



Results of the COVID-19 mental health international for the health professionals (COMET-HP) study: depression, suicidal tendencies and conspiracism

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Abstract

Introduction The current study aimed to investigate the rates of anxiety, clinical depression, and suicidality and their changes in health professionals during the COVID-19 outbreak.

Extended author information available on the last page of the article

Materials and methods The data came from the larger COMET-G study. The study sample includes 12,792 health professionals from 40 countries (62.40% women aged 39.76 ± 11.70 ; 36.81% men aged 35.91 ± 11.00 and 0.78% non-binary gender aged 35.15 ± 13.03). Distress and clinical depression were identified with the use of a previously developed cut-off and algorithm, respectively.

Statistical analysis 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 detected in 13.16% with male doctors and ‘non-binary genders’ having the lowest rates (7.89 and 5.88% respectively) and ‘non-binary gender’ nurses and administrative staff had the highest (37.50%); distress was present in 15.19%. A significant percentage reported a deterioration in mental state, family dynamics, and everyday lifestyle. Persons with a history of mental disorders had higher rates of current depression (24.64% vs. 9.62%; $p < 0.0001$). Suicidal tendencies were at least doubled in terms of RASS scores. Approximately one-third of participants were accepting (at least to a moderate degree) a non-bizarre conspiracy. The highest Relative Risk (RR) to develop clinical depression was associated with a history of Bipolar disorder (RR = 4.23).

Conclusions The current study reported findings in health care professionals similar in magnitude and quality to those reported earlier in the general population although rates of clinical depression, suicidal tendencies, and adherence to conspiracy theories were much lower. However, the general model of factors interplay seems to be the same and this could be of practical utility since many of these factors are modifiable.

Keywords COVID-19 · Health professionals · Depression · Suicidality · Mental health · Conspiracy theories · Mental disorders · Psychiatry · Anxiety

Introduction

There are many reports in the literature suggesting that health professionals are at particular risk to experience a deterioration of their mental health during the COVID-19 pandemic [23]. Clinical depression, sleep disorders, and post-traumatic stress disorder (PTSD) was also reported both in the general population as well as in health care professionals (HCP) [55, 97]. Thus, while the COVID-19 pandemic started as an epidemic of an infectious agent, it soon gained a wider content and included all effects on all aspects of human life by this condition, even the overwhelming burst of information of questionable reliability and validity (‘infodemic’) [10]. The abuse of the terms ‘trauma’ and ‘PTSD’ is such an example. The vast majority of studies reported a ‘tsunami’-scale impact on mental health. It is highly possible that this could be an exaggeration [96]. In addition, changes to social behavior, as well as working conditions, daily habits, and routines have imposed secondary stress. 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; the response is by no means homogenous [37, 85, 96, 115], [75, 104]. Apart from the effect of the virus itself, 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. In this frame, mental health has gained a central position as an area that is expected to be affected by

the pandemic because of its threatening nature as well as because of the profound impact on the 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 [90]. Especially the expectation of an upcoming economic crisis and possible unemployment were stressful factors. Conspiracy theories and maladaptive behaviors were also prevalent, compromising the public defense against the outbreak. The issue of increased suicidality as a consequence of extreme stress and depression has been raised again [25, 84].

At the end of the day, although there are several empirical data papers, their methodology varies, it is very difficult to make comparisons among countries and it is also difficult to arrive at universally valid conclusions [55, 97]. Additionally, the literature is full of opinion papers, viewpoints, perspectives, guidelines, and narrations of activities to cope with the pandemic. These borrow from previous experiences with different pandemics and utilize common sense, but, as a result, they often obscure rather than clarify the landscape. The role of mass and social media has been discussed but remains poorly understood in empirical terms.

An early meta-analysis reported high rates of anxiety (25%) and depression (28%) in the general population [86] while a second one reported that 29.6% of people experienced stress, 31.9% anxiety and 33.7% depression [92]. Not only do we need more reliable and valid data, but we also need to identify risk and protective factors to be able to recommend measures that will eventually improve public

health by preventing the adverse impact on mental health and simultaneously improve health-related behaviors [4, 47, 73, 75].

The **aim** of the current study was to investigate the rates of anxiety, clinical depression, and suicidality and their changes in health professionals aged 18–69 internationally, during the COVID-19 pandemic. The secondary aims were to investigate their relations with several personal, interpersonal/social, and lifestyle variables. The aim also included the investigation of the spreading of conspiracy theories concerning the COVID-19 outbreak and their relationship with mental health in this specific population group.

Materials and methods

Methods

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

According to a previously developed method, [39, 40, 42] the cut-off score of 23/24 for the Center for Epidemiological Studies-Depression (CES-D) scale and a derived algorithm were used to identify cases of clinical depression. This algorithm utilized the weighted scores of selected CES-D items to arrive at the diagnosis of clinical depression, and has already been validated. Cases identified by only either method were considered cases of distress (false positive cases in terms of depression), while cases identified by both the cut-off and the algorithm were considered as clinical depression. The State-Trait Anxiety Inventory-State form (STAI-S) [100] and the Risk for Assessment of Suicidality Scale (RASS) [42] were used to assess anxiety and suicidality respectively.

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 on 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.

Materials

The data came from the larger COMET-G study [41].

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 [40], 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.

Statistical analysis

- 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 [69].
- Factorial Analysis of Variance (ANOVA) was used to test for the main effect as well as the interaction among grouping variables concerning continuous variables. The Scheffe test was used as the post-hoc test.
- 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. clinical depression).

To correct for multiple comparisons, the level of $p < 0.001$ was accepted as the level of significance for ANOVA and MFSLRA results (but not for post-hoc tests)

Results

Demographics

From the 55,589 responses from 40 countries (Table 1) of the COMET study, 23.01% reported they were working in the health field. Thus, the study sample of the current paper includes 12,792 health professionals ($N = 7983$ –62.40% women aged 39.76 ± 11.70 ; $N = 4709$ –36.81% men aged 35.91 ± 11.00 and $N = 100$ –0.78% non-binary gender aged 35.15 ± 13.03). The contribution of each country and the gender and age composition are shown in Table 1. The sex-by-specific occupation composition is shown in Table 2. The sociodemographic characteristics are shown in webtables 1,2,3,4,5,6,7 of the appendix. Details concerning various sociodemographic variables (marital status, education, work, etc. are shown in the webappendix, in webtables 1,2,3,4,5,6,7,8,9).

History of health

Moderate or bad somatic health was reported by 16.70% and the presence of a chronic medical somatic condition was reported by 21.29%. Detailed results are shown in webtable 8. Being either relatives or caretakers of vulnerable persons was reported by 46.88% (webtable 9).

Table 1 List of participating countries by sex, with number of subjects and mean age

Country	Men				Women				Non-binary gender					
	Age				Age				Age					
	<i>N</i>	%	Mean	SD	<i>N</i>	%	Mean	SD	<i>N</i>	%	Mean	SD	<i>N</i>	%
Argentina	439	20.14	44.53	14.39	1725	79.13	40.60	14.49	16	0.73	37.44	17.29	2180	3.92
Australia	21	30.43	33.67	8.05	48	69.57	32.63	7.89		0.00			69	0.12
Azerbaijan	70	19.89	36.20	10.33	280	79.55	37.71	11.46	2	0.57	26.00	0.00	352	0.63
Bangladesh	1681	55.42	24.09	5.24	1333	43.95	23.98	5.48	19	0.63	27.42	8.88	3033	5.46
Belarus	200	18.30	38.62	12.46	893	81.70	39.15	11.11		0.00			1093	1.97
Brazil	86	40.19	31.36	13.06	127	59.35	28.80	9.97	1	0.47	31.00		214	0.38
Bulgaria	202	26.47			558	73.13			3	0.39			763	1.37
Canada	142	27.73	42.24	15.49	367	71.68	42.57	14.00	3	0.59	46.33	17.79	512	0.92
Chile	86	26.71	40.76	15.43	234	72.67	39.57	15.08	2	0.62	42.50	16.26	322	0.58
Croatia	1041	35.91	41.73	11.70	1835	63.30	42.32	11.84	23	0.79	44.26	13.75	2899	5.22
Egypt	24	14.55	37.38	14.18	141	85.45	39.66	11.82		0.00			165	0.30
France	64	24.33	38.98	14.70	197	74.90	37.89	15.53	2	0.76	27.50	10.61	263	0.47
Georgia	48	11.59	30.77	6.82	364	87.92	32.06	9.04	2	0.48	33.50	6.36	414	0.74
Germany	15	25.00	48.93	18.58	45	75.00	34.87	13.98		0.00			60	0.11
Greece	624	18.26	36.55	10.58	2772	81.10	34.00	9.87	22	0.64	29.59	6.68	3418	6.15
Honduras	74	33.48	28.19	7.17	147	66.52	32.05	11.09		0.00			221	0.40
Hungary	146	19.13	44.60	11.95	617	80.87	41.36	11.95		0.00			763	1.37
India	3044	61.01	33.51	8.94	1917	38.42	31.59	11.97	28	0.56	28.36	7.86	4989	8.97
Indonesia	909	27.68	33.64	12.06	2358	71.80	30.49	11.42	17	0.52	28.00	11.62	3284	5.91
Israel	28	19.44	48.79	18.24	116	80.56	38.97	13.56		0.00			144	0.26
Italy	257	26.22	43.10	16.17	717	73.16	41.22	14.17	6	0.61	42.17	21.14	980	1.76
Japan	182	70.00	45.31	11.61	78	30.00	41.71	11.10		0.00			260	0.47
Kyrgyz Republic	614	27.76	36.38	14.16	1561	70.57	38.87	14.58	37	1.67	33.57	12.60	2212	3.98
Latvia	1036	39.72	48.18	12.38	1570	60.20	45.26	14.64	2	0.08	48.00	18.38	2608	4.69
Lithuania	271	21.54	39.34	13.62	983	78.14	40.16	12.75	4	0.32	40.75	12.89	1258	2.26
Malaysia	311	32.29	41.95	12.08	578	60.02	39.24	11.71	74	7.68	39.03	12.66	963	1.73
Mexico	447	25.03	36.84	16.13	1332	74.58	38.18	14.74	7	0.39	22.86	4.78	1786	3.21
Nigeria	752	65.22	30.30	7.46	397	34.43	25.83	7.55	4	0.35	31.75	7.97	1153	2.07
Pakistan	575	28.24	25.46	6.35	1445	70.97	23.45	4.42	16	0.79	24.75	10.93	2036	3.66
Peru	56	36.13	43.80	15.80	99	63.87	38.72	14.03		0.00			155	0.28
Poland	286	18.58	33.46	11.54	1239	80.51	33.65	11.24	14	0.91	31.21	14.67	1539	2.77
Portugal	16	18.82	43.31	18.22	68	80.00	42.34	13.77	1	1.18	38.00		85	0.15
Romania	293	20.22	47.54	14.45	1144	78.95	46.77	14.21	12	0.83	51.58	15.45	1449	2.61
Russia	3825	38.50	30.34	12.03	5847	58.85	31.74	12.25	264	2.66	27.64	10.87	9936	17.87
Serbia	152	25.08	39.16	11.94	453	74.75	41.84	11.77	1	0.17	58.00		606	1.09
Spain	330	31.82	51.49	14.85	703	67.79	48.52	13.53	4	0.39	50.00	13.11	1037	1.87
Turkey	95	27.38	25.03	6.26	249	71.76	25.05	7.36	3	0.86	21.33	0.58	347	0.62
Ukraine	306	21.07	38.42	15.38	1132	77.96	39.09	13.13	14	0.96	35.93	17.88	1452	2.61
UK	55	34.38	43.53	11.12	105	65.63	44.56	11.95		0.00			160	0.29
USA	124	30.32	37.50	15.47	273	66.75	37.78	14.51	12	2.93	28.00	9.78	409	0.74
Total	18,927	34.05	34.90	13.29	36,047	64.85	35.80	13.61	615	1.11	31.64	13.15	55,589	100.00

In terms of mental health history and self-harm, 8.59% had a prior history of an anxiety disorder, 10.93% of depression, 0.71% of Bipolar disorder, 0.42% of psychosis, and 2.90% of other mental disorder. Any mental disorder history

was present in 23.58%. At least once, 17.20% had hurt themselves in the past and 8.20% had attempted at least once in the past. The detailed rates by sex and country are shown in webtable 10.

Table 2 Sex-by-occupation composition and rates of clinical depression and distress

	%	Age		Distress %	Clinical depression %	Distress plus clinical depression (%)
		Mean	SD			
Administrative staff in hospital (4.10%)						
Women	64.35	40.29	11.14	12.28	17.37	29.64
Men	34.10	38.01	10.83	13.56	15.82	29.38
Non-binary gender	1.54	39.00	12.42	37.50	37.50	75.00
Total				13.10	17.15	30.25
Doctor (42.66%)						
Women	70.70	39.88	11.84	15.36	15.23	30.60
Men	28.67	40.21	13.42	14.03	7.89	21.91
Non-binary gender	0.63	37.35	15.25	35.29	5.88	41.18
Total				15.11	13.07	28.17
Nurse (10.89%)						
Women	87.22	41.11	11.90	14.49	16.65	31.14
Men	12.20	34.99	11.25	16.67	11.31	27.98
Non-binary gender	0.58	32.00	12.74	0.00	37.50	37.50
Total				14.67	16.12	30.79
Other healthcare profession (36.21%)						
Women	44.97	38.77	11.31	15.69	14.81	30.50
Men	54.36	33.34	7.87	14.54	9.60	24.15
Non-binary gender	0.68	36.35	11.57	29.03	16.13	45.16
Total				15.16	11.99	27.15
Other hospital staff (6.14%)						
Women	60.05	39.35	11.78	17.38	15.45	32.83
Men	37.63	34.40	12.43	18.84	14.38	33.22
Non-binary gender	2.32	28.61	9.58	33.33	22.22	55.56
Total				18.30	15.21	33.51
Total study sample						
Women	62.40	39.76	11.70	15.30	15.44	30.75
Men	36.81	35.91	11.00	14.68	9.63	24.31
Non-binary gender	0.78	35.15	13.03	30.30	17.17	47.47
Total	100.00	38.31	11.61	15.19	13.31	28.50

Family

In terms of family status, 57.86% were married, 60.02% had at least one child and only 11.42% were living alone. The responses suggested an increased need for communication with family members in 41.79%, an increased need for emotional support in 30.26%, fewer conflicts in 37.36% and increased conflicts within families for 17.77%, an improvement of the quality of relationships in 25.62%, while in most cases (90.18%) there was maintenance of basic daily routine at least somehow (webtable 11). During lockdowns 80.81% continued to work, while 47.65% expected their economic situation to worsen because of the COVID-19 outbreak (webtable 12).

Present mental health

Concerning mental health, data 47.15% reported an increase in anxiety, and 39.95% reported a worsening in depressive affect. Suicidal thoughts were increased in 10.48%. Overall, current clinical depression was present in 13.16% of the study sample (unweighted average) with male doctors and ‘non-binary genders’ having the lowest rates (7.89 and 5.88%, respectively) and ‘non-binary gender’ nurses and administrative staff having the highest (37.50%). In detail, the results are shown in Table 2. However, after taking into consideration the expected rates of current clinical depression in the population, men with positive history had the highest Relative Risk (RR = 6.47) while the lowest

was observed in women without a history of mental disorder (RR = 1.81). Additionally, distress was present in 15.19%, with the highest rates being for ‘non-binary genders’ (> 30%) and the lowest for female administrative staff (12.28%). The complete rates by sex and occupation are shown in webtable 17.

Suicidal tendencies doubled according to RASS subscales scores (webtable 17) and in comparison to what is expected [42].

Persons with a history of mental disorders had higher rates of current clinical depression (24.64% vs. 9.62%, chi-square test = 454.90; df = 1; $p < 0.0001$) (webtable 14). In persons without mental health history, the RR ranged from 2.14 to 2.90. In persons with a mental health history, the RR was highest in those with a psychotic history (Bipolar disorder RR = 9.04; Psychosis RR = 8.08) and ranged between 3.82 and 6.40 for non-psychotic history, with the lowest RR in persons with a history of ‘other mental disorder’, in comparison to the expected prevalence of depression (3% for men and 6% for women). Of women with clinical depression, half were new cases (without any past history of mental disorder) while this was true for two thirds of men. Taking into consideration that the pandemic increased the risk by definition, the risk to develop clinical depression during the pandemic when having a previous history was highest for bipolar disorder (RR = 4.23), while the previous history of self-harm or suicidal attempts did not increase the risk (Table 3).

The mean scale scores were 43.52 ± 11.99 for the STAI-S, 19.36 ± 8.17 for the CES-D, and 70.23 ± 134.74 for the Intention subscale of the RASS. The complete results by sex and country are shown in webtable 17.

Table 3 Relative Risk (RR) to develop clinical depression vs. participants with no mental health history and no history of self-harm or suicidal acts

History	Risk to develop clinical depression			
	When alone		When history of self-harm/attempt is also present	
	%	RR	%	RR
No previous history at all	9.62	1.00		1.0
Any mental disorder	31.81	3.31	29.87	3.11
Anxiety	19.93	2.07	29.49	3.07
Clinical depression	28.81	2.99	30.46	3.17
Bipolar disorder	40.66	4.23	30.78	3.20
Psychosis	36.36	3.78	30.93	3.22
Other	17.20	1.79	30.52	3.17
Only history of self-harm/attempt	17.89	1.86		

From the total sample, 5.17% reported that they often thought much or very much about committing suicide if they had the chance. Men and women had similar rates (5.76% vs. 4.69%) but those self-identified as ‘non-binary gender’ had much higher rates (17.00%). In subjects with a history of psychotic disorder or self-harm/attempt the rate was 15.45% while in those with a history of non-psychotic disorder, it was 9.76%. In persons free of any mental disorder or self-harm/attempt history the rate was as low as 2.09%. This means that the RR for the manifestation of at least moderate suicidal thoughts was equal to 7.4 for psychotic history and 3.7 for non-psychotic history. In those identified as ‘non-binary gender’, the RR was approximately equal to 3.5.

Beliefs in conspiracy theories

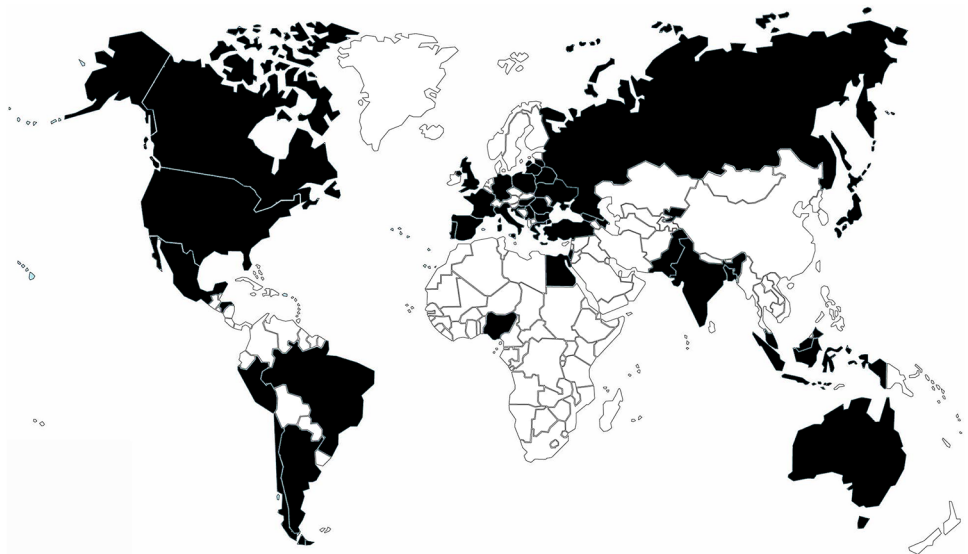
Approximately one third of responders accepted at least a moderate degree some non-bizarre conspiracy theory. The acceptance of inflated death rates was 44.24% while that of the 5G antenna theory was 20.81%. Doctors had the lowest rates, but impressively, 37.6% of doctors and 50.86% of nurses reported they were believing in the deliberate inflation of death rates by governments and 14.75% and 27.22% respectively were accepting the 5G theory. In detail, the responses by sex and country are shown in webtable 21.

Modeling of mental health changes during the pandemic

The presence of any mental health history acted as a risk factor for the development of current clinical depression with all chi-square tests being significant at $p < 0.001$. Interestingly a history of self-harm or suicidality emerged as a risk factor even for persons without reporting mental health history. In persons with only a history of self-harm or suicidality, 17.89% developed clinical depression. The combination of both self-harm and suicidal attempts history with specific mental health history revealed that subjects without any such history at all had the lowest rate or current clinical depression (9.62%), while the presence of previous self-harm/attempts increased the risk in subjects with past anxiety (29.49%) and other mental disorders (30.52%), but not clinical depression (30.46%), Bipolar disorder (30.78%) and psychoses (30.93%). The highest relative risk (RR) was calculated for history of Bipolar disorder but history of self-harm/attempt played no role (RR = 4.23). All RR values are shown in Table 2 and webtable 22. After taking into consideration that the annual incidence of depression is 0.3% [66], the calculated risk because of the pandemic for the health professionals population to develop clinical depression is RR = 30 Fig. 1.

The presence of a chronic somatic condition acted as a significant but weak risk factor for the development of

Fig. 1 Map of the 40 participating countries



clinical depression (Chi-square = 14.61, $df = 1$, $p < 0.001$; In terms of rates, 15.35% of those with a chronic somatic condition manifested clinical depression vs. 12.56% of those without ($RR = 1.22$).

The results of the MFSLRA suggested that a significant number of variables acted either as risk or as protective factors (Table 4, Fig. 2, webtable 23). These factors explained 16.1% of the change in anxiety, 11.6% of change in depressive affect, 19.1% of the development of distress or clinical depression, and 5.1% of change in suicidal thoughts. The individual contribution of each predictor separately was very small (many b coefficients were very close to zero).

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 (Fig. 2, webfigure 1) that exert a stable either adverse or protective effect throughout the course of the development of the mental state.

Factorial ANOVA with the scores of STAI-S, CES-D and RASS as continuous variables and sex and being a doctor or a nurse as grouping variables was always significant for sex ($p < 0.0001$). For doctors only the interaction with sex is significant (Wilks = 0.996, $F = 4.86$, $df = 10$, error $df = 25,562$, $p < 0.0001$), with ‘non-binary genders’ having higher psychopathology. For nurses it was significant both independently (Wilks = 0.999, $F = 7.768$, $df = 10$, error $df = 25,562$, $p = 0.009$) as well as in interaction with sex (Wilks = 0.998, $F = 2.618$, $df = 10$, error $df = 25,562$, $p = 0.004$). Overall nurses had lower psychopathological scores than the rest. The Scheffe post-hoc tests (at $p < 0.05$) revealed that most groups defined by sex and occupation differed from each other in a complex and difficult-to-explain matrix.

Conspiracy theories manifest a complex behavior with some of them exerting a protective effect at certain phases

(Fig. 2), but their overall impact was lower in comparison to the general population. The mean scores of responses to questions pertaining to different conspiracy beliefs by history of any mental disorder and current clinical depression are shown in Table 5 and webtable 24. Factorial ANOVA suggested that history of any mental disorder and current clinical depression as well as their interaction were significant factors concerning the belief in conspiracy theories (Table 5). The results of post-hoc tests are shown in webtable 25. They suggest that persons with a history of mental disorder have lower overall tendency in believing in both the threatening and the reassuring conspiracy theories. Not believing in any conspiracy theory had a different composition with history of having any mental disorder being the determining factor leading to lower adaption of conspiracy theories and with depression acting at a second level and further decreasing this tendency. These findings were consistent across disorders and conspiracy theories.

Discussion

This large international study in a convenient sample of 12,792 health professionals from 40 countries detected clinical depression in 13.31% (unweighted average) with men and ‘non-binary genders’ doctors having the lowest rates (7.89% and 5.88% respectively) and ‘non-binary gender’ nurses and administrative staff having the highest (37.50%). Distress was present in 15.19%, with the highest rates being for the ‘non-binary gender’ (> 30%) and the lowest for female administrative staff (12.28%). A significant percentage reported a deterioration in mental state, family dynamics and everyday lifestyle. Persons with a history of mental disorders had higher rates of current clinical depression

Table 4 Results of four separate Multiple Forward Stepwise Linear Regression Analysis (MFSLRA) with change in anxiety (F21), change in depressive affect (G21), change in suicidal thoughts (O11) and the development of distress or clinical depression as dependent variables

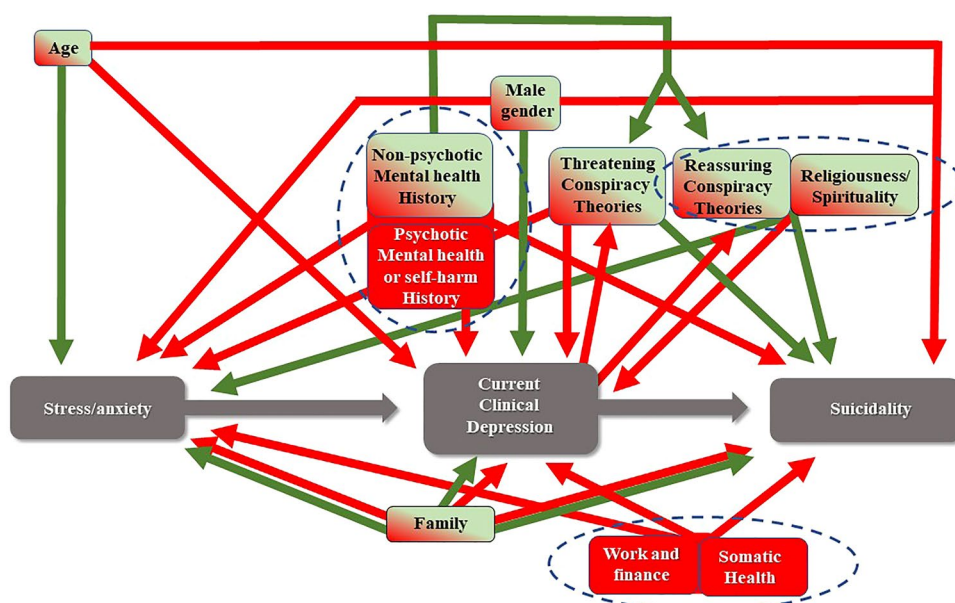
	Change in anxiety (F21)			Change in depressive affect (G21)			Development of distress or clinical depression (O11)			Change in suicidal thoughts (O11)						
	b	SE	t	b	SE	t	b	SE	t	b	SE	t	p			
Intercept	-0.87	0.06	-14.49	<0.001	-0.75	0.06	-11.95	<0.001	0.59	0.04	14.31	<0.001	0.44	0.06	7.24	<0.001
Demographics																
Sex (A1)- 'non-binary gender' was not included	0.06	0.02	3.88	<0.001				-0.04	0.01	-3.02	0.003	0.06	0.02	3.98	<0.001	
Age (A2)	0.00	0.00	3.23	0.001	0.00	0.00	3.67	<0.001	0.00	-4.00	<0.001	0.00	0.00	-3.79	<0.001	
Number of persons in household (A5)																
Education level (A7)	-0.02	0.01	-2.23	0.026	-0.02	0.01	-2.42	0.016								
Work and finance																
Continue to work during lockdown (A11)																
Change in economic situation (E7)	0.10	0.01	14.02	<0.001	0.11	0.01	15.11	<0.001	-0.02	0.01	-3.15	0.002	-0.02	0.01	-2.58	0.010
Health																
Condition of general health (B1)	0.10	0.01	13.90	<0.001	0.08	0.01	10.55	<0.001	-0.09	0.01	-15.30	<0.001	-0.02	0.01	-3.29	0.001
Presence of a chronic medical condition (B2)																
Family/social																
Being a carer of a person belonging to a vulnerable group (B4)	-0.04	0.02	-2.60	0.009				-0.04	0.01	-2.98	0.003	0.04	0.01	2.57	0.010	
Conflicts within family (E3)	-0.03	0.01	-4.53	<0.001	-0.04	0.01	-5.21	<0.001	0.04	0.01	7.37	<0.001	0.06	0.01	8.30	<0.001
Change in quality of relationships within family (E4)	0.12	0.01	12.27	<0.001	0.15	0.01	15.33	<0.001	-0.02	0.01	-3.24	0.001	-0.06	0.01	-6.67	<0.001
Keeping a basic routine during lockdown (E5)	0.11	0.01	12.78	<0.001	0.10	0.01	11.46	<0.001	-0.10	0.01	-14.79	<0.001	-0.05	0.01	-5.81	<0.001
Changes in religiousness/spirituality (P1)	0.02	0.01	2.63	0.009	0.02	0.01	2.22	0.026	0.03	0.01	4.99	<0.001	-0.05	0.01	-6.22	<0.001
Mental health history																
History of anxiety (B5)	-0.14	0.03	-5.37	<0.001	-0.12	0.03	-4.39	<0.001	0.20	0.02	9.37	<0.001	0.05	0.03	2.03	0.042
History of depression (B5)	-0.10	0.02	-4.14	<0.001	-0.13	0.02	-5.45	<0.001	0.36	0.02	18.61	<0.001	0.07	0.02	2.95	0.003
History of psychosis (B5)								0.37	0.09	4.26	<0.001					
History of bipolar disorder (B5)								0.44	0.07	6.36	<0.001	-0.19	0.08	-2.28	0.023	
History of other mental disorder (B5)	-0.20	0.04	-4.50	<0.001				0.15	0.03	4.46	<0.001					
History of self-harm (O12)								0.008	0.17	0.02	9.63	<0.001	0.05	0.02	2.48	0.013
History of suicidal attempt (O13)								0.14	0.02	5.65	<0.001	0.11	0.03	3.87	<0.001	
The effect of the pandemic																
Fears of getting COVID-19 (C1)	-0.10	0.01	-12.09	<0.001	-0.05	0.01	-6.41	<0.001	0.06	0.01	8.69	<0.001	0.02	0.01	2.08	0.037
Fears that a member of the family will get COVID-19 and die (C3)	-0.08	0.01	-11.22	<0.001	-0.04	0.01	-6.35	<0.001	0.05	0.01	9.92	<0.001	-0.01	0.01	-2.24	0.025
Time spent outside of house during lockdown (D1)	0.02	0.01	3.89	<0.001	0.02	0.01	3.21	0.001								

Table 4 (continued)

	Change in anxiety (F21)			Change in depressive affect (G21)			Development of distress or clinical depression			Change in suicidal thoughts (O11)		
	<i>b</i>	SE	<i>t</i>	<i>p</i>	<i>b</i>	SE	<i>t</i>	<i>p</i>	<i>b</i>	SE	<i>t</i>	<i>p</i>
Currently locked up in the house (D2)					-0.03	0.01	-4.03	<0.001	0.02	0.01	3.05	0.002
Satisfaction by availability of information (D4)	0.06	0.01	8.09	<0.0001	0.06	0.01	7.88	<0.001	-0.06	0.01	-8.12	<0.001
Beliefs in conspiracy theories												
The vaccine was ready before the virus broke out and they conceal it (J1)	0.04	0.01	5.15	<0.0001	0.03	0.01	4.41	<0.001	0.03	0.01	4.38	<0.001
COVID-19 was created in a laboratory as a biochemical weapon (J2)									-0.03	0.01	-4.09	<0.001
COVID-19 is the result of 5G technology antenna (J3)					-0.03	0.01	-3.19	0.001	0.05	0.01	6.71	<0.001
COVID-19 appeared accidentally from human contact with animals (J4)									0.01	0.01	2.42	0.016
COVID-19 has much lower mortality rate but there is terror-inducing propaganda (J5)					0.01	0.01	2.03	0.042				
COVID-19 is a creation of the world's powerful leaders to create a global economic crisis (J6)									0.02	0.01	2.43	0.015
COVID-19 is a sign of divine power to destroy our planet (J7)	0.04	0.01	4.43	<0.001					0.04	0.01	6.12	<0.001
Occupation (A10)												
Doctor									-0.04	0.01	-3.08	0.002
Nurse												
Other Hospital staff	0.07	0.02	2.89	0.004								
Other healthcare professional												
Administrative staff												

The predictors are shown in the left column

Fig. 2 The model which was previously developed in the general population and was proven valid also in the population of health professionals. It includes multiple vulnerabilities representing the mechanism through which the COVID-19 outbreak in combination a great number of factors could lead to clinical depression through stress, and eventually to suicidality. A number of variables act as risk factors (red) or as protective factors (green), while some of them change direction of action depending on the phase (green/red). Three core clusters emerge (delineated with the dotted lines)



(24.64%) while persons without any such history had the lowest rate of current clinical depression (9.62%). The highest rate was for the history of Bipolar disorder (40.66%; RR = 4.23). In those with a chronic somatic condition, the rate of clinical depression was 15.35% vs. 12.56% in those without (RR = 1.22). Believing in conspiracy theories was significant with at least one-third of cases accepting at least to a moderate degree a non-bizarre conspiracy.

The model developed suggested that a significant number of variables acted either as risk or as protective factors, explaining 19.1% of the development of distress or clinical depression, but their individual contribution was very small. Conspiracy theories manifested a complex behavior with some of them exerting a protective effect at certain phases. Current clinical depression acted as a risk factor and past history acted as a protective for the development of such beliefs.

The overall levels of clinical depression were lower than the rates reported in the literature, probably because of the stringent criteria of the algorithm in the current study. The large heterogeneity among countries probably reflects different phases of the pandemic in each country during the data collection. Rates of depression and mental health deterioration, in general, are probably higher in those that actually suffered from COVID-19 [29]. Other studies reported that half or more of health care professionals might suffer from depression. [7, 24, 32, 48, 76, 81, 82, 103, 117], Mira et al. 2020; [111, 112, 118]. Our results are identical to two reports [26, 52]. Meta-analyses suggested that depression rates range from 27% to 36% [45, 102, 109, 116] which is two to three times higher in comparison to our findings. In comparison, it has been reported that more than two-thirds of the general population experienced at least severe distress

[18, 31, 50, 62, 80, 83, 110], and high levels of suicidality [19]. Furthermore, our findings are in accord with a recently published meta-analysis that reported much lower depression rates in the general population [21].

An important observation is that while the rate of clinical depression was much higher in persons with a history of a mental disorder the proportion of depressed persons without such a history is much higher than expected, taking into consideration that the annual incidence of depression is 0.3% [66]. This might mean that the pandemic posed a RR = 30 on the population of health professionals to develop clinical depression.

The multivariable analysis of the data allowed the current paper to confirm a staged model previously proposed concerning the effect of the pandemic on mental health (Fig. 2). This model had been developed concerning the general population and it seems that in principle it is valid for health professionals, although with some differences, especially concerning the attenuating effect of conspiracy theories and religiousness/spirituality.

According to it, with the onset of the pandemic, its psychological impact and the development of severe anxiety and distress were determined by several sociodemographic and interpersonal variables including age, fears specific to the pandemic, the quality of relationships within the family, keeping a basic daily routine, change in the economic situation, history of any mental disorder and being afraid that him/herself or a family member will get COVID-19 and die. Similar findings concerning the effects of these factors have been reported in the literature [7, 17, 32, 35, 36, 46, 56, 57, 65, 67, 70, 80, 95, 98, 107, 111–113], Garre-Olmo et al. 2021; [89], but until now their detailed contribution had not been identified and no comprehensive model had been

Table 5 Means of responses (from -2 to +2) to all conspiracy theories by current clinical depression and history of any mental disorder and ANOVA results

Current clinical depression	History of any mental dis	Reassuring conspiracy theories						Threatening conspiracy theories						No believing in conspiracy theories					
		J1		J5		J7		J2		J3		J6		J4		Mean	SD		
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD				
Means of response scores by clinical depression and history																			
No	Yes	0.61	1.02	1.20	1.29	0.41	0.89	0.97	1.15	0.39	0.85	0.92	1.19	2.01	1.21				
No	No	0.81	1.10	1.32	1.25	0.57	0.99	1.28	1.24	0.56	0.95	1.20	1.24	1.69	1.19				
Yes	Yes	0.94	1.23	1.28	1.28	0.58	1.05	1.31	1.29	0.63	1.08	1.22	1.31	1.87	1.23				
Yes	No	1.06	1.21	1.41	1.25	0.95	1.28	1.43	1.28	0.89	1.16	1.44	1.30	1.73	1.21				
All Grps	0.80	1.11	1.31	1.26	0.57	1.01	1.24	1.24	0.55	0.96	1.17	1.25	1.76	1.21					
ANOVA results																			
		Wilks						F						Effect df		Error df		p	
Clinical depression		0.986						26.54						7		12,780		<0.001	
History of any mental disorder		0.988						23.06						7		12,780		<0.001	
Clinical depression* history of any mental disorder		0.997						5.51						7		12,780		<0.001	

developed. On the other hand, several factors not assessed by the current study, including the level of training, whether the person worked in the frontline against COVID or in an ICU, etc. [8, 54, 67, 111, 112], Mira et al. 2020; [7, 20, 24, 48, 51, 52, 71, 82, 95, 101, 103, 107] were reported as contributing in the development of clinical depression. The current paper suggests that from all health occupations, nurses might be at a higher risk to develop severe stress and clinical depression, and this is in accord with the literature [33, 48, 51, 58, 118]. Previous reports on the role of temperament are in accord with this [74]

At the 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 [22, 28]. According to the results of the current study, approximately one-third of responders accepted at least to a moderate degree a non-bizarre conspiracy theory, and this was true both for ‘threatening’ as well as for ‘reassuring’ theories. The acceptance of inflated death rates was 44.24% while that of the 5G antenna theory was 20.81%. Doctors had the lowest rates, but impressively, 37.6% of doctors and 50.86% of nurses reported they were believing in the deliberate inflation of death rates by governments, and 14.75% and 27.22% respectively were accepting the 5G theory. Interestingly, believing in conspiracy theories pertaining to COVID-19 was lower in comparison to the general population and played an attenuated role in the development of anxiety and depression, however, these beliefs seem to be an important factor even among doctors. The high rates of believing in conspiracy theories are in accord with findings from various countries [1, 64, 91, 108] and are a worrying manifestation. Conspiracy beliefs – especially those regarding science, medicine, and health-related topics – are widespread [78], are widely distributed in social media [1, 11] and they challenge the capacity of the average person to distill and assess the content [30, 34]. They exert a well-documented adverse effect on health behaviors, especially vaccination [2, 3, 14–16, 43, 49, 59, 63, 72, 88, 91, 93, 99, 105]. There seems to be some relationship between believing in bizarre conspiracy theories and psychotic tendencies or a history of psychotic disorders [60].

As was found in the general population, current clinical depression and past history of mental disorders are both critical factors related to believing in conspiracy theories. Our results could mean that the critical factor which increases belief is the presence of current clinical depression, while the past history acts at a second level. As correlation does not imply causation, conspiracy theories could be either the cause of clinical depression, a copying mechanism against clinical depression, or a marker of maladaptive psychological patterns of cognitive appraisal.

After taking into consideration the complete model, and especially the relationship to past mental health history, the authors propose that the beliefs in conspiracy theories are a copying mechanism against stress. The finding of the relationship between current clinical depression and believing in conspiracies is in accord with the literature [28, 44, 106]. One explanation could be found in the theory concerning ‘Depressive Realism’ [5, 6], Alloy et al. 1981; [12, 68, 77] which suggests that depressive persons are more able than others to realistically interpret the world, however, this higher ability leads to pessimism.

At the most extreme end, when the emergence of suicidal thinking is possible, the family environment and family responsibilities and care act either as risk or protective factors, depending on their quality, while religiosity/spirituality and all beliefs in conspiracy theories act as protective factors, except for one which includes religious content. These results are in accord with the reports in the literature [9, 56, 57, 61, 65, 79, 113].

A difficult-to-answer question is how many of the cases detected by questionnaires and sophisticated algorithms correspond to real major clinical depression. The underlying neurobiology is opaque and maybe much diagnosed clinical depression might simply be an extreme form of a normal adjustment reaction [53]. However, there is no better way to psychometrically achieve higher validity and the algorithm we utilized is the best available method. The impressive increase in new cases of clinical depression (9.62% of persons without any history of mental disorders developed depression) which was found in our sample is in accord with the literature [87]. However, a large part of clinical depressions emerged from a previous mental health history. Of the 13.15% with current clinical depression, 7.35% were new cases while 5.80% had previous history. This suggests that almost beyond doubt true clinical depression increased by 30% (in the extreme scenario that none of cases without previous history was a case of true clinical depression. This extremely positive scenario also suggests that maybe relapses expected to occur in the next several years occurred earlier.

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 end of the pandemic [27] 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 [13, 114]. Especially sociability and the sense of belonging could be important factors determining mental health and health-related behaviors [15], and these factors seem to correspond to specific vulnerabilities seen especially in western cultures.

Conclusion

The current paper reports high rates of clinical depression, distress, and suicidal thoughts among the population of health workers during the pandemic, with a high prevalence of beliefs in conspiracy theories. For the development of clinical depression, general health status, previous mental health history, self-harm and suicidal attempts, family responsibility, economic change, and age acted as risk factors while keeping a daily routine, religiousness/spirituality, and belief in conspiracy theories were acting mostly as protective factors. These findings, although they should be closely monitored longitudinally, support previous suggestions by other authors concerning the need for a proactive intervention to protect the mental health of the general population but more specifically of vulnerable groups [38, 94]

Strengths and limitations

The strengths of the current paper include the large number of persons who filled out 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 the self-selection of the responders. Additionally, the assessment included only the cross-sectional application of self-report scales, although the advanced algorithm used for the diagnosis of clinical depression corrected the problem to a certain degree. However, what is included under the umbrella of ‘clinical 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.

Finally, a limitation would be that data from different countries were pooled together and with a rather large difference in numbers among countries. So the interpretation of findings should bear in mind the possible bias induced by different cultural backgrounds. However, one should have also in mind that backgrounds are not so different as one might think since the online survey of a specific professional population poses requirements that lead to similarities rather than differences among the populations from different countries. Each of these countries was also undergoing a different phase of the pandemic at each time point and phases were also different across individuals. This means that the results should be interpreted.

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.

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Data availability statement Raw data are available upon request to the principal investigator.

Declarations

Conflict of interest None pertaining to the current paper.

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