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Research paper

Self-reported changes in anxiety, depression and suicidality during the COVID-19 lockdown in Greece



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ABSTRACT

Introduction: There are only a few published empirical data on COVID-19's effects on the mental health.

Material and Methods: During lockdown, an online questionnaire registered demographic, health data, previous psychiatric history, current anxiety, depression and suicidality, believing in conspiracy theories and other domains. Data from 3399 persons were used (81.08% females; aged 34.02 ± 9.72 and 18.27% males; aged 36.38 ± 10.33). Distress and clinical depression were identified with the use of cut-off and a previously developed algorithm respectively.

Statistical Analysis: A post-stratification method was used; descriptive statistics were calculated. Chi-square tests, multiple forward stepwise linear regression analyses and Factorial Analysis of Variance (ANOVA) tested relations among variables.

Results: Clinical depression was present in 9.31% of the stratified sample, while 8.5% had severe distress; increased anxiety was present in more than 45%. Suicidal thoughts increased in 10.40% and decreased in 4.42%. Beliefs in conspiracy theories were widely prevalent; at least half of cases were following various misconceptions. A model for the development of depression was created with general health status, previous history of depression, self-harm and suicidal attempts, family responsibility, economic change, and age acting as risk factors, while keeping a daily routine, pursuing religiousness/spirituality, and believing in conspiracy theories acting as protective factors.

Conclusions: The model developed here revealed multiple vulnerabilities and an interplay leading from simple anxiety to clinical depression and suicidality through distress. This could be of practical utility since most of these factors are modifiable. Future research, as well as interventions, should focus specifically on them.

1. Introduction

The COVID-19 outbreak is expected to trigger feelings of fear, worry, and stress, as responses to an extreme threat for the community and the individual. In addition, changes in social behavior, as well as in working conditions, daily habits and routine are expected to impose further

stress, especially with the expectation of an upcoming economic crisis and possible unemployment.

There have been a few published empirical data so far and, instead, the literature is full of opinion papers, viewpoints, perspectives, guidelines and narrations of activities to cope with the pandemic, which borrow from previous experience with pandemics and utilize common

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sense, but, as a result, often obscure rather than clarify the landscape. A recent meta-analysis reported a 25% anxiety and 28% depression in the general population (Ren et al., 2020) while a second one reported that 29.6% of people experienced stress, 31.9% anxiety and 33.7% depression (Salari et al., 2020). Within the scope of precision and personalized psychiatry, it is important to identify the exact contribution of specific variables to the observed pathology.

In Greece, where the lockdown was extremely successful in terms of containing the outbreak, worries concerning the effects on mental health were also predominant. The ultra-fast application of measures was probably the reason of this outstanding success (Fountoulakis et al., 2020), however an impact on the mental health status of university students has already been documented by our group (Kaparounaki et al., 2020; Patsali et al., 2020).

The aim of the study was to investigate the rate of clinical depression in the adult population aged 18–69 in Greece, during the period of the lockdown. Secondary aims were to investigate the changes in anxiety, distress, suicidal ideation and their relations with a number of personal and interpersonal/social variables. The aim also included the investigation of the spreading of conspiracy theory beliefs concerning the COVID-19 outbreak.

2. Material and methods

2.1. Method

The protocol used is available in the webappendix; each question was given an ID code; throughout the results these ID codes were used for increased accuracy.

According to a previously developed method, (Fountoulakis et al., 2001, 2012) the cut-off score 23/24 for the CES-D and a derived algorithm were used to identify cases of major depression, as those identified by both methods. Those identified by only one of them, were considered cases of distress (false positive cases in terms of depression).

The data were collected online and anonymously from April 11th to May 1st, 2020, during the period of the full implementation of lockdown in the country. Announcements and advertisement was done in the social media and through news sites, but no other organized effort had been undertaken.

Approval was given by the Ethics Committee of the Faculty of Medicine, Aristotle University of Thessaloniki, Greece.

Participants were informed of the existence of the study and the questionnaire through announcements in the social media and news sites. The first page included a declaration of consent which everybody accepted by continuing with the participation.

2.2. Material

The study sample included 2756 females (81.08%; aged 34.02±9.72) and 621 males (18.27%; aged 36.38±10.33), while 22 declared 'other' (0.64%; aged 29.65.6 ± 6.68).

2.3. Statistical analysis

The analysis of data utilized two pathways:

a Epidemiological analysis

- The study population was self-selected. A method of simplified post-stratification was used (Holt and Smith, 1979; Keeble et al., 2015; Lavrakas, 2008; Little, 1993; Sarndal, 1992) in order to create a standardized study sample with characteristics as close as possible to those of the Greek general population (Table 1). The detailed method can be found in the webappendix.
- Afterwards, descriptive tables were created for the variables under investigation.

Table 1

Descriptive statistics of the original (raw) and the standardized study samples in comparison to the general population aged 18–19 years.

	General population Aged 18–69 years old		raw study sample		Standardized study sample
	N ¹	%	N	%	% ²
A1. Sex					
males	3,757,583	48.95	621	18.27	50.54
females	3,918,917	51.05	2756	81.08	49.16
A2. Age					
Males mean age	44.17		36.39		43.47
Females mean age	44.84		34.02		40.70
A9. Work status					
Total population	7,676,500	100.00	3,399	100.00	100,00
Unemployed	818,900	10.67	355	10.44	8.26
Self-employed	1,247,500	16.25	530	15.59	20.99
Civil servants	700,000	9.12	501	14.74	19.34
Private clerks	1,963,500	25.58	1,380	40.60	37.11
University/college students	221,730	2.89	388	11.42	2.35
Family and household					
A4. Married (or living with sb)	5,358,081	69.80	1,132	33.30	53.58
A5. Lives alone	1,061,547	25.68	524	15.42	18.29
2-persons household	1,218,466	29.47	1018	29.95	28.58
3-persons household	817,921	19.78	797	23.45	22.14
4-persons household	726,554	17.57	794	23.36	23.94
>5-persons household	310,052	7.50	266	7.83	7.02
Mental health history					
O12. History of deliberate self-harm (at least once)		6.14 ²	573	16.86	5.28
O13. History of suicide attempt (at least once)		1.77 ²	207	6.1	2.53

¹ Source: www.statistics.gr.

² Fountoulakis KN et al. J Affect Disord 2012;138(3):449–57.

Source: www.statistics.gr.

b Case-control analysis with the use of the original unstandardized (raw) dataset

- 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 (MacDonald and Gardner, 2016).
- Multiple forward stepwise linear regression analysis was performed with Scheffe as post hoc test to investigate which variables could contribute to the development of others.
- Factorial Analysis of Variance (ANOVA) was used to test for the main effect as well as the interaction among categorical variables.

3. Results

a Epidemiological analysis (on the basis of the standardized dataset)

Mental health (Table 2)

History of any mental disorder was reported by 29.60%, with history of depression being the most frequent (26.92%). Psychotic disorders (0.49%), bipolar disorder (0.12%), eating disorders (0.11%) and substance abuse disorder (0.02%) were rather rare, but within the expected range. Increased anxiety due to the lockdown was reported by more than 45%, and more depressive feelings by almost 40%. Suicidal thoughts were increased in 10.40% and decreased in 4.42%. Major depression was present in 9.31% with an additional 8.5% experiencing severe

Table 2
Percentage of answers to questions pertaining to mental state.

Question	Scoring	%
F21. How much has your emotional state changed in relation to the appearance of anxiety and insecurity compared to before the COVID-19 epidemic?	It got a lot worse	8.82
	It got a little worse	37.64
	Neither better nor worse	47.33
	It's a little improved	4.43
	It has improved a lot	1.76
G21. How much has your emotional state related to the experience of joy or melancholy changed in comparison to before the COVID-19 epidemic?	It got a lot worse	6.54
	It got a little worse	32.33
	Neither better nor worse	53.37
	It's a little improved	5.90
	It has improved a lot	1.84
O11. How much has your tendency to think about death and/or suicide changed, compared to before the outbreak of COVID-19?	Very much increased	3.56
	Increased a bit	0.86
	Neither increased, nor decreased	85.17
	Decreased a bit	9.19
	Very much decreased	1.22
Clinical depression according to both CES-D methods	No depression	82.20
	Depression according only to CES-D cut-off ¹	5.88
	Depression according only to CES-D algorithm ¹	2.61
	Depression according to both methods ²	9.31

¹ Distress.

² Clinical depression.

distress.

Family status and relationships (Table 1 and Web Table 1)

One third concerned married cases. The majority (58.01%) were carers of at least one person belonging to a vulnerable population. There was an increased need for communication (>40%), emotional support (24.16%) and improvement of the quality of relationships (24.6%) while conflicts within the family remained unchanged in comparison to before the lockdown. The exception concerned families with children whose behavior was more difficult to manage than before (27.43%). In the majority of cases there was a maintenance of basic daily routine (58.13%).

Work and finances (Web Table 1)

During lockdown, 55.67% continued to work; 47.37% expect their economic situation to worsen as a result of the COVID-19 outbreak

General somatic health (Web Table 2)

Self-reporting of chronic medical conditions (e.g. asthma, diabetes mellitus, hypertension, thyroid disorder, cardiological etc.) was positive in 17.64%. Excellent general health was reported by 30.45%, very good by 42.22%, good by 20.01%, fair by 6.39% and bad by 0.90%.

Thoughts pertaining to the COVID-19 outbreak (Web Table 3)

That prophylactic measures indeed work was believed by 84.14% and more than 95% followed them at least to a moderate degree, with almost 80% obeying to at least a large extent to the lockdown rules; more than 80% were feeling that the situation was very stressful. More than 95% feels that there was enough information concerning the necessity of the measures. Less than 10% was afraid much or very much that they will get COVID-19 but interestingly, almost half are afraid that a family member will do.

Lifestyle changes and lockdown.

There were lifestyle changes concerning physical activity, exercise, appetite and eating sex and sleep and are mentioned in the appendix and are shown in Web Table 4. In approximately 22% religious or spiritual inquires increased

Beliefs in conspiracy theories (Web Table 5)

Beliefs in conspiracy theories seem widely prevalent with the more bizarre (like the relationship between COVID-19 and 5 G, or the involvement of a supernatural power) enjoying lower acceptance. However, on average at least half of cases accepted at least to a moderate degree some non-bizarre conspiracy including the deliberate release of the virus as a bio-weapon to deliberately create a global crisis.

b *Case-control analysis (on the basis of the raw dataset, ID codes for variables also mentioned)*

The effect of lockdown on Mental health

The comparison of cases without vs. those with a previous history of depression (B5) in terms of development of depression or distress, returned Chi-square=201.816, df=2, $p<0.001$. Post-hoc tests suggested the two groups differed both in the presence of distress as well as for depression ($p<0.001$); 23.31% of those with previous history were manifesting depression and 8.96% of cases without previous history, manifested their first depressive episode. Their comparison in terms of the changes in suicidal thoughts (O11) returned Chi-square=44.601, df=16, $p<0.001$. Post-hoc tests suggested that the two groups differed in any increase in suicidal ideation (8.39% vs. 15.66%, $p<0.001$; Web Table 6).

The comparison of the numbers of cases without vs. those with a previous history of suicide attempts (O13) in terms of the presence of depression or distress returned Chi-square=134.791, df=2, $p<0.001$. Bonferroni corrected post-hoc tests suggested that the two groups differed both in the presence of distress as well as for depression ($p<0.001$). The comparison in terms of changes in current suicidal ideation (O11) returned Chi-square=61.561, df=16, $p<0.001$. Bonferroni corrected post-hoc tests suggested that the two groups differed in any increase in suicidal ideation (9.96% vs. 23.19%, $p<0.001$; Web Table 6).

Multiple forward stepwise linear regression analysis was performed with dependent variables: change in anxiety (F21), change in depressive affect (G21), change in suicidal thoughts (O11) and the development of distress or depression, and as predictors: sex (A1), age (A2), education level (A7), number of persons in household (A5), continue to work during lockdown (A11), condition of general health (B1), presence of a chronic medical condition (B2), being a carer of a person belonging to a vulnerable group (B4), any mental history (B5), history of depression (B5), fears of getting COVID-19 (C1), fears that a member of the family will get COVID-19 and die (C3), time spent outside of house during lockdown (D1), satisfaction by availability of information (D4), conflicts within family (E3), change in quality of relationships within family (E4), keeping a basic routine during lockdown (E5), change in economic situation (E7), history of suicidality (O13) and self-harm (O12) and changes in religiousness/spirituality (P1). The results with the variables which survived in the model are shown in Table 3.

Mental health and conspiracy theories

Chi-square tests revealed no relationship between history of depression (B5), self-harm (O12) or suicidal attempts (O13) and any conspiracy beliefs (J1-J7) concerning COVID-19 (WebTable 7). The use of Factorial ANOVA with each history variable as grouping and the belief variables as dependent did not return significant results either.

Chi-square tests revealed a significant relationship between the current presence of distress or depression and the belief the vaccine was ready before the outbreak (J1; $p=0.003$), that there is a relationship to 5G (J3; $p<0.001$), with all three groups differing from each other (WebTable 8).

The use of ANOVA with healthy/distress/depression as grouping variable and the belief variables (J1-J7) as dependent returned significant results (wilks=0.991, $F=2.139$, effect df=14, error df=6780, $p=0.007$). The Scheffe post hoc tests revealed that the difference between healthy individuals vs. depressed patients concerned that the vaccine was ready before the outbreak (J1; $p=0.003$), that there is a relationship to 5 G (J3; $p=0.017$), that mortality is lower than officially declared (J5; $p=0.020$) and that a divine power is involved in the outbreak (J7; $p=0.022$), with depressed patients having higher rate of beliefs.

Mental health and somatic disorders during lockdown

Factorial ANOVAs were performed with the use as independent variables the scores on CES-D, STAI and RASS and as grouping variables any chronic medical condition (B2) (wilks=0.988, $F=8.131$, effect df=5,

Table 3

Results of Multiple linear Regression analysis (total model). The model explains 3.1% of changes in suicidality, 15.9% of depressive thoughts, 16.8% of anxiety and 21.6% of depression or distress.

	Test: Wilks, df effect=4, df error=3374			F21. Change in anxiety R ² =0.168		G21. Change in depressive thoughts R ² =0.159		Development of distress or depression R ² =0.216		O11. Change in thoughts of suicide R ² =0.031	
	Value	F	p	Beta	SE	Beta	SE	Beta	SE	Beta	SE
Intercept	0.997	2.680	0.0301								
A2. Age	0.997	2.380	0.0496	0.007	0.016	0.022	0.016	-0.045	0.016	0.007	0.018
B1. General condition of health	0.947	46.893	<0.001	0.170	0.017	0.135	0.017	-0.188	0.016	-0.084	0.018
C1. Afraid he/she will get the covid and die	0.987	11.531	<0.001	-0.109	0.018	-0.115	0.018	0.038	0.018	0.046	0.020
C3. Afraid that family member will got covid and die	0.986	11.850	<0.001	-0.080	0.018	-0.030	0.018	0.096	0.018	-0.017	0.020
D1. Time spend outside home, work not included	0.991	7.828	<0.001	0.067	0.016	0.082	0.016	0.000	0.015	0.000	0.017
E3. Conflicts with other family members	0.986	12.072	<0.001	-0.093	0.018	-0.118	0.018	0.047	0.017	0.064	0.019
E4. Overall quality of relationships within family	0.987	11.042	<0.001	0.097	0.018	0.113	0.018	-0.057	0.017	-0.033	0.019
E5. Keeping a basic daily routine	0.971	25.591	<0.001	0.088	0.017	0.101	0.017	-0.154	0.016	-0.023	0.018
E7. Change in economic situation	0.976	20.901	<0.001	0.140	0.016	0.120	0.016	-0.068	0.016	-0.014	0.018
O12. History of deliberate self-harm	0.994	5.503	0.0002	-0.043	0.018	-0.041	0.018	0.077	0.017	0.016	0.019
O13. History of suicide attempt	0.987	11.131	0.0000	0.002	0.017	-0.004	0.018	0.098	0.017	0.057	0.019
P1. Change in religiousness/spirituality	0.995	3.929	0.0035	0.009	0.016	0.015	0.016	0.026	0.015	-0.055	0.017

error df=3393, $p < 0.001$), asthma (wilks=0.993, $F = 4.357$, effect df=5, error df=3393, $p < 0.001$), any pulmonary (wilks=0.993, $F = 4.753$, effect df=5, error df=3393, $p = 0.004$), any autoimmune (wilks=0.995, $F = 3.361$, effect df=5, error df=3393, $p < 0.001$) and diabetes melitus (wilks=0.995, $F = 3.126$, effect df=5, error df=3393, $p = 0.008$). The Scheffe post hoc tests revealed that those with the condition had higher scores in all psychometric scales. ANOVAs produced non significant results when the grouping variables were Hashimoto, any thyroid, any cancer, cardiological, neurological, renal, or myosceletal.

Conspiracy theories and adherence to measures

Multiple Regression Analysis with adherence to measures, that is time spent outside home (work not included) during lockdown (D1), adhering to lockdown in principle (D2), keeping sufficient prophylactic measures (D3) and the feeling that there is sufficient information concerning measures (D4) as dependent variables and conspiracy theories (J1-J7) as regressors suggested that only beliefs on the origin of virus (J1) and beliefs concerning its lethality (J5) were significantly contributing to the model. (WebTable9)

4. Discussion

According to the results this study, during the lockdown, clinical depression was present in 9.31%, with an additional 8.5% experiencing severe distress. Increased anxious and depressive emotions (including subclinical cases) were present in more than 40%. Of persons with a previous history of depression, 23.31% experienced depression vs. 8.96% of cases without previous history, who manifested their first depressive episode. It is unknown which percentage of those persons with a previous history manifested a relapse and which had an ongoing episode with onset before the outbreak. A similar picture concerned previous history of self-harm and suicide attempts.

Previous research has shown the presence of anxiety and depression in 8.3% and 14.6% in unaffected persons in China (Lei et al., 2020), while another study suggested a prevalence of depression or anxiety as high as 20.4% (Li et al., 2020). Again in China, moderate-to-severe stress, anxiety and depression were noted in 6.5–8.1%, 28.8% and 16.5%, respectively (Wang et al., 2020a), while there were no significant longitudinal reductions (Wang et al., 2020b). Two other studies again from China reported that 27.5% and 31.6% had anxiety, 29.3% and 27.9% had depression, 30.0% had a sleep disorder or 29% insomnia, 24.4% acute stress and 29.8% had a passive response to COVID-19. Female gender and being married have been identified as a risk factor for anxiety (Fu et al., 2020; Shi et al., 2020). A study from Turkey reported 23.6% depression and 45.1% anxiety (Ozdin and Bayrak Ozdin, 2020). In Cyprus a large percentage (48%) reported significant financial concerns and 66.7% significant changes in their

quality of life; 41% reported symptoms associated with mild anxiety; 23.1% reported moderate-severe anxiety symptoms, 48% reported mild and 9.2% moderate-severe depression symptoms. Again female gender and younger age were risk factors for anxiety and depression (Solomou and Constantinidou, 2020). In Germany over 50% expressed suffering from anxiety and psychological distress (Petzold et al., 2020). In Italy the prevalence of depression and anxiety symptoms was 24.7% and 23.2%; 42.2% had sleep disturbances and, among them, 17.4% reported moderate/severe insomnia. Here also, being female and younger age were risk factors (Gualano et al., 2020). In Spain 71.98% presented psychological distress (Dominguez-Salas et al., 2020), and there was a circular relationship, in which perceived threat influenced the presence of negative mood, and negative mood, in turn, linked to emotions of irritation and agitation from a present situation, promoted the feeling of threat (Perez-Fuentes et al., 2020). In Colombia 7.6% of participants reported a high suicide risk (Caballero-Dominguez et al., 2020). In India 25%, 28% and 11.6% of the participants were moderate to extremely severely depressed, anxious and stressed, respectively. Interestingly, in India, male gender and older age were risk factors for the development of distress, anxiety and depression (Verma and Mishra, 2020).

The high rates of believing in conspiracy theories are in accord with findings from other countries (Ahmed et al., 2020; Uscinski et al., 2020) and are a worrying manifestation. Conspiracy beliefs – especially those regarding science, medicine, and health-related topics – are widespread (Oliver and Wood, 2014) and capable of prompting people to eschew appropriate health-related behaviors (Bogart et al., 2010; Jolley and Douglas, 2014).

Changes in anxiety, depressive thoughts, the development of distress or clinical depression and changes in suicidality are determined by overlapping groups of variables (Table 3), and a model might take shape. One important detail is that the signs of beta coefficients of variables regarding family dynamics suggested that fewer conflicts and better quality of relationships are surprisingly related to higher anxiety and depressive emotions, higher rates of depression and distress, and greater rates of suicidal thoughts. This might mean that stronger ties to family members and the responsibility that comes with them or, on the contrary, the expected support and fears of loss of it, constitute a risk rather than a protective factor, and this might constitute a strong cultural element in the model.

If we consider a more or less linear continuum from fear to anxiety to depressive emotions to clinical depression and eventually to suicidality, the model which can be derived suggests there is a core of variables (general condition of health, fears that he/she will get the COVID-19, and conflicts with other family members) exerting a generic stressful effect, leading to simple thoughts and feelings of fear. At a second step, the development of anxiety is determined by a number of social and

interpersonal variables, including the quality of relationships within the family, keeping a basic daily routine, change in economic situation and history of deliberate self-harm, and being afraid that a family member will get COVID-19 and die. Interestingly, all of these variables are social-interpersonal (including history of self-harm) and suggest that the fear of losing the supportive environment is stronger than the support by the environment in those persons who go on to develop anxiety.

At the next step, the restriction of time outside the house because of the lockdown led to the development of depressive feelings, while the additional presence of history of suicidal attempts, especially in younger individuals, constitute additional risk factors in developing clinical depression. Eventually, spiritual and religious affiliation could protect the individual from emerging suicidal thoughts (Webfigure A). These results are in accord with the reports in the literature (Huang and Zhao, 2020a, b; Li et al., 2020; Ozdin and Bayrak Ozdin, 2020; Wang et al., 2020a), although this is the first time that a comprehensive model is proposed.

The results regarding the beliefs in conspiracy theories showed that the latter were related to the presence of depression or distress, but not to past history of depression or suicidality, and were in accord with the literature (Freyler et al., 2019; Tomljenovic et al., 2020). As correlation does not imply causation, conspiracy theories could be either the cause of depression or on the contrary a coping mechanism against depression. After taking into consideration that also in the family environment the expression of anger seemed to be a protective factor, the authors propose that the beliefs in conspiracy theories are a coping mechanism against the emergence of depression. Interestingly, beliefs specifically regarding the origin of the virus and its lethality significantly affected adherence to prophylactic measures. Adding conspiracy beliefs to our general model for response and coping to the COVID-19 outbreak, could lead to a model of multiple vulnerabilities, as presented graphically in Fig. 1.

5. Conclusion

The current paper reports high rates of depression, distress and suicidal thoughts in the general population during the lockdown, with a high prevalence of beliefs in conspiracy theories. For the development of depression, general health status, previous history of depression, self-harm and suicidal attempts, family responsibility, economic change, and age acted as risk factors while keeping daily routine, religiousness/spirituality and belief in conspiracy theories were acting as protective factors.

6. 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.

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Author contributions

All authors contributed equally to the paper

KNF 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 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.

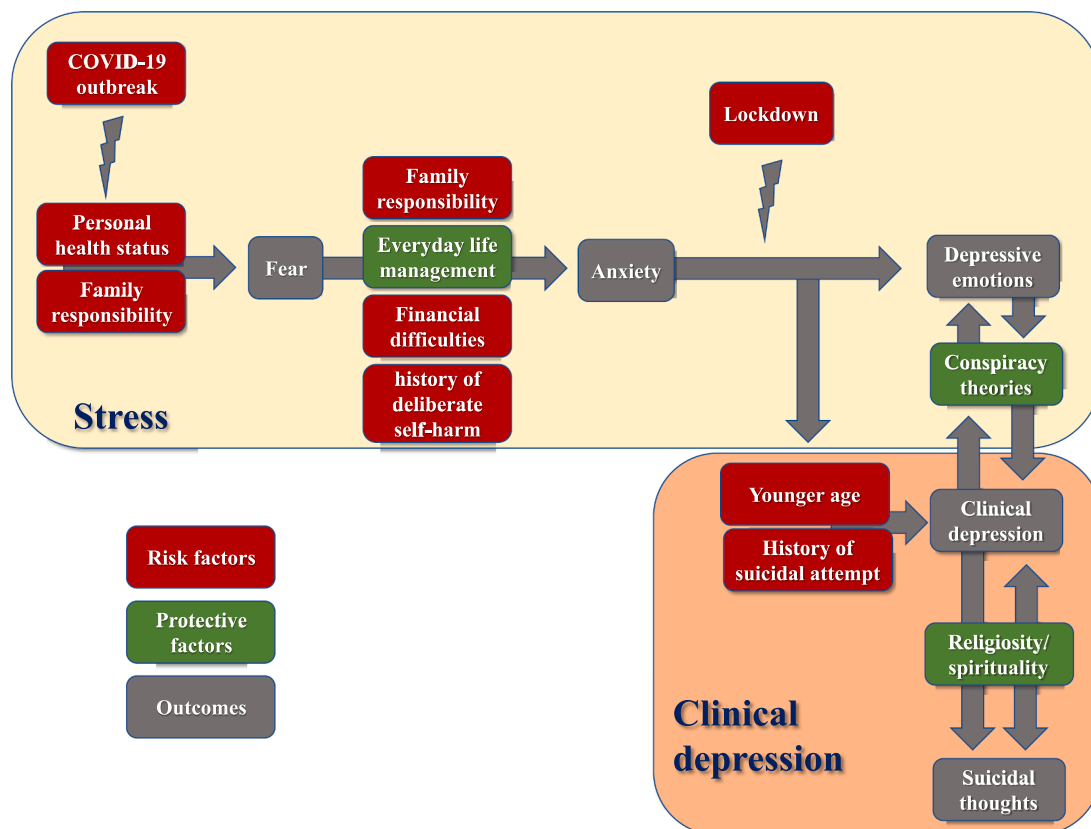


Fig. 1. The developed multiple vulnerabilities model representing the mechanism through which the COVID-19 outbreak in combination with the lockdown could lead to depression through stress. A number of variables act as risk factors (red) or as protective factors (green).

Declaration of Competing Interest

None pertaining to the current paper

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.jad.2020.10.061](https://doi.org/10.1016/j.jad.2020.10.061).

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