substance use changes, with influences from anxiety disorders, depression, and self-harm. Additionally, family and social dynamics, including economic expectations and household composition, significantly shaped substance use behaviors during lockdowns. Given these findings, the development of comprehensive approaches targeting the adverse effects of the pandemic on individual behaviors and general welfare is crucial.

Introduction

The COVID-19 pandemic has resulted in substantial challenges at an international level, affecting various aspects of human existence, including mental health, patterns of substance misuse, and coping mechanisms. An onslaught of research efforts has been prompted by this turbulent environment in an attempt to comprehend its complex effects on human health and behavior. Although previous research has examined the overall impacts of substance use and mental health, there is a notable knowledge gap regarding the precise effects of sociodemographic factors, mental health background, and familial dynamics on fluctuations in alcohol consumption, smoking, and illicit substance use amidst the worldwide health emergency.

The primary objective of the researchers is to highlight any changes in levels of substance use during the pandemic. Secondly, their objective is to ascertain the attributes that can serve as predictors of alterations in said behaviors. A thorough analysis of these components contributes to a more precise comprehension of how individuals navigate the complexities associated with lockdowns, societal disruptions, and the impending economic uncertainties that are linked to the ongoing global health crisis.

Historical data about past pandemics and crises can offer a contextual framework for comprehending the possible transformations in substance utilization amidst periods of adversity. An instance of this can be seen in the correlation between elevated levels of psychological distress and heightened smoking and alcohol consumption during the 2003 SARS outbreak [1-3]. Likewise, inquiries into the consequences of the terrorist attacks that occurred on September 11th unveiled a surge in the consumption of cigarettes, alcohol, and marijuana within the populations that were impacted [4-17].

Moreover, it is widely recognized that there exists a multifaceted relationship between substance use and mental health, whereby individuals frequently turn to substances as a means of managing mental health sequelae [18-21].

The current pandemic is characterized by stressful life experiences, which have been widely acknowledged as significant determinants in shaping patterns of alcohol consumption and substance use [22-29]. There is a suggestion that in response to collective stressors, individuals may adopt coping strategies, which can be positive or negative [30]. While certain individuals may reduce their substance use as a protective mechanism, others may revert to these behaviors as maladaptive coping mechanisms.

To address this disparity, the present study employs the all-encompassing approach described in Fountoulakis, et al. [31]. The primary aim of the current study was to identify any fluctuations in substance use behaviors and, secondly, to canvass predictors and patterns that account for any observed fluctuations. An additional aim of the study was to provide pragmatic knowledge for public health endeavors and interventions that specifically address the adverse consequences of the pandemic on substance addiction and mental health.

Materials and methods

Method

The protocol used is referred to in Fountoulakis, et al. [31] and gathered sociodemographic data, data about somatic and mental health history, and data concerning the COVID-19 pandemic including lockdown intensity (Completely, To a high degree, Partially, Not at all). It also included six questions about alcohol use, smoking, and substance abuse as follows:

M1. Smoking before the epidemic (I didn't smoke/I was smoking)

M2. Alcohol use before the epidemic (I did not drink much/I drank a lot, more than one drink or its equivalent every day)

M3. Use of illegal substances before the epidemic (e.g. hashish) (I did not use it/Occasionally and rather rarely/Often)

M4. During lockdown, you smoke (…) compared to before (More than before/Same as before/Less than before)

M5. During lockdown, you drink alcohol (…) compared to before (More than before/same as before/Less than before)

M6. While isolated at home, you use illegal substances (…) compared to before (More than before/same as before/Less than before)

Depression was assessed with the use of the CES-D [32-34] and anxiety with the STAI-S [35]. The RASS [34] was used to assess suicidality.

The data were collected online and anonymously from April 2020 through March 2021, covering periods of full implementation of lockdowns as well as of relaxations of measures in countries around the world. Announcements and advertisements were made on social media and through news sites, but no other organized effort had been undertaken. The first page included a declaration of consent which everybody accepted by continuing with the participation.

Approval was initially given by the Ethics Committee of the Faculty of Medicine, Aristotle University of Thessaloniki, Greece, and locally concerning each participating country.

The study sample included data from 40 countries concerning 55,589 responses (64.85% females; 34.05% males; 1.10% other) to the online questionnaire. The contribution of each country and the gender and age composition has been published previously as well as details concerning various sociodemographic variables (marital status, education, work, etc.) [31].

The study population was self-selected. It was not possible to apply post-stratification on the sample as it was done in a previous study [33], because this would mean that we would utilize a similar methodology across many different countries and the population data needed were not available for all.

- The six items about alcohol, smoking, and substance abuse were handled both as categorical variables but also as continuous variables taking into consideration the rank nature of their scoring as well as the big size of the study sample.Chi-square tests were used for the comparison of frequencies when categorical variables were present and for the post hoc analysis of the results a Bonferroni-corrected method of pair-wise comparisons was utilized [36].
- Analysis of Variance (ANOVA) was used to test differences among groups
- Pearson Correlation Coefficient (R) was used to test for relationships between continuous variables
- Multiple forward stepwise linear regression analysis (MFSLRA) was performed to investigate which variables could function as predictors and contribute to the development of others (e.g. depression).

Results

Demographics

The study sample included data from 40 countries. In total responses were gathered from 55,589 participants, aged 35.45 ± 13.51 years old; 36047 females (64.84%; aged 35.80 ± 13.61) and 18927 males (34.05%; aged 34.90 ± 13.29), while 615 declared 'non-binary gender' (1.11%; aged 31.64 ± 13.15). One-third of the study sample was living in the country's capital and an additional almost one-fifth in a city of more than one million inhabitants. Half were married or living with someone while 10.41% were living alone. Half had no children at all and approximately 75% had a bachelor's degree or higher. In terms of employment, 23.54% were civil servants, 37.06% were working in the private sector, 18.35% were college or university students while the rest were retired or were not working for a variety of reasons; of these, 33.86% did not work during lockdowns. The detailed composition of the study sample has been published in detail previously [31].

The effect of the COVID-19 pandemic on smoking, alcohol and substance abuse

Overall and concerning the total study sample, 21.95% of females, 28.67% of males, and 24.07% of 'non-binary gender' reported that they were smoking before the pandemic (24.26% of the total study sample, df = 2, chi-square = 1.387, $p = 0.499$). The respective rates concerning alcohol abuse were 6.55%, 12.85%, and 17.07 (8.81% of the total study sample, df = 2, chi-square = 4.686, $p = 0.096$), and concerning illegal substances were 5.61%, 9.71% and 18.05% (7.14% of total study sample, df = 2, chi-square = 7.430, $p = 0.024$). Concerning substance abuse before the pandemic the difference was specifically significant concerning females *vs.* 'nonbinary gender' (df = 1, chi-square = 6.818, $p = 0.009$).

Although smoking was increased by some and decreased by others during the lockdown, more people reduced than increased smoking (females 29.29% *vs.* 9.03%; males 32.54% *vs.* 10.54%; 'nonbinary gender' 35.28% *vs.* 16.10%; total study sample 30.46% *vs.* 9.62%). The pattern was similar with alcohol (females 30.88% *vs.* 10.42%; males 34.64% *vs.* 11.33%; 'nonbinary gender' 26.67% *vs.* 15.93%; total study sample 32.11% *vs.* 10.79%) and with substance abuse (females 32.68% *vs.* 2.12%; males 37.91% *vs.* 5.70%; 'nonbinary gender' 38.37% *vs.* 12.36%; total study.

Sample 34.52% *vs.* 3.45%). There was no difference between genders concerning the percentages of reduction (df = 2, chi-square = 0.720, $p = 0.868$), but there was concerning the increase (df = 2, chi-square = 8.143, $p = 0.017$), which was due to the difference between females *vs.* 'nonbinary gender' (df = 1, chi-square = 7.680, $p = 0.005$).

Interestingly, only in 'non-binary gender', the degree of lockdown was related to higher reporting of non-smoking (df = 3, chi-square = 20.495, $p = 0.001$; RR = 1.17-1.41), non-alcohol abuse (df = 3, chi-square = 16.015, $p = 0.001$; 1.17-1.32) and non-abuse of illegal substances (df = 3, chi-square = 13.094, $p = 0.004$; 1.11-1.27) before the lockdown.

Only in 'non-binary gender', a reduction was related to the degree of lockdown only concerning smoking (df = 3, chi-

square = 68.374, $p = 0.001$; RR = 1.42-1.80) and an increase was inversely related to the degree of lockdown only concerning illegal substance abuse (df = 3, chi-square = 11.509, $p = 0.009$; RR = 0.25-0.75).

Age correlated weakly but significantly ($p < 0.05$) with smoking (R = 0.04), alcohol abuse (R = 0.01), and illegal substance use (R = -0.09) before the lockdown. Interestingly advanced age was positively correlated ($p < 0.05$) with the increase in the use of all substances during the lockdown.

In comparison to no-lockdown, complete lockdown puts the person at approximately RR = 1.4-1.5 times to either increase or decrease smoking, RR = 1.46 to decrease alcohol, and 1.4-1.6 to either increase or decrease illegal substance use.

The detailed results of substance use patterns by gender and lockdown measures presence are shown in Table 1.

Relationship of substance use changes with anxiety, depression, suicidality, and a history of mental health

The complete results concerning mental health during the pandemic will only briefly be mentioned here and are referred to in Fountoulakis, et al. [31]. From the total study sample, 47.41% reported an increase in anxiety, and 40.28% reported an increase in depressive feelings. Suicidal thoughts were increased by 10.83%. Overall, current probable depression was present in 20.49% of females, 12.36% of males, and 27.64% of those registered as 'non-binary gender', with an unweighted average of 17.80% for the whole study sample. Additionally, distress was present in 17.41%, 15.17%, 23.09%, and 16.71% respectively. Also, 4.80% reported that they often thought much or very much about committing suicide if they had the chance.

In terms of mental health history and self-harm, 7.85% had a prior history of an anxiety disorder, 12.57% of depression,

Table 1: Impact of the COVID-19 Lockdown on Substance Use Patterns: A Gender-Stratified Analysis.

M1. Smoking before the epidemic		I didn't smoke	I was smoking	RR for "I didn't smoke"	RR for "I was smoking"	
Females	Not at all	75.69	24.31			
	Partially	77.1	22.9	1.02	0.94	
	To a high degree	77.14	22.86	1.02	0.94	
	Completely	81.79	18.21	1.08	0.75	
	All females	78.05	21.95			
Males	Not at all	68.08	31.92			
	Partially	70.23	29.77	1.03	0.93	
	To a high degree	70.99	29.01	1.04	0.91	
	Completely	76.53	23.47	1.12	0.74	
	All males	71.33	28.67			
Non-binary gender	Not at all	57.58	42.42			
	Partially	67.27	32.73	1.17	0.77	
	To a high degree	81.3	18.7	1.41	0.44	
	Completely	80.23	19.77	1.39	0.47	
	All non-binary gender	75.93	24.07			
All gender groups	Not at all	72.14	27.86			
	Partially	74.4	25.6	1.03	0.92	
	To a high degree	75.33	24.67	1.04	0.89	
	Completely	80.19	19.81	1.11	0.71	
All study sample		75.74	24.26			
M2. Alcohol use before the epidemic		**I did not drink much**	**I used to drink a lot, more than one drink or its equivalent every day**	**RR for "I did not drink much"**	**RR for "I used to drink a lot, more than one drink or its equivalent every day"**	
Females	Not at all	93.61	6.39			
	Partially	93.14	6.86	0.99	1.07	
	To a high degree	93.28	6.72	1	1.05	
	Completely	93.95	6.05	1	0.95	
	All females	93.45	6.55			
Males	Not at all	84.34	15.66			
	Partially	86.74	13.26	1.03	0.85	
	To a high degree	87.95	12.05	1.04	0.77	
	Completely	88.96	11.04	1.05	0.7	
	All males	87.15	12.85			
Non-binary gender	Not at all	66.67	33.33			
	Partially	78.18	21.82	1.17	0.65	
	To a high degree	87.79	12.21	1.32	0.37	
	Completely	84.75	15.25	1.27	0.46	

	All non-binary gender	82.93	17.07				
All gender groups	Not at all	89.25	10.75				
	Partially	90.58	9.42	1.01	0.88		
	To a high degree	91.6	8.4	1.03	0.78		
	Completely	92.32	7.68	1.03	0.71		
All study sample		91.19	8.81				
M3. Use of illegal substances before the epidemic (e.g. hashish)		**I did not use it**	**Occasionally and rather rarely**	**Often**	**RR for "I did not use it"**	**RR for "occasionally and rather rarely"**	**RR for "often"**
Females	Not at all	95.78	3.59	0.63			
	Partially	94.22	5.11	0.68	0.98	1.42	1.08
	To a high degree	94.1	4.98	0.92	0.98	1.39	1.46
	Completely	94.37	5	0.63	0.99	1.39	1
	All females	94.39	4.84	0.77			
Males	Not at all	90.8	7.28	1.92			
	Partially	90.8	7.33	1.87	1	1.01	0.97
	To a high degree	89.77	8.48	1.75	0.99	1.16	0.91
	Completely	90.12	7.85	2.04	0.99	1.08	1.06
	All males	90.29	7.84	1.87			
Non-binary gender	Not at all	68.18	21.21	10.61			
	Partially	75.45	22.73	1.82	1.11	1.07	0.17
	To a high degree	85.11	11.83	3.05	1.25	0.56	0.29
	Completely	86.44	11.3	2.26	1.27	0.53	0.21
	All non-binary gender	81.95	14.63	3.41			
All gender groups	Not at all	93.33	5.38	1.29			
	Partially	92.75	6.11	1.14	0.99	1.14	0.88
	To a high degree	92.69	6.12	1.2	0.99	1.14	0.93
	Completely	92.98	5.94	1.08	1	1.1	0.84
All study sample		92.86	5.97	1.17			
M4. During lockdown, you smoke compared to before		**Less than before**	**Same as before**	**More than before**	**RR for "less than before"**	**RR for "same as before"**	**RR for "more than before"**
Females	Not at all	20.9	71.67	7.43			
	Partially	30.03	60.96	9.01	1.44	0.85	1.21
	To a high degree	28.71	61.78	9.51	1.37	0.86	1.28
	Completely	34.04	56.96	9	1.63	0.79	1.21
	All females	29.29	61.68	9.03			
Males	Not at all	26.43	65.58	7.99			
	Partially	33.42	56.22	10.36	1.26	0.86	1.3
	To a high degree	32.26	57.96	9.77	1.22	0.88	1.22
	Completely	37.88	47.47	14.65	1.43	0.72	1.83
	All males	32.54	56.92	10.54			
Non-binary gender	Not at all	22.73	54.55	22.73			
	Partially	34.55	48.18	17.27	1.52	0.88	0.76
	To a high degree	40.84	49.24	9.92	1.8	0.9	0.44
	Completely	32.2	45.76	22.03	1.42	0.84	0.97
	All non-binary gender	35.28	48.62	16.1			
All gender groups	Not at all	23.39	68.81	7.8			
	Partially	31.36	59.04	9.59	1.34	0.86	1.23
	To a high degree	29.92	60.48	9.59	1.28	0.88	1.23
	Completely	35.16	53.95	10.88	1.5	0.78	1.39
All study sample		30.46	59.92	9.62			
M5. During lockdown, you drink alcohol compared to before (More than before/Same as before/Less than before)		**Less than before**	**Same as before**	**More than before**	**RR for "less than before"**	**RR for "same as before"**	**RR for "more than before"**
Females	Not at all	22.8	66.5	10.7			
	Partially	29.81	59.43	10.76	1.31	0.89	1.01
	To a high degree	30.69	58.38	10.93	1.35	0.88	1.02
	Completely	36.37	54.58	9.05	1.6	0.82	0.85
	All females	30.88	58.7	10.42			
Males	Not at all	29.34	61.24	9.42			
	Partially	35.61	53.72	10.67	1.21	0.88	1.13
	To a high degree	33.28	55.25	11.47	1.13	0.9	1.22
	Completely	41.04	45.16	13.8	1.4	0.74	1.46
	All males	34.64	54.03	11.33			

Non-binary gender	Not at all	24.24	51.52	24.24			
	Partially	33.64	50	16.36	1.39	0.97	0.67
	To a high degree	22.14	67.56	10.31	0.91	1.31	0.43
	Completely	29.94	49.15	20.9	1.24	0.95	0.86
	All non-binary gender	26.67	57.4	15.93			
All gender groups	Not at all	25.74	64.02	10.24			
	Partially	32.05	57.18	10.78	1.25	0.89	1.05
	To a high degree	31.38	57.54	11.08	1.22	0.9	1.08
	Completely	37.68	51.68	10.64	1.46	0.81	1.04
All study sample		32.11	57.1	10.79			
M6. While isolated at home, you use illegal substances compared to before		**Less than before**	**Same as before**	**More than before**	**RR for "less than before"**	**RR for "same as before"**	**RR for "more than before"**
Females	Not at all	24.38	73.59	2.03			
	Partially	34.57	63.42	2.01	1.42	0.86	0.99
	To a high degree	31.83	66.28	1.89	1.31	0.9	0.93
	Completely	36.83	60.48	2.69	1.51	0.82	1.33
	All females	32.68	65.2	2.12			
Males	Not at all	30	65.47	4.53			
	Partially	40.9	54.33	4.77	1.36	0.83	1.05
	To a high degree	37.7	57.9	4.4	1.26	0.88	0.97
	Completely	42.19	47.44	10.37	1.41	0.72	2.29
	All males	37.91	56.4	5.7			
Non-binary gender	Not at all	36.36	40.91	22.73			
	Partially	31.82	53.64	14.55	0.88	1.31	0.64
	To a high degree	45.04	49.24	5.73	1.24	1.2	0.25
	Completely	33.33	49.72	16.95	0.92	1.22	0.75
	All non-binary gender	38.37	49.27	12.36			
All gender groups	Not at all	26.99	69.69	3.32			
	Partially	36.95	59.88	3.17	1.37	0.86	0.95
	To a high degree	33.75	63.55	2.69	1.25	0.91	0.81
	Completely	38.39	56.41	5.2	1.42	0.81	1.57
All study sample		34.52	62.03	3.45			

RR: Relative Risk.

1.16% of Bipolar disorder, 0.97% of psychosis and 2.70% of other mental disorders. Any mental disorder history was present in 25.25%. At least once, 21.44% had hurt themselves in the past and 10.59% had attempted at least once in the past.

There was no difference among the diagnostic groups of 'no depression or dysphoria' *vs.* 'dysphoria' *vs.* 'clinical depression' in terms of smoking (df = 2, chi-square = 0.320, p = 0.852), alcohol abuse (df = 2, chi-square = 0.667, p = 0.716) or illegal substance abuse (df = 2, chi-square = 3.388, p = 0.183) before the lockdown. There was no difference among the diagnostic groups concerning the rates of increase or decrease in smoking and alcohol or substance abuse.

The detailed results of substance use patterns, before and during the COVID-19 lockdown, by gender and depression clinical group are shown in Table 2.

The presence of a history of mental health acted as an important risk factor for substance use. The highest RR for smoking and alcohol abuse before the lockdown concerned a history of psychosis (RR = 1.60 and 2.87). History of Bipolar disorder (RR = 1.51 and 1.83) history of suicidal attempts (RR = 1.43 AND 2.57) and self-harm (RR = 1.29 and 2.04) were also strong risk factors. The strongest risk factors for illegal substance use before the lockdown were mainly psychosis (RR = 3.57), suicidal attempt (RR = 4.02), and Bipolar disorder (RR = 3.55). The strongest risk factors for an increase in smoking during the lockdown were Psychosis (RR = 2.22), Bipolar disorder (RR = 2.19), and suicidal attempt (RR = 2.18) while concerning the increase in alcohol abuse were any mental disorder (RR = 1.74), Bipolar disorder (1.83) and suicidal attempt (RR = 1.72). History of Psychosis (RR = 3.29), Bipolar disorder (RR = 3.18), and suicidal attempt (RR = 3.92) were the strongest factors for an increase in illegal substance use during the lockdown.

The complete set of RRs concerning the effect of a history of mental disorders on substance use is shown in Table 3.

Relationship of substance use changes with the family and social environment

In terms of family status, 43.95% were married, 48.53% had at least one child and only 10.41% were living alone. The responses suggested an increased need for communication with family members in 38.08%, an increased need for emotional support in 26.22%, fewer conflicts in 34.81% and increased conflicts within families for 37.71%, an improvement of the quality of relationships in 23.95%, while in most cases (61.62%) there was a maintenance of basic daily routine. During lockdowns, 33.86% did not work, while

Table 2: Association Between Depression and Substance Use Patterns Before and During the COVID-19 Lockdown.

M1. Smoking before the epidemic		I didn't smoke	I was smoking	RR for "I didn't smoke"	RR for "I was smoking"
Females	no depression or dysphoria	79.07	20.93		
	dysphoria	78.14	21.86	0.99	1.04
	Clinical depression	74.88	25.12	0.95	1.20
	All females	78.05	21.95		
Males	no depression or dysphoria	71.98	28.02		
	dysphoria	71.65	28.35	1.00	1.01
	Clinical depression	67.18	32.82	0.93	1.17
	All males	71.33	28.67		
Non-binary gender	no depression or dysphoria	79.21	20.79		
	dysphoria	73.94	26.06	0.93	1.25
	Clinical depression	71.76	28.24	0.91	1.36
	All non-binary gender	75.93	24.07		
all genders	no depression or dysphoria	76.40	23.60		
	dysphoria	76.07	23.93	1.00	1.01
	Clinical depression	73.01	26.99	0.96	1.14
All groups		75.74	24.26		

M2. Alcohol use before the epidemic		I did not drink much	I used to drink a lot, more than one drink or its equivalent every day	RR for "I did not drink much"	RR for "I used to drink a lot, more than one drink or its equivalent every day"
Females	no depression or dysphoria	94.83	5.17		
	dysphoria	91.38	8.62	0.96	1.67
	Clinical depression	91.02	8.98	0.96	1.74
	All females	93.45	6.55		
Males	no depression or dysphoria	88.57	11.43		
	dysphoria	84.08	15.92	0.95	1.39
	Clinical depression	82.61	17.39	0.93	1.52
	All males	87.15	12.85		
Non-binary gender	no depression or dysphoria	89.77	10.23		
	dysphoria	78.17	21.83	0.87	2.13
	Clinical depression	74.71	25.29	0.83	2.47
	All non-binary gender	82.93	17.07		
all genders	no depression or dysphoria	92.43	7.57		
	dysphoria	88.92	11.08	0.96	1.46
	Clinical depression	88.75	11.25	0.96	1.49
All groups		91.19	8.81		

M3. Use of illegal substances before the epidemic (e.g. hashish)		I did not use it	Occasionally and rather rarely	Often	RR for "I did not use it"	RR for "occasionally and rather rarely"	RR for "often"
Females	no depression or dysphoria	96.31	3.23	0.46			
	dysphoria	91.70	7.31	0.99	0.95	2.26	2.17
	Clinical depression	90.86	7.62	1.52	0.94	2.36	3.33
	All females	94.39	4.84	0.77			
Males	no depression or dysphoria	93.15	5.45	1.41			
	dysphoria	84.71	12.64	2.65	0.91	2.32	1.88
	Clinical depression	80.43	15.94	3.63	0.86	2.93	2.58
	All males	90.29	7.84	1.87			
Non-binary gender	no depression or dysphoria	90.76	7.59	1.65			
	dysphoria	78.87	16.20	4.93	0.87	2.13	2.99
	Clinical depression	68.82	25.88	5.29	0.76	3.41	3.21
	All non-binary gender	81.95	14.63	3.41			
all genders	no depression or dysphoria	95.07	4.10	0.82			
	dysphoria	89.34	9.10	1.56	0.94	2.22	1.89
	Clinical depression	88.01	9.90	2.08	0.93	2.41	2.53
All groups		92.86	5.97	1.17			

M4. During lockdown, you smoke compared to before		Less than before	Same as before	More than before	RR for "less than before"	RR for "same as before"	RR for "more than before"
Females	no depression or dysphoria	27.17	66.05	6.78			
	dysphoria	31.68	57.82	10.50	1.17	0.88	1.55
	Clinical depression	33.70	51.71	14.58	1.24	0.78	2.15
	All females	29.29	61.68	9.03			

Males	no depression or dysphoria	31.38	60.37	8.25			
	dysphoria	35.21	51.10	13.69	1.12	0.85	1.66
	Clinical depression	36.07	43.80	20.13	1.15	0.73	2.44
	All males	32.54	56.91	10.54			
Non-binary gender	no depression or dysphoria	36.63	50.83	12.54			
	dysphoria	34.51	44.37	21.13	0.94	0.87	1.68
	Clinical depression	33.53	48.24	18.24	0.92	0.95	1.45
	All non-binary gender	35.28	48.62	16.10			
all genders	no depression or dysphoria	28.83	63.78	7.38			
	dysphoria	32.81	55.54	11.65	1.14	0.87	1.58
	Clinical depression	34.26	49.78	15.96	1.19	0.78	2.16
All groups		30.47	59.91	9.62			
M5. During lockdown, you drink alcohol compared to before (More than before/Same as before/Less than before)		**Less than before**	**Same as before**	**More than before**	**RR for "less than before"**	**RR for "same as before"**	**RR for "more than before"**
Females	no depression or dysphoria	28.85	62.78	8.37			
	dysphoria	33.24	53.57	13.19	1.15	0.85	1.58
	Clinical depression	35.03	50.71	14.26	1.21	0.81	1.70
	All females	30.88	58.70	10.42			
Males	no depression or dysphoria	33.24	56.81	9.95			
	dysphoria	36.96	48.97	14.07	1.11	0.86	1.41
	Clinical depression	40.04	43.93	16.03	1.20	0.77	1.61
	All males	34.64	54.03	11.33			
Non-binary gender	no depression or dysphoria	28.71	60.73	10.56			
	dysphoria	21.83	57.04	21.13	0.76	0.94	2.00
	Clinical depression	27.06	51.76	21.18	0.94	0.85	2.01
	All non-binary gender	26.67	57.40	15.93			
all genders	no depression or dysphoria	30.50	60.51	8.99			
	dysphoria	34.21	52.20	13.59	1.12	0.86	1.51
	Clinical depression	36.08	49.13	14.80	1.18	0.81	1.65
All groups		32.11	57.10	10.79			
M6. While isolated at home, you use illegal substances compared to before		**Less than before**	**Same as before**	**More than before**	**RR for "less than before"**	**RR for "same as before"**	**RR for "more than before"**
Females	no depression or dysphoria	30.43	68.06	1.51			
	dysphoria	34.31	62.79	2.90	1.13	0.92	1.93
	Clinical depression	38.10	58.56	3.33	1.25	0.86	2.21
	All females	32.68	65.20	2.12			
Males	no depression or dysphoria	36.58	58.68	4.74			
	dysphoria	39.46	52.94	7.59	1.08	0.90	1.60
	Clinical depression	43.80	47.22	8.97	1.20	0.80	1.89
	All males	37.91	56.39	5.70			
Non-binary gender	no depression or dysphoria	42.57	49.17	8.25			
	dysphoria	34.51	46.48	19.01	0.81	0.95	2.30
	Clinical depression	34.12	51.76	14.12	0.80	1.05	1.71
	All non-binary gender	38.37	49.27	12.36			
all genders	no depression or dysphoria	32.85	64.37	2.78			
	dysphoria	35.90	59.50	4.60	1.09	0.92	1.65
	Clinical depression	39.38	55.77	4.85	1.20	0.87	1.74
All groups		34.52	62.02	3.45			

RR: Relative Risk.

48.43% expected their economic situation to worsen because of the COVID-19 outbreak.

Pearson's R among the number of people living in the house returned a significant but weak negative correlation (R = -0.11 to -0.13) with all smoking alcohol and substance use variables reflecting change during lockdown, reflecting an increase of use in crowded households. On the contrary, the number of children was significantly but weakly and positively correlated (R = 0.017 to 0.058) with all smoking alcohol and substance use variables reflecting change during lockdown, suggesting a decrease of use in families with many children. Education was also weakly protective (R = 0.02 to 0.05).

Multiple forward stepwise linear regression analysis

MFSLRA was performed with each one of the three items reflecting smoking, alcohol, and substance use change items as dependent variables and gender (three dummy variables males, females, and 'non-binary' gender as yes/

Table 3: Association Between Mental Health Disorders and Substance Use Patterns Across Different Phases of Lockdown.

	M1. I was smoking	M2. I used to drink a lot, more than one drink or its equivalent every day	M3. Use of illegal substances before the epidemic (e.g. hashish)			M4. During lockdown, you smoke (...) compared to before			M5. During lockdown, you drink (...) alcohol compared to before			M6. While isolated at home, you use (...) illegal substances compared to before		
History of:			I did not use it	Occasionally and rather rarely	Often	Less than before	Same as before	More than before	Less than before	Same as before	More than before	Less than before	Same as before	More than before
Any mental disorder	1.28	1.56	0.93	2.20	2.28	0.91	0.95	1.69	0.97	0.90	1.74	0.92	1.03	1.46
Anxiety	1.04	1.25	0.98	1.34	1.04	1.01	0.95	1.25	1.02	0.91	1.45	1.00	0.99	1.17
Depression	1.32	1.36	0.94	1.89	1.99	0.88	0.98	1.57	0.96	0.92	1.59	0.91	1.05	1.10
Bipolar disorder	1.51	1.83	0.85	2.95	3.55	1.00	0.81	2.19	1.05	0.81	1.83	0.98	0.89	3.18
Psychosis	1.60	2.87	0.81	3.59	3.57	0.94	0.84	2.22	1.02	0.87	1.64	0.84	0.96	3.29
Other mental disorder	1.06	1.40	0.95	1.60	2.17	0.85	1.02	1.37	0.86	1.01	r1.38	0.85	1.07	1.32
Self-harm	1.29	2.04	0.90	2.96	2.77	0.98	0.90	1.81	1.03	0.89	1.62	0.96	0.96	2.41
Suicidal attempt	1.43	2.57	0.84	3.66	4.02	1.05	0.81	2.18	1.04	0.85	1.72	1.03	0.86	3.92

no), age, number of persons in the house, number of children, presence of chronic somatic condition, being a caretaker, lockdown intensity, history of specific mental disorders (in separate variables), CES-D, STAI-S and RASS subscales scores (Intention, life, and history subscales). Although the results were significant, the regressions explained only approximately 4% of the observed variance.

- Change in smoking was significantly predicted (F = 129.907, R-sqr = 0.04, df: 18,54806; $p < 0.001$) by age (b = -0.01), number of people at home (b = -0.15), number of children (b = 0.68), being a caretaker (b = 0.06), lockdown intensity (b = -0.02), STAI-S (b = -0.02), CES-D (b = -0.03), RASS Life (b = 0.09), RASS History (b = -0.04), history of psychosis (b = 0.01), history of depression (b = 0.02), history of other mental disorder (b = 0.02), history of self-harm (b = 0.05) and history of suicide attempts (b = 0.02).

- Change in alcohol consumption was significantly predicted (F = 138.984, R-sqr = 0.04, df: 16,54808; $p < 0.001$) by male gender (b = -0.01), non-binary gender (b = 0.01), number of people at home (b = -0.13), number of children (b = 0.09), being a caretaker (b = 0.06), suffering from a chronic somatic condition (b = -0.009), lockdown intensity (b = -0.03), STAI (b = -0.03), CES-D (b = -0.04), RASS Life (b = 0.08), RASS Intention (b = 0.02), history of anxiety (b = 0.01), history of depression (b = 0.2), history of other mental disorder (b = 0.2), and history of self-harm (b = 0.02).

- Change in illegal substance use was significantly predicted (F = 117.031, R-sqr = 0.04, df: 18,54806; $p < 0.001$) by male gender (b = -0.02), age (b = -0.03), number of people at home (b = -0.11), number of children (b = 0.04), being a caretaker (b = 0.06), lockdown intensity (b = -0.02), STAI-S (b = -0.05), CES-D (b = -0.08), RASS Life (b = 0.10), RASS Intention (b = 0.01), RASS History (b = -0.04), history of psychosis (b = 0.02), history of anxiety (b = 0.008), history of depression (b = 0.01), history of Bipolar disorder (b = 0.009), history of other mental disorder (b = 0.01), history of self-harm (b = 0.04) and history of suicide attempts (b = 0.02).

Discussion

Before the COVID-19 pandemic outbreak, the percentage of those who smoked cigarettes was 24.26%, those who abused alcohol were 8.81%, and those who used illegal substances were 7.14% in the overall study population. The impact of lockdown measures on substance use was variable, as a greater proportion of respondents indicated a decrease in alcohol, nicotine, and substance abuse rather than an increase. Complete lockdown put the person at an approximately RR = 1.5 times to either increase or decrease substance use. Similar findings have been described in other studies [37,38]. Potential determinants of this variability could encompass fluctuations in social interactions, heightened levels of stress, modified routines, and psychological health difficulties encountered throughout periods of lockdown. Certain individuals may resort to substance use as a means of managing difficulties [39], whereas others may decrease their use in response to access disruptions or shifts in social dynamics [40,41].

The prevalence of smoking decreased varied across gender groups. Similarly, the proportions of alcohol and illicit substance use reduction spanned from 32.11% to 34.52%. The aforementioned figures are consistent with the findings of several research studies [39,41-48]. These findings suggest that the ongoing crisis has, to a certain degree, prompted favorable modifications in substance use patterns. However, a multitude of studies propose an alternative perspective [37,38,40,49-58]. These contrasts may be attributed to differences in study methodologies, distinctions in study participant demographics, and the diverse stages of quarantine that were examined.

It is worth mentioning that individuals who self-identified as "non-binary gender" demonstrated greater reductions in substance use during the lockdown. Significantly, a discernible correlation was identified among non-binary individuals between the severity of confinement protocols and a reduction in the consumption of all substances. This may underscore the criticality of taking into account a wide range of sociodemographic variables [59]. Non-binary individuals frequently confront social structures and norms that contest the conventional binary conception of gender. Engaging in this process of navigating societal expectations and stereotypes has the potential to foster the growth of resilience and coping mechanisms, which in turn may have an impact on patterns of substance use. The consensus among researchers regarding LGBTQ+ communities as a whole indicates that minority stress and discrimination are correlated with a heightened likelihood of engaging in substance use [60]. Nevertheless, non-binary individuals may also benefit from specialized support networks, community resilience, and coping mechanisms that may aid in the reduction of substance abuse. Conversely, alternative research has indicated that women are more likely to endorse proactive strategies in the face of challenges associated with COVID-19 [45,61].

Before the lockdown, there was a faint negative correlation between advanced age and reductions in smoking, alcohol abuse, and illegal substance use. Advanced age was positively correlated with the increase in the use of all substances during the lockdown. A plausible hypothesis is that elderly individuals may encounter difficulties acclimating to abrupt transformations in their lives, including diminished social interactions, restricted availability of support systems, and heightened experiences of isolation or ennui. As a consequence, certain individuals may have resorted to illicit substances such as cigarettes, alcohol, or drugs to alleviate emotional distress and manage stress, although findings from different studies are non-decisive [41,43,52,59].

Before the lockdown, individuals with a documented history of mental health disorders including psychosis, bipolar disorder, and suicidal ideation exhibited the most pronounced correlations with substance use. Anxiety (as measured by the STAI-S scale), depressive symptoms (as measured by the CES-D scale), and suicidality (as measured by the RASS subscale) were all significant predictors of changes in smoking, alcohol consumption, and illicit substance use throughout the pandemic. A rise in anxiety and depressive symptoms was observed in 40.28% and 47.41% of the participants, respectively. One in 10.83% of respondents indicated that they had suicidal thoughts. The incidence of depression exhibited variability among non-binary individuals, males, and females, comprising 20.49%, 12.36%, and 27.64%, respectively. There is substantial evidence of the reciprocal relationship between substance use disorders and psychiatric conditions [62-65]. Acknowledging the cyclical nature of their relationship assists in highlighting the critical importance of integrated mental health and substance use interventions, as well as the profound impact that external stressors have on mental health. Buckner, et al. (2007) [66] have proposed that individuals may resort to self-regulating behaviors such as alcohol or nicotine use to momentarily ameliorate stress and tension due to the overwhelming nature of anxiety. Furthermore, according to the self-medication hypothesis [67], depressed individuals might self-medicate with substances in an attempt to alleviate feelings of hopelessness or sadness. In addition, as a means of coping with the distressing nature of these emotions, individuals who are facing suicidal ideation or behavior may resort to substance use. Nevertheless, it is imperative to acknowledge that substance use may also constitute an independent suicide risk factor [68].

The exploration of further sociodemographic variables yielded intricate understandings of how economic considerations, family structure, and work-related interactions influenced substance use patterns during lockdowns. The participants documented an increased need for emotional support and communication, as well as changes in conflicts and the overall standard of interpersonal connections. Further factors that were taken into account were the employment status and the number of occupants in the household. The employment status exhibited a marginally negative correlation with substance use behaviors during the lockdown period, while the former did indeed contribute to such changes. A substantial majority of respondents expected a deterioration in the economy as a direct outcome of the pandemic. The influence of the social environment has been underscored by a negative correlation observed between congested households and increased substance use [44,69]. Kassel, Veilleux, Wardle, and Markowitz [70] have also proposed a correlation between substance abuse and overcrowding in living quarters. The pressure associated with cohabitating in a small area with a large number of people may potentially lead some individuals to turn to substances as a coping mechanism or source of solace. Nevertheless, one could argue that the frequency of alcohol consumption or alcohol dependence does not exhibit a direct cause-and-effect relationship with loneliness amidst the COVID-19 pandemic.

Conversely, there was a marginal yet statistically significant positive correlation between the number of children residing in a household and a decrease in smoking, alcohol usage, and illicit substance use throughout the lockdown period. This finding implies the possibility of a protective effect. According to research, after having children, parents frequently adopt protective behaviors because they place a higher value on their children's safety than on engaging in hazardous activities. According to a study by Latendresse, et al. [71], to provide a secure and nurturing atmosphere for their children, parents are more likely to desist from or reduce their substance use, with mothers being particularly likely to do so. In addition, the cohabitation of children within the household may foster stronger social support systems, as parents work together in

concert to address the difficulties presented by the lockdowns. A correlation has been established between social support and reduced substance use [72]. Furthermore, the shared obligation of child care may cultivate an atmosphere in which parents proactively discourage substance use to preserve a stable and healthy household. It has been suggested that health factors and greater social proximity to non-smokers may provide a preventative effect against the use of cigarettes [45,73].

Additionally, education exhibited a feeble protective effect. The protective effects of higher education suggest that education may serve as a buffer against the detrimental effects of substance use-inducing stressors. This result is consistent with previous research [30] that highlighted the importance of education in fostering health literacy and adaptive coping mechanisms. Individuals who have attained higher levels of education may possess enhanced capabilities to evaluate the hazards critically linked to substance use, thereby decreasing the probability of their involvement in such behaviors. However, the results of the research are not unanimous [39].

Conclusion

The changes in substance use behaviors that have been observed throughout the pandemic emphasize the significance of situating these behaviors in a wider framework of individuals' lives. Due to the complex interaction between sociodemographic variables, mental health indicators, and environmental influences, targeted and individualized interventions seem essential. As society confronts the intricate challenges of public health in the aftermath of a global health crisis, the insights gained and the lessons learned provide significant value for the development of such evidence-based approaches. Approaches that consider various reactions to stressors, foster mental health and avert harms associated with substance use during critical periods. Notwithstanding the importance of specific predictors, the restricted explanatory variance implies the presence of latent variables or dynamic interactions that could potentially exert pivotal influences. Capturing the complete range of factors that influence various types of substance use presents a significant challenge, which requires continuous research to improve predictive models and interventions.

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