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## The effect of different degrees of lockdown and self-identified gender on anxiety, depression and suicidality during the COVID-19 pandemic: Data from the international COMET-G study.

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## ABSTRACT

**Introduction:** During the COVID-19 pandemic various degrees of lockdown were applied by countries around the world. It is considered that such measures have an adverse effect on mental health but the relationship of measure intensity with the mental health effect has not been thoroughly studied. Here we report data from the larger COMET-G study pertaining to this question.

**Material and Methods:** During the COVID-19 pandemic, data were gathered with an online questionnaire from 55,589 participants from 40 countries (64.85% females aged  $35.80 \pm 13.61$ ; 34.05% males aged  $34.90 \pm 13.29$  and 1.10% other aged  $31.64 \pm 13.15$ ). Anxiety was measured with the STAI, depression with the CES-D and suicidality with the RASS. Distress and probable depression were identified with the use of a previously developed cut-off and algorithm respectively.

**Statistical Analysis:** It included the calculation of Relative Risk (RR), Factorial ANOVA and Multiple backwards stepwise linear regression analysis

**Results:** Approximately two-thirds were currently living under significant restrictions due to lockdown. For both males and females the risk to develop clinical depression correlated significantly with each and every level of increasing lockdown degree (RR 1.72 and 1.90 respectively). The combined lockdown and psychiatric history increased RR to 6.88 The overall relationship of lockdown with severity of depression, though significant was small.

**Conclusions:** The current study is the first which reports an almost linear relationship between lockdown degree and effect in mental health. Our findings, support previous suggestions concerning the need for a proactive targeted intervention to protect mental health more specifically in vulnerable groups

## 1. Introduction

As the COVID-19 pandemic started spreading as an epidemic of an infectious agent, governments around the world were soon obliged to adopt strict measures of social distancing and isolation in order to contain the pandemic. The strictest of these measures was the lockdown which took a variety of forms and was applied with different intensity on different countries and different groups of the population. It was soon evident that although it was probably the most efficacious of all measures in the controlling of the pandemic (Fountoulakis et al., 2022a, 2020), it might had an adverse effect on population mental health at a large scale. This effect should be considered in combination with the overwhelming burst of information of questionable reliability and validity ('infodemic') (Asmundson and Taylor, 2021) and the abuse of the term 'trauma' and 'PTSD'. In general, during the pandemic but particularly because of the repeated lockdowns, mental health has gained a central position as an area which is expected to be affected by the pandemic because of its threatening nature as well as because of the profound impact on everyday life of people. Especially concerning the later, it has been suggested that lockdowns triggered feelings of loneliness, irritableness, restlessness, and nervousness in the general population (Saladino et al., 2020),

There are many reports in the literature suggesting that the COVID-19 outbreak triggered feelings of fear, worry, and stress, as responses to an extreme threat for the community and the individual with the general picture suggesting that more than 40% of the general population might experience high levels of anxiety or distress (Fountoulakis et al., 2021a, 2022b, 2021b; Fullana et al., 2020; Fullana and Littarelli, 2021; Gonda and Tarazi, 2021; Kaparounaki et al., 2020; Kopishinskaia et al., 2021; Kulig et al., 2020; Patsali et al., 2020; Ren et al., 2020; Salari et al., 2020; Smirnova et al., 2021; Vinkers et al., 2020; Vrublevska et al., 2021a), especially during lockdowns (Czeisler et al., 2021; Fiorillo and Gorwood, 2020; Mary-Krause et al., 2021; Pieh et al., 2020; Simon et al., 2021), and including health care professionals (Karlafti et al., 2022). The issue of increased suicidality as a consequence of extreme stress and depression has been raised again (Courtet and Olie, 2021; Czeisler et al., 2021; Efstathiou et al., 2021; Pompili, 2021). In addition, changes to social behavior, as well as working conditions, daily habits and routine have imposed secondary stress. Especially the expectation of an upcoming economic crisis and possible unemployment were stressful

factors. The vast majority of studies reported a 'tsunami'-scale impact on mental health. It is highly possible that this reporting could be an exaggeration (Shevlin et al., 2021). Higher levels of anxiety, stress and depressive feelings have been reported, but it seems that this depends on the temporal situation and the specific events; response is by no means homogenous (Fancourt et al., 2021; Mortier et al., 2021; Racine et al., 2021; Shevlin et al., 2021; Taquet et al., 2021; Wong et al., 2020). It is important to note that negative reports do exist, and they come from the study of carefully selected representative samples (van der Velden et al., 2020). Another important observation is that the population as a whole seemed to adjust rather well to the new situation and successfully cope with challenges at least in the middle term (Fancourt et al., 2021). Conspiracy theories and maladaptive behaviors were also prevalent, compromising the public defense against the outbreak.

Currently there is a great number of empirical data papers on the possible effect of lockdown on mental health, but no reliable assessments of clinical cases of depression exist. Reports suggest that up to half of the population might experience significant elevations in anxiety and depressive feelings (Al-Ajlouni et al., 2020; Antiporta et al., 2021; Czeisler et al., 2021; De Pietri and Chiorri, 2021; Fiorillo and Gorwood, 2020; Jacques-Avino et al., 2020; Kakaje et al., 2021; Khubchandani et al., 2021; Killgore et al., 2021; Kopilas et al., 2021; Mary-Krause et al., 2021; Msherghi et al., 2021; Pandey et al., 2020; Pieh et al., 2020; Ramiz et al., 2021; Simon et al., 2021; Smirnova et al., 2021; Surina et al., 2021; Vrublevska et al., 2021b) with the symptomatology being mixed and complex (Ben-Ezra et al., 2021; Di Blasi et al., 2021; Mary-Krause et al., 2021) and many individuals experiencing a severe form of psychopathology (Al-Ajlouni et al., 2020; Pieh et al., 2020) and high levels of suicidal ideation (Bell et al., 2021; Czeisler et al., 2021; Efstathiou et al., 2021; Every-Palmer et al., 2020; Killgore et al., 2021). Females seems to be at a higher risk (Andersen et al., 2021a; Cruyt et al., 2021; De Pietri and Chiorri, 2021; Di Giuseppe et al., 2020; Fiorillo and Gorwood, 2020; Hamama-Raz et al., 2021; Jacques-Avino et al., 2020; Kakaje et al., 2021; Msherghi et al., 2021; Pieh et al., 2020; Pinedo et al., 2021; Ramiz et al., 2021; Rossi et al., 2020), and younger age (Alleaume et al., 2021; Czeisler et al., 2021; Di Giuseppe et al., 2020; Killgore et al., 2021; Msherghi et al., 2021; Pieh et al., 2020; Pinedo et al., 2021; Ramiz et al., 2021; Rossi et al., 2020) and prior mental health history seems to be additional risk factors (Alleaume et al., 2021; Antiporta et al., 2021; Bell et al., 2021; Castellini et al., 2021; Czeisler et al., 2021; De Pietri and

Chiorri, 2021; Fiorillo and Gorwood, 2020; Hamama-Raz et al., 2021; Kopishinskaia et al., 2021; Kulig et al., 2020; Simon et al., 2021). However, the literature manifests a number of problems and drawbacks and the current study will try to fill the gaps. First of all, the research methodology varies greatly among studies, it is very difficult to make comparisons among countries and it is also difficult to arrive at universally valid conclusions. A second additional problem is that they deal with symptomatology as a continuum and fail to identify probable clinical cases. The current paper will apply a reliable and already tested algorithm to detect rates of clinical depression. Finally, the literature is full of opinion papers, viewpoints, perspectives, guidelines and narrations of activities to cope with the pandemic. These articles borrow from previous experience with different pandemics and utilize common sense, but, as a result, they often obscure rather than clarify the landscape.

The aim of the current study was to investigate the rates of dysphoria, probable clinical depression and suicidality and their changes in the adult population aged 18–69, during the COVID-19 pandemic in relationship with perceived lockdown degree. Secondary aims were to investigate the contributing effect of various factors specifically in combination with lockdown. The data came from the large international COMET-G study (Fountoulakis et al., 2021b).

## 2. Material and methods

### 2.1. Method

The protocol used, is available in the webappendix of a previously published study (Fountoulakis et al., 2021b); each question was given an ID code; these ID codes were used throughout the results for increased accuracy.

According to a previously developed method, (Fountoulakis et al., 2001, 2021a, 2012) the cut-off score 23/24 for the Center for Epidemiological Studies-Depression (CES-D) scale and a derived algorithm were used to identify cases of probable depression. This algorithm utilized the weighted scores of selected CES-D items in order to arrive at the diagnosis of depression, and has already been validated. Cases identified by only either method, were considered cases of dysphoria (false positive cases in terms of depression), while cases identified by both the cut-off and the algorithm were considered as probable depression. The State-Trait Anxiety Inventory S version (STAI-S) (Spielberger, 2005) and the Risk Assessment for Suicidality Scale (RASS) (Fountoulakis et al., 2012) were used to assess anxiety and suicidality respectively.

The degree of lockdown was assessed with a simple question: 'Are you currently locked up in the house?' (Completely-To a high degree-Partially-Not at all). Seven questions pertaining to beliefs in conspiracy theories (1. vaccine was ready even before the virus broke out 2. the virus was created in a laboratory as a biochemical weapon and 3. to create a global economic crisis, 4. it did not appeared accidentally from human contact with animals, 5. relationship to 5 G, 6. mortality is lower than announced and 7. the pandemic is a sign of divine power to destroy our planet) were rated on a five point scale from 'I don't believe it at all' to 'I believe it very much'. They were utilized in the analysis separately, not as a single combined score. Information concerning family and working, general health status and other topics were obtained by single direct questions and the information was based on the self-reporting by the subject.

The study research protocol can be found in full in the appendix of a previous publication (Fountoulakis et al., 2021b). 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 done in the 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.

### 2.2. Material

The study sample included data from 40 countries (Fig. 1) concerning 55,589 responses to the online questionnaire. The contribution of each country and the gender and age composition as well as details concerning various sociodemographic variables (marital status, education, work etc.) have been included in the original publication (Fountoulakis et al., 2021b).

The study population was self-selected. The study was advertised through the social media so that the population was informed and encouraged to participate. It was not possible to apply post-stratification on the sample as it was done in a previous study (Fountoulakis et al., 2021a), because this would mean that we would utilize a similar methodology across much different countries and the population data needed were not available for all.

### 2.3. Statistical analysis

- The Relative Risk (RR) was calculated at each level of lockdown degree and its confidence intervals have been calculated also
- Factorial ANOVA was performed to test for differences among groups and the interaction between grouping variables. The Scheffe test was used for post-hoc comparisons.
- Multiple backwards stepwise linear regression analysis (MBSLRA) was performed to investigate whether the psychometric scores and self-reported changes in depression, anxiety and suicidality could be predicted by lockdown degree. The analysis included a number of other variables as well, in order to rule out confounding effects. Concerning gender, only females (0) and males (1) were used in this analysis.

## 3. Results

### 3.1. Descriptive statistics

The study sample included data from 40 countries. In total responses were gathered from 55,589 participants, aged  $35.45 \pm 13.51$  years old; 36,047 females (64.84%; aged  $35.80 \pm 13.61$ ) and 18,927 males (34.05%; aged  $34.90 \pm 13.29$ ), while 615 declared 'non-binary gender' (1.11%; aged  $31.64 \pm 13.15$ ). 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 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 in terms of country by gender by age as well as in terms of residency, marital status, household size, children, education and occupation and their mental history and present mental status in terms of the presence of current clinical depression have been reported previously (Fountoulakis et al., 2021b).

The proportion of participants by gender and level of lockdown they were experiencing during the survey and at the time they were filling the questionnaire is shown in table 1, in table 2 the respected percentages are shown by country. Approximately two-thirds were currently living under significant restrictions due to lockdown.

### 3.2. Psychometric results

The responses to the questions whether their anxiety, mood or suicidal thoughts changed as well as their scores in the psychometric scales



Fig. 1. Map of the 40 participating countries.

Table 1

Numbers and percentages of participants by gender and level of lockdown they were experiencing during the survey and at the time they were filling the questionnaire.

Gender	Lockdown status	N	% of Gender
Female	Not at all	4428	12.28
	Partially	7658	21.25
	To a high degree	15,436	42.82
	Completely	8523	23.65
	Total	36,045	100.00
Male	Not at all	3640	19.23
	Partially	4758	25.14
	To a high degree	6794	35.90
	Completely	3733	19.73
	Total	18,925	100.00
Non-binary gender	Not at all	66	10.73
	Partially	110	17.89
	To a high degree	262	42.60
	Completely	177	28.78
	Total	615	100.00
All genders	Not at all	8134	14.63
	Partially	12,526	22.53
	To a high degree	22,492	40.46
	Completely	12,433	22.37
	Total	55,585	100.00

Table 2

Percentages of participants by country and level of lockdown they were experiencing during the survey and at the time they were filling the questionnaire.

Country	not at all (%)	Partially (%)	To a high degree(%)	Completely (%)	Total N
Argentina	3.72	18.58	51.79	25.92	2180
Australia	8.70	31.88	44.93	14.49	69
Azerbaijan	7.67	23.86	45.74	22.73	352
Bangladesh	3.13	11.70	49.19	35.97	3033
Belarus	10.80	25.98	50.96	12.26	1093
Brazil	2.34	11.21	46.73	39.72	214
Bulgaria	16.12	31.85	39.84	12.19	763
Canada	16.80	31.05	42.19	9.96	512
Chile	3.42	17.70	46.89	31.99	322
Croatia	12.49	29.70	44.60	13.21	2899
Egypt	5.45	16.36	40.61	37.58	165
France	14.83	22.81	38.40	23.95	263
Georgia	1.69	12.80	42.27	43.24	414
Germany	1.67	43.33	50.00	5.00	60
Greece	4.56	12.76	52.37	30.31	3418
Honduras	10.86	26.24	40.27	22.62	221
Hungary	12.06	29.36	46.92	11.66	763
India	20.85	25.62	20.79	32.75	4989
Indonesia	3.38	27.04	52.77	16.81	3284
Israel	41.67	12.50	31.94	13.89	144
Italy	2.86	27.04	39.18	30.92	980
Japan	3.85	35.00	55.00	6.15	260
Kyrgyz Republic	9.49	20.84	34.99	34.67	2212
Latvia	72.35	14.84	9.43	3.37	2608
Lithuania	91.26	4.69	1.59	2.46	1258
Malaysia	5.61	20.25	52.23	21.91	963
Mexico	4.54	25.08	53.86	16.52	1786
Nigeria	17.17	42.06	21.42	19.34	1153
Pakistan	5.84	17.68	45.38	31.09	2036
Peru	5.16	28.39	52.26	14.19	155
Poland	19.62	30.93	40.55	8.90	1539
Portugal	3.53	34.12	43.53	18.82	85
Romania	13.46	36.16	44.44	5.94	1449
Russia	7.84	21.84	45.98	24.34	9936
Serbia	50.83	23.93	21.29	3.96	606
Spain	3.76	14.37	30.76	51.11	1037
Turkey	5.19	7.20	49.28	38.33	347
Ukraine	9.92	30.10	46.83	13.15	1452
UK	28.75	36.25	28.13	6.88	160
USA	25.92	38.63	31.78	3.67	409
All	14.64	22.54	40.46	22.37	55,589
Countries					

by gender and degree of lockdown are shown in table 3. Factorial ANOVA with gender and lockdown degree as grouping variables and the scale scores for anxiety, depression and suicidality as independent variables, suggested that there was a significant effect of both gender (Wilks: 0.971;  $F = 276.1$ ; effect  $df=6$ , error  $df=70,115$ ;  $p<0.001$ ) and lockdown degree (Wilks: 0.999;  $F = 7.0$ ; effect  $df=9$ , error  $df=79,331$ ;  $p<0.001$ ) as well as for their interaction (Wilks: 0.999;  $F = 3.6$ ; effect  $df=18$ , error  $df=88,035$ ;  $p<0.001$ ). The scheffe post hoc tests revealed significant differences among all comparisons except those concerning 'non-binary gender' under 'no lockdown at all', which did not differ from any other group in terms of CES-D and STAI and non-binary gender under partial lockdown which did not differ from the rest groups in terms of STAI.

These results suggest that with the intensifying of lockdown, changes in anxiety, depression and suicidality increase, especially in females concerning anxiety and depression and in males concerning suicidality. In Fig. 2 the charts of changes in anxiety, depressive feelings and suicidal thoughts and scale scores for anxiety, depression and suicidality are shown, plotted vs. the degree of lockdown. The curves were plotted on

**Table 3**

Mean responses to the questions whether anxiety, mood or suicidal thoughts changed as well as mean scores in the psychometric scales by gender and degree of lockdown. Factorial ANOVAs with gender (only males/females) and lockdown degree as grouping factors and each of the 8 columns as dependent variables returned significant effects for both gender and lockdown degree as well as for their interaction.

Lockdownstatus	Gender	Change in						STAI		CES-D		RASS standardized					
		Anxiety		Depression		Suicidality		Mean	SD	Mean	SD	Intention scale		Life scale		History scale	
		Mean	SD	Mean	SD	Mean	SD					Mean	SD	Mean	SD	Mean	SD
Not at all	Female	-0.42	0.84	-0.25	0.82	0.01	0.66	43.51	12.38	19.00	8.91	63.88	125.35	175.77	93.53	54.79	66.67
	Male	-0.23	0.84	-0.17	0.88	-0.01	0.80	39.54	11.28	16.88	7.82	70.06	133.73	162.16	95.78	46.46	69.97
	NBG	-0.11	1.29	-0.17	1.22	0.14	1.18	39.88	12.60	21.52	9.78	186.44	202.42	182.35	101.80	104.02	106.59
Partially	Female	-0.45	0.85	-0.32	0.85	0.00	0.76	44.45	12.76	20.34	8.86	81.52	144.92	164.65	102.26	67.15	73.81
	Male	-0.30	0.86	-0.28	0.89	0.02	0.85	41.18	11.68	18.47	7.93	84.50	147.22	160.91	97.49	58.74	72.34
	NBG	-0.25	1.24	-0.46	1.06	0.15	0.95	40.52	12.75	24.95	10.46	215.18	202.32	226.00	96.60	109.73	96.95
To a high degree	Female	-0.56	0.87	-0.42	0.88	0.04	0.76	44.94	13.55	21.77	9.40	96.58	154.72	168.69	105.01	74.10	73.19
	Male	-0.43	0.88	-0.34	0.89	0.03	0.85	42.04	12.42	19.75	8.50	105.86	160.89	173.52	100.12	68.71	73.74
	NBG	-0.26	1.25	-0.20	1.23	-0.16	1.16	41.98	13.45	23.60	9.74	190.59	201.97	204.43	99.83	112.39	84.38
Completely	Female	-0.58	0.96	-0.46	0.97	0.07	0.88	45.77	14.03	22.81	10.09	104.40	159.59	169.76	106.95	81.39	76.98
	Male	-0.48	1.04	-0.45	1.06	0.15	1.00	41.49	12.77	19.95	8.80	106.62	159.69	171.97	98.60	71.46	80.55
	NBG	-0.58	1.08	-0.57	1.12	0.29	1.11	38.73	14.06	23.22	11.12	204.66	199.86	215.93	93.68	106.16	92.68
Not at all	All genders	-0.33	0.85	-0.21	0.85	0.00	0.73	41.70	12.06	18.07	8.52	67.64	130.41	169.73	94.85	51.46	68.85
Partially		-0.39	0.86	-0.31	0.87	0.01	0.80	43.17	12.46	19.67	8.60	100.48	157.59	170.56	103.58	72.92	73.66
To a high degree		-0.52	0.88	-0.39	0.89	0.04	0.79	44.03	13.29	21.18	9.19	106.49	160.68	171.08	104.47	78.76	78.51
Completely		-0.55	0.99	-0.46	1.00	0.09	0.92	44.38	13.82	21.96	9.83	83.82	146.91	163.77	100.60	64.33	73.72
All intensities	Female	-0.52	0.89	-0.39	0.89	0.03	0.78	44.86	13.38	21.37	9.48	91.21	151.09	168.95	103.60	71.97	73.91
	Male	-0.37	0.91	-0.31	0.93	0.04	0.87	41.23	12.13	18.92	8.37	93.75	153.04	167.86	98.50	62.47	74.64
	NBG	-0.33	1.21	-0.35	1.18	0.06	1.13	40.56	13.46	23.51	10.30	198.59	201.24	209.23	98.27	109.22	91.49
All Grps		-0.47	0.90	-0.36	0.91	0.04	0.82	43.58	13.08	20.56	9.21	93.27	152.81	169.03	101.92	69.15	74.63

**Note:** NBG stands for Non-Binary gender.

Scoring for change in anxiety, depression or suicidality:.

-2 = Much worse; -1 = Worse; 0 = It has not changed; 1 = A little better; 2 = Much better.



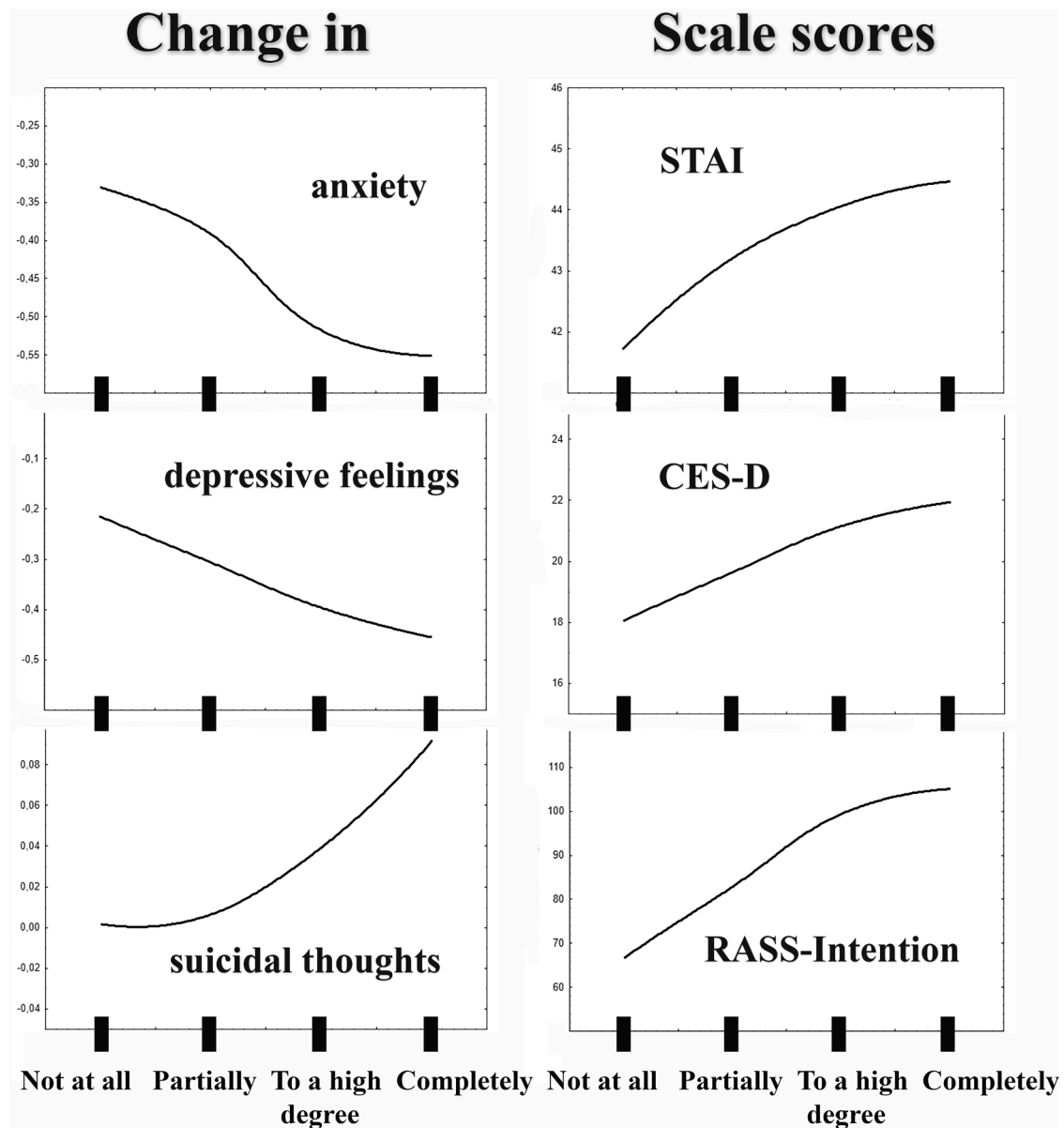


Fig. 2. Charts of changes in anxiety, depressive feelings and suicidal thoughts (left) and scale scores (right) for anxiety (STAI), depression (CES-D) and suicidality (RASS-Intention) plotted vs. the degree of lockdown (x-axis). The curves were plotted on the basis of distance-weighted least squares method.

the basis of distance-weighted least squares method

### 3.3. Rates of dysphoria and probable depression and RR

In table 4 the rates of clinical depression and dysphoria are shown again by gender and lockdown degree. In Fig. 3 the plot of probable depression rates in the three gender groups are shown vs. the degree of lockdown. The curves were plotted on the basis of distance-weighted least squares method. Males and females manifested a similar RR which was significant and significantly different from that of persons with 'non-binary gender' whose depressions did not seem to be affected by lockdown degree, but it should be noted that their rates under 'not at all' lockdown are already higher than those of males or females under 'complete' lockdown. For both males and females the risk to develop clinical depression increases significantly with each and every level of increasing lockdown degree (table 4), and the RR is 1.72 and 1.90 respectively. In table 5 the rates of probable depression and dysphoria are shown by history of any mental disorder or suicidality. The lower rate of probable depression is for subjects without any mental health

history and not under any lockdown (7.40%) and it is escalating to 50.79% for subjects with both mental health history and both history of self-harm and suicidal attempts under complete lockdown (RR for the combined total effect equal to 6.88 with 95% CI 6.08–7.78 (table 5)

### 3.4. Factors interacting with lockdown to affect mental health

The coefficients  $b$  in parentheses stand for standardized coefficients (also called beta).

MBSLRA with the CES-D score as dependent variable ( $R = 0.453$ ,  $F = 987,7340$ ,  $R^2 = 0.205$ ,  $df = 12,45,838$ ;  $p < 0.001$ ) returned significant results for the degree of the lockdown ( $b = 0.06$ ) and additionally for gender (male  $b = -0.08$ ), age ( $b = -0.13$ ), any history of mental disorder ( $b = 0.22$ ), general condition of health ( $b = -0.25$ ), continue working during lockdown ( $b = -0.02$ ), believing in conspiracy theories ( $b$  ranging from  $-0.02$ – $0.06$ ) and number of children ( $b = -0.03$ ). The number of persons in the household was not significant.

MBSLRA with the STAI score as dependent variable ( $R = 0.348$ ,  $F = 528,9351$ ,  $R^2 = 0.121$ ,  $df = 12,45,839$ ;  $p < 0.001$ ) returned significant

**Table 4**

Percentages of dysphoria and clinical depression and Risk Ratio at each level of increasing lockdown degree for the development of clinical depression. For males and females the risk is significant at every level while for non-binary gender is not at any level.

Gender	Lockdown status	No depression or dysphoria (%)	Dysphoria (%)	Clinical Depression (%)	Either Depression or Dysphoria (%)	RR (95% CI) concerning depression
Female	Not at all	71.75	13.78	14.48	28.25	<u><i>1.72 (1.59–1.87)</i></u> <sup>1</sup>
	Partially	66.94	15.47	17.59	33.06	<u><i>1.22 (1.11–1.32)</i></u> <sup>2</sup>
	To a high degree	60.50	18.31	21.19	39.50	<u><i>1.20 (1.14–1.28)</i></u> <sup>3</sup>
	Completely	55.64	19.42	24.94	44.36	<u><i>1.18 (1.12–1.23)</i></u> <sup>4</sup>
	Total	62.10	17.41	20.49	37.90	
Male	Not at all	80.85	11.07	8.08	19.15	<u><i>1.90 (1.66–2.17)</i></u> <sup>1</sup>
	Partially	74.19	14.65	11.16	25.81	<u><i>1.38 (1.21–1.58)</i></u> <sup>2</sup>
	To a high degree	69.19	16.96	13.85	30.81	<u><i>1.24 (1.12–1.37)</i></u> <sup>3</sup>
	Completely	68.04	16.58	15.38	31.96	<u><i>1.11 (1.01–1.22)</i></u> <sup>4</sup>
	Total	72.46	15.17	12.36	27.54	
Non-Binary gender	Not at all	60.61	7.58	31.82	39.39	0.89 (0.58–1.36) <sup>1</sup>
	Partially	42.73	25.45	31.82	57.27	1.00 (0.64–1.56) <sup>2</sup>
	To a high degree	49.24	26.34	24.43	50.76	0.77 (0.54–1.09) <sup>3</sup>
	Completely	49.15	22.60	28.25	50.85	1.16 (0.84–1.59) <sup>4</sup>
	Total	49.27	23.09	27.64	50.73	
<b>Total</b>		65.49	16.71	17.80	34.51	

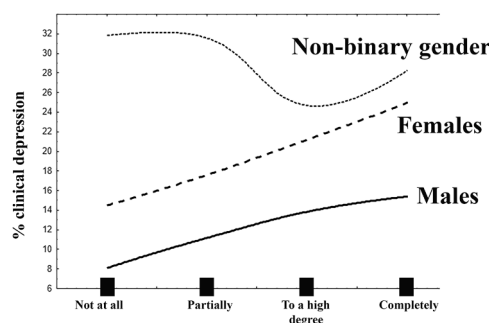
Significant RR values are in bold underlined italics.

<sup>1</sup> RR between ‘not at all’ vs. ‘complete’ lockdown.

<sup>2</sup> RR between ‘not at all’ vs. ‘partially’ lockdown.

<sup>3</sup> RR between ‘partially’ vs. ‘to a high degree’ lockdown.

<sup>4</sup> RR between ‘to a high degree’ vs. ‘complete’ lockdown.



**Fig. 3.** Plot of probable depression rates in the three gender groups vs. the degree of lockdown (x-axis). The curves were plotted on the basis of distance-weighted least squares method.

results for the degree of the lockdown ( $b = 0.03$ ), and additionally for gender (male  $b = -0.9$ ), age ( $b = 0.4$ ), any history of mental disorder ( $b = 0.14$ ), general condition of health ( $b = -0.22$ ), number of children ( $b = -0.07$ ), number of persons in the household ( $b = 0.09$ ) and believing in some conspiracy theories ( $b$  ranging from  $-0.02$ – $0.07$ ). There was no effect of continuing to work during lockdown.

MBSLRA with the RASS Intention score as dependent variable ( $R = 0.394$ ,  $F = 767,9869$ ,  $R^2 = 0.155$ ,  $df = 11,458$ ;  $p < 0.001$ ) returned significant results for degree of lockdown ( $b = 0.21$ ), gender (male  $b = 0.02$ ), age ( $b = -0.26$ ), any history of mental disorder ( $b = 0.18$ ), number of children ( $b = -0.02$ ), number of persons in the household ( $b = -0.05$ ) and believing in some conspiracy theories ( $b$  ranging from  $-0.04$ – $0.08$ ). There was no significant contribution by the general condition of health or of continuing to work during lockdown.

MBSLRA with the presence of probable depression (yes/no) as dependent variable ( $R = 0.333$ ,  $F = 575,2150$ ,  $R^2 = 0.111$ ,  $df = 10,45,837$ ;  $p < 0.001$ ) returned significant results for the degree of the lockdown ( $b = 0.04$ ), as well as for gender (male  $b = -0.7$ ), age ( $b = -0.08$ ), any history of mental disorder ( $b = 0.17$ ), general condition of health ( $b = -0.19$ ), and believing in some conspiracy theories ( $b$  ranging from  $-0.02$ – $0.03$ ). There was no significant contribution of the number of persons in the household, number of children or of continuing to work during lockdown.

MBSLRA with changes in depression ( $-2$  to  $+2$ ) as dependent

variable ( $R = 0.239$ ,  $F = 349,5308$ ,  $R^2 = 0.057$ ,  $df = 8,45,843$ ;  $p < 0.001$ ) returned significant results for the degree of the lockdown ( $b = -0.06$ ), as well as age ( $b = 0.05$ ), any history of mental disorder ( $b = -0.06$ ), general condition of health ( $b = 0.19$ ), number of persons in the household ( $b = 0.02$ ), number of children ( $b = 0.02$ ), continuing to work during lockdown ( $b = 0.02$ ) and believing in some conspiracy theories ( $b$  equal to  $0.02$ ). There was no significant contribution of gender.

MBSLRA with changes in anxiety ( $-2$  to  $+2$ ) as dependent variable ( $R = 0.274$ ,  $F = 340,0370$ ,  $R^2 = 0.075$ ,  $df = 11,45,840$ ;  $p < 0.001$ ) returned significant results for the degree of the lockdown ( $b = -0.06$ ), as well as sex ( $b = 0.04$ ), age ( $b = 0.02$ ), any history of mental disorder ( $b = -0.06$ ), general condition of health ( $b = 0.22$ ), number of persons in the household ( $b = 0.02$ ), continuing to work during lockdown ( $b = 0.02$ ) and believing in some conspiracy theories ( $b$  ranging from  $-0.03$  to  $0.04$ ). There was no significant contribution of number of children.

MBSLRA with changes in suicidality ( $-2$  to  $+2$ ) as dependent variable ( $R = 0.136$ ,  $F = 87,20,290$ ,  $R^2 = 0.018$ ,  $df = 10,45,841$ ;  $p < 0.001$ ) returned significant results for the degree of the lockdown ( $b = -0.02$ ), as well as sex ( $b = 0.02$ ), age ( $b = -0.06$ ), any history of mental disorder ( $b = 0.04$ ), general condition of health ( $b = -0.08$ ), number of persons in the household ( $b = -0.03$ ), (and believing in some conspiracy theories ( $b$  ranging from  $-0.04$  to  $0.02$ ). There was no significant contribution of continuing to work during lockdown and number of children.

The results of all the above MBSLRA analyses are shown in [table 6](#). Taken together, these results suggest that the lockdown has a clear although very weak adverse effect on the mental state of the general population, which also depends on the intensity of lockdown. Females are at a higher risk as are younger individuals who live alone and families without children. The presence of past mental health history is a significant risk factor while adherence to conspiracism has a variable effect. However, overall the combined contribution of all these variables is rather small.

#### 4. Discussion

This large international study in convenience sample of 55,589 participants from 40 countries reports that lockdown significantly increases depression at every degree of lockdown intensity for males and females but not for those with non-binary gender. It is probably the first to specifically show that the lockdown degree is positively related with an increase in anxiety, depressive symptoms and suicidality thoughts as

**Table 5**  
Rates of dysphoria and probable depression by lockdown degree and history of mental disorder.

Lockdown degree	History of mental disorder, self-harm and suicidality	Dysphoria	Probable depression	Either dysphoria or probable depression
Not at all	No history at all	9.73	<u>7.40</u>	17,13
	His-or SH or SA (1/3)	16.40	18.32	34,72
	His-or SH or SA (2/3)	22.83	21.17	44,00
	His-and SH and SA (3/3)	24.51	43.08	67,59
Partially	Total	12.52	11.75	24,27
	No history at all	11.41	8.75	20,16
	His-or SH or SA (1/3)	20.23	20.03	40,27
	His-or SH or SA (2/3)	23.53	32.70	56,23
To a high degree	His-and SH and SA (3/3)	26.18	48.03	74,21
	Total	15.25	15.27	30,52
	No history at all	13.87	11.81	25,69
	His-or SH or SA (1/3)	22.19	24.39	46,58
Completely	His-or SH or SA (2/3)	28.09	34.59	62,68
	His-and SH and SA (3/3)	26.25	49.16	75,42
	Total	17.99	19.01	37,00
	No history at all	15.41	13.55	28,95
Column Total	His-or SH or SA (1/3)	21.84	28.10	49,94
	His-or SH or SA (2/3)	24.20	38.06	62,26
	His-and SH and SA (3/3)	24.60	<u>50.79</u>	75,40
	Total	18.61	22.12	40,73
Column Total		16.71	17.80	34.51

●His-or SH or SA (1/3): one of the following: history of any mental disorder, history of self-harm or history of suicidal attempt.  
 ●His-or SH or SA (2/3): two of the following: history of any mental disorder, history of self-harm or history of suicidal attempt.  
 ●His-and SH and SA (3/3): all of the following: history of any mental disorder, history of self-harm or history of suicidal attempt.  
 The two extreme rates of probable depression (no lockdown and no history at all; 7.40% vs. complete lockdown and 3/3 history; 50.79%) are marked in bold underlined italics.

**Table 6**  
The effect of lockdown degree/intensity on mental health.

Factor	Probable depression	Depressive symptomatology	Anxiety	Suicidal thoughts	Change in depression	Change in anxiety	Change in suicidality
Lockdown degree/intensity	+	+	+	+	+	+	+
Stopped working during lockdown		+			+	+	
Female gender	+	-	+	+		+	-
Age	-	-	+	-	-	-	-
Number of children		-	-	-	-	-	-
Number of persons in household			+	-	-	-	-
Bad condition of general health	+	+	+		+	+	+
Presence of any history of mental disorder	+	+	+	+	+	+	+
Conspiracism	+/-	+/-	+/-	+/-	+/-	+/-	+/-
Variance explained by Lockdown degree*	0.8%	1.9%	0.4%	0.7%	0.7%	0.8%	0.1%
Total variance explained	11.1%	20.5%	12.1%	15.5%	5.7%	7.5%	1.8%
Contribution of lockdown degree to explained variable	7.2%	9.2%	3.3%	4.5%	12,3%	10,6%	5,5%

+ increased by factor/positive correlation.  
 - decreased by factor/negative correlation.  
 +/- variable relationship.  
 \* with univariate regression.

well as in the rates of probable depression after correcting for other effects (via the MbSLRA analysis). The interaction of strict lockdown with history of mental illness and suicidal attempts increases the risk to depression almost seven times. However, the overall effect of lockdown, though significant is small and explains for 0.4% of anxiety, 1.9% of depressive symptoms, 0.8% of probable depression and 0.7% of suicidal thoughts variability.

The literature so far suggests that during lockdowns there is a deterioration of mental health in general. Although there are no reliable assessments of clinical cases of depression, anxious and depressive symptomatology are reported to increase with 30–50% of subjects experiencing significant elevations (Al-Ajlouni et al., 2020; Antiporta et al., 2021; Czeisler et al., 2021; De Pietri and Chiorri, 2021; Fiorillo and Gorwood, 2020; Jacques-Avino et al., 2020; Kakaje et al., 2021; Khubchandani et al., 2021; Killgore et al., 2021; Kopilas et al., 2021; Mary-Krause et al., 2021; Msherghi et al., 2021; Pandey et al., 2020; Pieh et al., 2020; Ramiz et al., 2021; Simon et al., 2021; Smirnova et al., 2021; Surina et al., 2021; Vrublevska et al., 2021b). Somatoform symptoms are also prevalent (Ben-Ezra et al., 2021; Mary-Krause et al., 2021). The increase concerned more the internalizing and to a much less extend the interpersonal symptoms (Castellini et al., 2021). The most common pattern seemed to be an admixture of all the above symptoms (Di Blasi et al., 2021).

At least moderate depression is reported in almost 20% (Al-Ajlouni et al., 2020; Pieh et al., 2020) and more that 10% have seek professional help for mental health issues during the lockdown and particularly because of the lockdown (Alleaume et al., 2021). These results are in accord with the findings of the current study. The increase in risk is reported to be 6.73 for depression (Andersen et al., 2021a), but our results suggest a much lower effect of lockdown alone (risk below 2). The risk rises above 6 only in the presence of severe history of mental disorders and suicidality.

Suicidality was also reported to increase with 4–20% reporting suicidal ideation, and 2–10% reporting having seriously considered suicide (Bell et al., 2021; Czeisler et al., 2021; Efstathiou et al., 2021; Every-Palmer et al., 2020; Killgore et al., 2021). The results of the current study do confirm this; high suicidality scores were detected, and this rise in suicidality was found to be the result of the interaction of lockdown with other factors, including gender and the presence of psychiatric and medical history.

Early meta-analyses found a small effect of lockdown on mental health ( $g = 0.17$ ) and substantial heterogeneity among studies, thus concluding that most people are psychologically resilient to their effects (Prati and Mancini, 2021). Interestingly, some authors reported that

negative affect decreased during lockdowns, which is suggestive of a differential effect of lockdowns on different population groups especially with respect to prior mental health (Foa et al. (2022); Recchi et al., 2020). These reports are in accord with the findings of the current study, which suggest a significant but weak effect of lockdown on mental health as the explained variance is very low (below 2% for depressive symptoms).

With the end of lockdowns, it seems that at least for half of those persons who previously were free of mental health history, the anxious and depressive symptomatology recovered quickly but in a significant proportion they persisted (Ahrens et al., 2021; Di Blasi et al., 2021). A habituation effect was also reported (Fancourt et al., 2021). The development and course as well as the outcome after the resolution of the lockdown are reported to be influenced by a number of factors. Gender is the most frequently reported such factor with females being at a higher risk, and this is in accord with our findings (Andersen et al., 2021a; Cruyt et al., 2021; De Pietri and Chiorri, 2021; Di Giuseppe et al., 2020; Fiorillo and Gorwood, 2020; Hamama-Raz et al., 2021; Jacques-Avino et al., 2020; Kakaje et al., 2021; Msherghi et al., 2021; Pieh et al., 2020; Pinedo et al., 2021; Ramiz et al., 2021; Rossi et al., 2020). However, in contrast to our report, at least one study reported higher depression rates in males and anxiety in females (Khubchandani et al., 2021). Additionally, people who do not identify with the man/woman binomial (non-binary gender) presented high proportions of anxiety (41.7%) and depression (30.6%) (Jacques-Avino et al., 2021). Our results do not permit conclusions on the long-term course after the resolution of lockdown. However, they support an interaction of gender with lockdown degree, with females being more susceptible to the development of depression and males to the development of anxiety. Interestingly, non-binary gender was unaffected by lockdown, although the baseline mental health indices were substantially worse in comparison to males and females.

The presence of a family with kids, as well as the presence of interpersonal and social relationships were mostly a protective factor (Andersen et al., 2021b; Cruyt et al., 2021; Di Blasi et al., 2021; Domenech-Abella et al., 2021; Killgore et al., 2021; Pinedo et al., 2021); however one study reported the opposite (Khubchandani et al., 2021) and the relationship seems rather complex (Msherghi et al., 2021; Ramiz et al., 2021). Our results (table 6) suggest that the presence of children protects from the development of anxiety, dysphoria and suicidality but not from the development of clinical depression while having a family increases baseline anxiety but protects from increases in anxiety, depression and suicidality.

Prior history of mental disorder is identified as an important risk factor for the development of depression and other mental disorders during lockdown (Alleaume et al., 2021; Antiporta et al., 2021; Bell et al., 2021; Castellini et al., 2021; Czeisler et al., 2021; De Pietri and Chiorri, 2021; Fiorillo and Gorwood, 2020; Hamama-Raz et al., 2021; Kopishinskaia et al., 2021; Kulig et al., 2020; Simon et al., 2021) and this is strongly supported by our results. Essentially the presence of mental history is what skyrockets the adverse effects of lockdown. Other risk factors include specific personality traits (Di Blasi et al., 2021; Di Giuseppe et al., 2020; Domenech-Abella et al., 2021; Landi et al., 2020; Rossi et al., 2021; Veer et al., 2021), economic and professional problems and unemployment (Alleaume et al., 2021; Antiporta et al., 2021; Castellini et al., 2021; De Pietri and Chiorri, 2021; Jacques-Avino et al., 2021; Kakaje et al., 2021; Khubchandani et al., 2021; Killgore et al., 2021; Msherghi et al., 2021; Pieh et al., 2020) as well as the low socioeconomic status (Antiporta et al., 2021; De Pietri and Chiorri, 2021; Khubchandani et al., 2021; Pieh et al., 2020).

Younger age is reported to act as another risk factor (Alleaume et al., 2021; Czeisler et al., 2021; Di Giuseppe et al., 2020; Killgore et al., 2021; Msherghi et al., 2021; Pieh et al., 2020; Pinedo et al., 2021; Ramiz et al., 2021; Rossi et al., 2020) as well as the presence of a chronic medical condition (Antiporta et al., 2021; Cruyt et al., 2021; Jacques-Avino et al., 2021; Ramiz et al., 2021) especially when accompanied by

significant disability (Czeisler et al., 2021). The effect of both these factors was confirmed by our results. Younger age acts as a risk factor for depression and suicidality but advanced age as a risk factor for the development of anxiety. This age effect is in accord with one study, which suggested that also advanced age constitutes a risk factor (Ramiz et al., 2021). Often these risk factors tend to accumulate on the same person and lead to ultra-high risk population groups (Bell et al., 2021).

Apart from intensity, also the duration of the lockdown was reported to be an additional risk factor (Di Giuseppe et al., 2020; Fiorillo and Gorwood, 2020; Killgore et al., 2020), although a negative report exists also (Pinedo et al., 2021). Repeated or intermittent lockdowns did not seem to worsen mental health as the same people seemed to be affected (Efstathiou et al., 2021). There was one report suggesting that the degree of the lockdown was related to deteriorating mental health (Benke et al., 2020), and this is clearly in accord with our findings.

At pandemic onset we might not have imagined the important role and the impact of conspiracy theories, which are largely social media driven. They are currently widely accepted as being important since the literature strongly supports their relationship with anxiety and depression (Chen et al., 2020; De Coninck et al., 2021; Elek et al., 2022; Fountoulakis et al., 2021a, 2021b). The current study utilized seven questions pertaining to conspirasism. What is interesting is that the results suggest that the COVID-19 related conspiracy theories exert a complex effect as it has been already mentioned in the publication of the basic COMET-G study results (Fountoulakis et al., 2021b). According to them, conspiracy theories could be classified as being either 'threatening' or 'reassuring' and these two groups exert different effects at different phases and periods. However they do not seem to interact with the lockdown degree.

A difficult to answer question is how many of the cases detected by questionnaires and sophisticated algorithms correspond to real probable depression. The underlying neurobiology is opaque and maybe much diagnosed depression might simply be an extreme form of a normal adjustment reaction (He et al., 2021). However there is no better way to psychometrically achieve higher validity and the algorithm we utilized is the best available method. However, a large part of depressions emerged from a previous mental health history and this adds validity to our results.

Concerning those without a previous history of mental disorder, it is expected that much of the adverse effects on mental health will rapidly attenuate with the lifting of lockdown restrictions and the end of the pandemic (Daly and Robinson, 2021) but enduring effects will impact some vulnerable populations. So far studies investigating the long-term outcome and the long-term impact of the pandemic on mental health display equivocal findings (Bendau et al., 2021; Wang et al., 2020). Especially sociability and the sense of belonging could be important factors determining mental health and health-related behaviors (Biddlestone et al., 2020), and these factors seem to correspond to specific vulnerabilities seen especially in western cultures.

## 5. Strengths and limitations

The strengths of the current paper include the large number of persons who filled the questionnaire and the large bulk of information obtained, as well as the detailed way of post-stratification of the study sample.

The major limitation was that the data were obtained anonymously online through self-selection of the responders. The nature and intensity of the lockdown was assessed on the basis of a single simple question. Additionally, the assessment included only the cross-sectional application of self-report scales, although the advanced algorithm used for the diagnosis of probable depression corrected the problem to a certain degree. However, what is included under the umbrella of 'probable depression' in the stressful times of the pandemic remains a matter of debate. Also, the lack of baseline data concerning the mental health of a similar study sample before the pandemic is also a problem.

Unfortunately the combined contribution of all variables in the models derived were rather small and it seems that other unknown factors play a stronger role.

Other sources of bias include response bias, recall bias and desirability bias.

## 6. Conclusion

The current paper is probably the first to report that lockdown significantly increases anxiety and depression but not suicidality at every degree of lockdown intensity for males and females but not for those with non-binary gender, especially in combination with the presence of mental health history. However, the overall effect of lockdown, though significant is small. These findings, although they should be closely monitored in a longitudinal way, support previous suggestions by other authors concerning the need for a proactive intervention to protect mental health of the general population but more specifically of vulnerable groups (Fiorillo and Gorwood, 2020; Sani et al., 2020).

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## Author contributions

All authors contributed equally to the paper.

KNF and DS conceived and designed the study. The other authors participated formulating the final protocol, designing and supervising the data collection and creating the final dataset. KNF and DS did the data analysis and wrote the first draft of the paper. All authors participated in interpreting the data and developing further stages and the final version of the paper.

Prof. Konstantinos N. Fountoulakis and Dr. Daria Smirnova had the original idea, developed the protocol, and coordinated the work groups. All the authors participated in the translation of the protocol into mother languages and in the collection of data. Prof. Konstantinos N. Fountoulakis, Dr. Grigorios N. Karakatsoulis and Dr. Daria Smirnova wrote the first draft. All authors participated in the revision of the first draft. The final manuscript was developed by Prof. Konstantinos N. Fountoulakis, Dr. Grigorios N. Karakatsoulis and Dr. Daria Smirnova and was approved by all authors.

## Declaration of Competing Interest

None pertaining to the current paper.

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