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Increased levels of anger associated with the French Government's restrictive measures against the COVID outbreak in subjects without pre-existing mental condition *vs. patients with history of depression*

The emergence of the coronavirus disease 2019 (COVID-19) and related government policy responses, especially social distancing measures, have generated speculation on behavioral health effects, including interpersonal violence. Having had arguments, feeling angry, or having fallen out with others because of COVID-19 has been reported (Smith et al., 2021). Subjects under lockdown reported a significantly higher tendency to become irritable or "fly off the handle" than those that were not under such restrictions (Killgore et al., 2021), especially in young adults (Maggi et al., 2021). Higher tendency to experience and express anger has also been associated with more severe personal consequences of the pandemic (Grondal et al., 2021) and pre-existing bipolar disorder and psychiatric comorbidities (Campos et al., 2021). We thus aimed to investigate the level of anger in subjects according to pre-pandemic history of depressive episode over a year following the COVID-19 outbreak including lockdowns periods. Here, we report partial results of an online survey (Registry (ClinicalTrials.gov NCT04374643 approved by the Institutional Review Board of the Montpellier Academic Hospital (IRB-MTP_2020_12_202000421 (30/03/2020) and IRB-MTP_2020_12_202000436 (08/04/2020)) which was submitted to 415 adult participants previously included, or followed in research projects at the Department of Psychiatric Emergency and Acute Care of the Academic Hospital of Montpellier (France) between March 15, 2019, and 2020. Pre-existing lifetime psychopathologies had been assessed by a trained psychiatrist or psychologist using the Mini-International Neuropsychiatric Interview (MINI) or Diagnostic Interview for Genetic Studies (DIGS) over this period which preceded the COVID-19 outbreak. Participants were invited to fill the same anonymized computerized form during 5 periods as follows: 1) first French lockdown (17th March – 10th May 2020); 2) 2 weeks after the end of the first lockdown (25th May -28th June 2020); 3) during the summer without any restriction (10th Aug - 23rd Aug 2020); 4) 2 weeks after the announcement of the second French lockdown (17th Nov - 30th Nov 2020); and 5) 6 weeks after the ease of the second lockdown (12th Feb – 5th March 2021). Anger states were assessed using the State-Trait Anger Expression Inventory (STAXI-state) (Spielberger and Sydeman, 1994). High levels of anger were defined by a STAXI-state >14, which equates to the median value of the whole sample during the first French lockdown (min: 10 - max: 40).

Logistic multivariate mixed models (including a random subject effect) were used to test temporal changes and identify possible differences in the group's anger levels. We calculated the adjusted mean marginal probability (with a 95% confidence interval) to assess the likelihood of an association between high levels of anger and sociodemographic variables (age, professional status, marital status, level of education) as well as a recent history of depressive episodes (DSM-IV

criteria) within the last 2 years (Table 1). The lapse of time between the start of the first lockdown and the completion of the first questionnaire was of 36 [17;55] days.

The whole sample consisted of 76.1% females ($N = 316$), with a median age of 38 years (min 18; max 77), 45.9% ($N = 188$) of them being single, 65% ($N = 231$) well-educated, and 44.33% ($N = 184$) professionally active. The sample included 16.6% subjects ($N = 69$) without lifetime history of psychiatric disorder (i.e. healthy controls (HC)) and 83.4% subjects ($N = 346$) with a recent history of depression (i.e. psychiatric patients (PP)) among those 59.8% ($N = 207$) had a lifetime history of anxiety disorders, 50.2% ($N = 174$) had attempted suicide, 43.3% ($N = 150$) had a lifetime history of bipolar disorder, 21.4% ($N = 74$) had a lifetime history of alcohol abuse/dependence, 14.7% ($N = 51$) had a lifetime history of substance abuse/dependence, and 14.7% ($N = 51$) had a lifetime history of eating disorders. With regards to anger, we were able to observe a main effect of time ($p = 0.01$), a main effect of group ($p < 10^{-3}$), and a significant interaction between time and group ($p = 0.006$). HC were more likely to report higher levels of anger during lockdown periods than at other times. PP reported higher levels of anger than HC throughout our investigation. PP with a lifetime history of anxiety disorders reported higher levels of anger than subjects without this comorbidity ($p = 0.001$).

Our results showed that pre-pandemic depressive history was a risk factor to report high level of anger during COVID-19, especially for subjects having a lifetime history of anxious disorder. De Bes et al. have recently reported higher levels of anger in subjects with a current or remitted depressive disorder than controls. Moreover, anger was most prevalent in subjects with comorbid depressive and anxiety disorders than depression only (de Bles et al., 2019). Interestingly, we observed an increase of the level of anger in HC (but not PP) during lockdowns, with a higher likelihood of anger during the first than during the second lockdown. Lockdowns may be an obstacle from reaching a desired goal leading to frustration and eliciting feelings of anger as proposed by the *frustration-aggression hypothesis* (Berkowitz, 1989). We can assume that level of anger is positively associated with the intensity of governmental restrictions. The abovementioned hypothesis is supported by the fact that restrictive measures were more intense during the first lockdown than during the second one as measured by according to the Oxford University COVID-19 stringency index (SI) (https://covidtracker.bsg.ox.ac.uk/stringency-map), illustrated by a higher SI (80+ vs. 70+ respectively). Our hypothesis is strengthened by the observed higher levels of anger following the easing of the second lockdown (persistence of curfew and the closure of buildings and businesses deemed unnecessary) than after the break of the first lockdown as illustrated by a higher SI (60+ vs. 50+ respectively).

Table 1

Probability of reporting a high level of anger (STAXI-state>14) during the year following the COVID-19 outbreak for the whole sample and for psychiatric patients only.

Variable	Levels	17th March-11th May 2020	25th May-28th June 2020	10th Aug-23rd Aug 2020	17th Nov-30th Nov 2020	12th Feb-5th March 2021	p-value (LRT)	p-value interaction (LRT)
For the whole sample, i.e. healthy controls and psychiatric patients (HC + PP)								
Period		0.454	0.348	0.267	0.39	0.38[0.25;0.53]	**0.01**	
		[0.33;0.583]	[0.238;0.477]	[0.172;0.39]	[0.259;0.538]			
Group (history of depression)	HC	0.397	0.069	0.068	0.31	0.169	**<0.0001**	**0.006**
		[0.207;0.624]	[0.023;0.189]	[0.021;0.198]	[0.117;0.602]	[0.053;0.425]		
	PP	0.645	0.62	0.508	0.595	0.619		
		[0.52;0.753]	[0.491;0.735]	[0.374;0.641]	[0.446;0.729]	[0.468;0.75]		
Gender	Female	0.453	0.374	0.311	0.388	0.411	0.62	0.32
		[0.329;0.583]	[0.259;0.505]	[0.204;0.444]	[0.254;0.541]	[0.272;0.566]		
	Male	0.526	0.302	0.164	0.462	0.313		
		[0.309;0.734]	[0.143;0.527]	[0.066;0.351]	[0.219;0.724]	[0.121;0.603]		
Age	18-27 years	0.354	0.281	0.225	0.451	0.274	0.27	0.62
		[0.192;0.557]	[0.141;0.481]	[0.104;0.422]	[0.221;0.704]	[0.116;0.521]		
	28-37 years	0.402	0.312	0.245	0.425	0.322		
		[0.265;0.555]	[0.193;0.463]	[0.141;0.39]	[0.255;0.615]	[0.18;0.507]		
	38-47 years	0.449	0.344	0.265	0.401	0.372		
		[0.326;0.58]	[0.235;0.473]	[0.17;0.388]	[0.266;0.552]	[0.242;0.523]		
	48-67 years	0.508	0.384	0.29	0.372	0.435		
		[0.357;0.658]	[0.25;0.54]	[0.175;0.441]	[0.228;0.544]	[0.277;0.607]		
	>67 years	0.647	0.488	0.358	0.307	0.594		
		[0.326;0.874]	[0.198;0.787]	[0.118;0.699]	[0.083;0.683]	[0.237;0.873]		
High school graduate	No	0.449	0.377	0.329	0.359	0.338	0.76	0.68
		[0.279;0.632]	[0.219;0.567]	[0.181;0.522]	[0.187;0.576]	[0.171;0.559]		
	Yes	0.449	0.327	0.231	0.401	0.397		
		[0.312;0.594]	[0.211;0.47]	[0.136;0.364]	[0.25;0.573]	[0.246;0.57]		
Marital status	In a relationship	0.446	0.308	0.233	0.321	0.288	0.21	0.58
		[0.302;0.599]	[0.192;0.456]	[0.134;0.375]	[0.185;0.496]	[0.159;0.463]		
	Single	0.455	0.392	0.307	0.475	0.493		
		[0.297;0.624]	[0.241;0.567]	[0.175;0.481]	[0.284;0.674]	[0.299;0.689]		
Professional status	Unemployed	0.477	0.341	0.301	0.444	0.323	0.82	0.43
		[0.31;0.648]	[0.201;0.514]	[0.166;0.481]	[0.252;0.655]	[0.167;0.532]		
	Employed	0.416	0.344	0.19[0.1;0.331]	0.392	0.371		
		[0.266;0.585]	[0.206;0.514]		[0.224;0.589]	[0.209;0.567]		
	Student	0.452[0.226;0.7]	0.339	0.398	0.226	0.536		
			[0.149;0.599]	[0.174;0.675]	[0.075;0.514]	[0.224;0.822]		
For the psychiatric patient sample (PP only)								
History of suicide attempt	No	0.588	0.558	0.482	0.488	0.577	0.2	0.75
		[0.417;0.74]	[0.383;0.719]	[0.308;0.66]	[0.288;0.691]	[0.368;0.762]		
	Yes	0.662	0.634	0.544	0.726	0.694		
		[0.499;0.794]	[0.465;0.776]	[0.365;0.713]	[0.539;0.857]	[0.496;0.839]		
Lifetime history of bipolar disorders	No	0.651	0.665	0.568	0.621	0.725	0.17	0.56
		[0.492;0.783]	[0.501;0.797]	[0.396;0.725]	[0.431;0.78]	[0.547;0.852]		
	Yes	0.595	0.509	0.441	0.63	0.484		
		[0.414;0.753]	[0.33;0.685]	[0.261;0.638]	[0.404;0.81]	[0.263;0.712]		
Lifetime history of anxiety disorders	No	0.551	0.43	0.346	0.334	0.505	**0.001**	0.26
		[0.372;0.717]	[0.261;0.616]	[0.187;0.549]	[0.164;0.562]	[0.295;0.713]		
	Yes	0.679	0.704	0.626	0.778	0.723		
		[0.529;0.799]	[0.554;0.82]	[0.462;0.765]	[0.618;0.883]	[0.541;0.853]		
Lifetime history of eating disorders	No	0.636	0.603	0.519	0.618	0.642	0.66	0.99
		[0.501;0.753]	[0.463;0.728]	[0.374;0.661]	[0.457;0.757]	[0.479;0.778]		
	Yes	0.563	0.556	0.47	0.625	0.606		
		[0.296;0.798]	[0.286;0.797]	[0.206;0.752]	[0.28;0.877]	[0.258;0.872]		
Lifetime history of alcohol abuse or dependence	No	0.643	0.599	0.506	0.616	0.659	0.8	0.84
		[0.503;0.762]	[0.453;0.729]	[0.356;0.655]	[0.448;0.761]	[0.494;0.793]		
	Yes	0.552[0.3;0.78]	0.603	0.55	0.65	0.497		
			[0.336;0.82]	[0.284;0.79]	[0.338;0.872]	[0.171;0.826]		
Lifetime history of illicit substance abuse or dependence	No	0.594	0.57	0.473	0.575	0.618	0.15	0.94
		[0.452;0.722]	[0.425;0.703]	[0.327;0.623]	[0.408;0.726]	[0.453;0.759]		
	Yes	0.735	0.688	0.67	0.796	0.644		
		[0.473;0.895]	[0.398;0.88]	[0.369;0.876]	[0.47;0.945]	[0.207;0.926]		

HC = healthy controls; PP = psychiatric patients, LRT = likelihood ratio test, 95%CI: 95% confidence interval.

Effects were tested using a LRT. Main effects (period, history of psychiatric disorders and diagnosis) were tested without considering the effects of their interaction with the period.

Bold data indicates statistically significant.

Anger has an indirect effect on the association between intolerance of uncertainty and depression during the COVID-19 pandemic (Hamama-Raz et al., 2021). Depression is promoted by decreasing human mobility such as during lockdowns and stay-at-home orders (Collaborators, 2021). Future studies should thus investigate whether anger could have an effect on the association between restrictive measures and depression. Although our sample is not representative of general population, our results could encourage to integrate assessment of anger into COVID-19 care settings. Considering the potential effects of lockdowns and movement restrictions on anger, as well as identifying the most vulnerable individuals, will be needed to promote social well-being while protecting populations from the COVID-19 spread.

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CRediT authorship contribution statement

EO and PC designed the study. JD performed the analyses. EO, SG and PC supervised the analyses. EO wrote the first draft of the manuscript. MB collected the data. SG and PC commented on the draft. All authors contributed to and have approved the final manuscript.

Declaration of competing interest

None.

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