Research paper

Poor mental health is associated with loneliness and boredom during Covid-19-related restriction periods in patients with pre-existing depression

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A B S T R A C T

Background: In 2020–2021, many European countries put in place temporary lockdown measures due to the increase in COVID-19 cases, although such measures have negative psychological effects. As pre-existing mental disorders are a risk factor of negative psychological consequences during pandemics, it is important to identify specific predictors of psychological distress caused by restrictive measures in patients with history of depressive episodes. The aims of this study were i) to determine whether depressive, anxious symptomatology and suicidal ideation (i.e. mental health outcomes) were influenced by stay-at-home orders, and ii) to identify the psycho-social dimensions that influenced these mental health outcomes in patients with pre-existing depression during/after COVID-19-related restrictions.
Methods: This study concerned 296 psychiatric patients with history of depressive episode in the 2 years before the COVID-19 outbreak. Participants received a computerized form to self-measure depression, suicidal ideation, and anxiety (5 times during 2020–2021, two lockdown periods and three non-lockdown periods). Loneliness, boredom, habits, substance consumption, and access to psychiatric care also were self-reported.
Results: Loneliness and boredom were independent risk factors of anxiety and depression, and their changes dynamically affected the psychological state. Suicidal ideation was mostly driven by depressive symptomatology.
Conclusions: Our results highlight the need to target these dimensions in the most vulnerable patients in order to prevent the psychological consequences of the repeated COVID-19-related restrictions.

1. Introduction

Previous epidemics and traumatic events have been associated with an exacerbation of negative psychological symptoms (Lancee et al., 2008; Marshall and Galea, 2004; Nickell et al., 2004). As the COVID-19 pandemic emerged, there were concerns about the potential damaging effects on mental health of this new disease and the associated containment measures (Brooks et al., 2020; COVID-19 Mental Disorders Collaborators, 2021; Holmes et al., 2020; Pfefferbaum and North, 2020). Several studies first reported that individuals with pre-existing psychiatric conditions were at higher risk of mental health problems during the pandemic (Asmundson et al., 2020; Brown et al., 2020; García-Álvarez et al., 2020; Hao et al., 2020; O'Connor et al., 2020; Vindegaard and Benros, 2020). Cross-sectional studies provided initial evidence that social isolation, disruption of mental health services, increased stress,

anxiety and fear, and greater reliance on substances might contribute to psychiatric symptom worsening in psychiatric populations (Hamada and Fan, 2020; Hao et al., 2020). However, these studies did not include pre-pandemic information. Recently, a meta-analysis of 201 longitudinal comparisons of mental health before and during the pandemic (Robinson et al., 2021) showed that while mental health symptoms increased at the beginning of the COVID-19 pandemic (March–April 2020), by mid-2020 (May–July 2020) their level was not different from the pre-pandemic period. Similarly, there was no evidence of mental health symptom worsening in participants with a pre-existing mental health condition compared with the pre-pandemic period. A longitudinal study that included three Dutch psychiatric case-control cohorts (Pan et al., 2021) found increased depressive symptomatology in controls, whereas symptom level changes were minimal or even negative in patients with the most severe and chronic mental health disorders. A recent UK study

on the mental health of the population in the first 6 months of the pandemic identified five (from very good to worsened) mental health trajectories. The two groups (11 % participants) with poor mental health throughout the observation period were more likely to have pre-existing mental problems. Living in an area under local lockdown measures also was linked to mental health worsening (Pierce et al., 2021).

Lockdowns and stay-at-home orders involve key changes in life domains, including restrictions on personal mobility (due to stay-at-home orders), on interpersonal relationships (reduced face-to-face interactions), on occupation/education roles (Le et al., 2020) on economic well-being and quality of life (Tran et al., 2020). Even debated (Wang et al., 2020), face masks, encouraged by many countries, may dampen social interaction (Wiesmann et al., 2021).

These changes, like the functional impairments associated with common mental disorders (e.g. anxiety and depression), may influence mental health in different ways in function of the studied population. Indeed, lifestyle changes (i.e. reductions in social contacts) explained 15 % of the distress increase in the American general population during the initial stage of the pandemic (Robinson and Daly, 2021). Social distancing (including both stay at home orders by governments as well as other personal decisions people to maintain distance to minimize risk of exposure to the virus) has been associated with depression, anxiety, and emotional distress (Rodríguez-Fernández et al., 2021; Spencer-Laitt et al., 2022) independently of levels of social support, (Marroquín et al., 2020). Having a pre-existing mental health condition was associated with social-distancing-related distress (Taylor et al., 2020). Restrictions in human mobility have been associated with the increased prevalence of major depressive disorder since the COVID-19 outbreak (COVID-19 Mental Disorders Collaborators, 2021). On the other hand, among mental health service users in UK, the lockdown was associated with a transient decrease in depression scores, whereas the ease of restrictions was associated with increased depression and anxiety (Saunders et al., 2021). Stay-at-home orders may provide a more structured routine and reduce exposure to external stressors (e.g. large social gatherings) in individuals with severe mental health conditions (Pan et al., 2021). This might also reflect the gain and then loss of the enhanced 'community spirit' that was experienced during the first 'lockdown' in 2020 and the rising financial pressure that may have become more apparent as people returned to work (Rutter, 2020).

Therefore, behavioral changes instigated by governmental measures and their relation with mental health status need to the be precisely investigated in patients with pre-existing mental disorders using a longitudinal approach to capture the dynamic effects of the COVID-19-related restriction measures in a long timeframe.

In France, the first national lockdown (16 March to 11 May 2020) included staying at home, limited social contacts, and closure of schools and of all unnecessary business activities. A second major pandemic wave in late 2020 and early 2021 required the reintroduction of strict restrictions (staying at home, closure of all unnecessary business activities but not schools) from 28 October to 15 December 2020 (second lockdown), followed by a curfew between 6:00 PM-6:00 AM. On 30 January 2021, the French Prime Minister announced the curfew maintenance with an additional closure of malls >20,000 m^2 and the threat of a third national lockdown. A better understanding of the effects of such measures on patients' mental health could inform service planning to mitigate deleterious effects and support clinicians working with patients. In this context, the aim of this study was to determine whether three different mental health outcomes (depressive symptoms, anxiety symptoms, suicidal ideation) changed in function to the different stay-at-home orders in patients with pre-existing psychiatric conditions (i. e. past history of major depressive episode). We also investigated which psychosocial factors influenced these mental health outcomes in this clinical population.

2. Materials & methods

2.1. Design and participants

This observational study was carried out at the Department of Psychiatric Emergency and Acute Care of Montpellier Academic Hospital, France. Adult participants were selected among individuals who participated in research projects at our department between 15 March 2019 and 15 March 2020. We included psychiatric patients (PP, subjects with a main diagnosis of depressive episode in the last 2 years according to the DSM-IV criteria, without psychotic features or schizophrenia). Exclusion criteria were: absence of a psychopathology assessment by a trained psychiatrist or psychologist to determine the presence/absence of lifetime psychopathology performed before 15 March 2020 using a validated psychometric tool (Mini-International Neuropsychiatric Interview, Structured Clinical Interview for the DSM-IV Axis I disorders, or Diagnostic Interview for Genetic Studies), and refusal to participate.

During the first French lockdown (16 March-11 May 2020) an e-mail message was sent to participants with an anonymization number and an information note about the study aims. In another e-mail message, they received a computerized form that included questions on their sociodemographic characteristics and their environment and several questionnaires (see below) to be completed and where they needed to add their anonymization number. Participants received an e-mail message with an invitation to complete the questions/questionnaires of the computerized form at five different times: during the first lockdown (3 April-6 May 2020), 2 weeks after the first lockdown end (25 May-28 June 2020), summer 2020 (10–23 August) during which no restriction was implemented, 2 weeks after the initiation of the second national lockdown (17–30 November 2020), and 2 weeks after the announcement of a possible third lockdown in a curfew period (12 February-5 March 2021).

The study aims were in a sample of mood-disordered patients with a past history of major depressive episode:

1) to characterize changes in depression, anxiety and suicidal ideation (SI) across time, while considering sociodemographic variables (age, gender, marital status, education level, and professional status) and psychopathology
2) to identify lifetime and current risk factors/protective factors of depression, anxiety and SI at three time points (after the first lockdown, during the second lockdown, and during the curfew period in 2021).
3) to identify dynamic risk factors/protective factors that play a role in depression, anxiety and SI.

The Patient Health Questionnaire-9 items (PHQ-9) (Kroenke et al., 2001) and Generalized Anxiety Disorder-7 items (GAD-7) (Spitzer et al., 2006) were filled in by participants to self-evaluate depression and SI (PHQ-9) and anxiety (GAD-7) in the last 15 days. A PHQ-9 score ≥ 10 has been associated with major depressive disorder (88 % sensitivity and 88 % specificity) (Kroenke et al., 2001; Manea et al., 2012). SI presence was assessed with the corresponding item of the PHQ-9 (score > 0). A GAD-7 score ≥ 10 corresponds to moderate to severe generalized anxiety disorder (89 % sensitivity and 82 % specificity) (Spitzer et al., 2006). Insomnia was self-assessed with the Insomnia Severity Index (ISI) (Bastien et al., 2001) using a cut-off of 14 for clinical insomnia (Benjamini and Hochberg, 1995). The French versions of the PHQ-9, GAD-7 and ISI could be downloaded by participants from the Health Questionnaire website (www.phqscreeners.com).

Participants also answered questions on their mental state (psychological pain, feelings of loneliness, boredom), habits [frequency of virtual (i.e. telephone and video) and written contacts (i.e. text messages, mails), frequency of physical activity and going out from home], substance consumption (tobacco, alcohol, analgesics and psychotropic drugs), access to psychiatric care in the last 15 days, lifetime

psychopathology, changes of mental state and habits.

The study protocol was registered at Clinical Trials (ClinicalTrials.gov NCT04374643) and was approved by the Montpellier Institutional Research Board (IRB- MTP_2020_12_202000421 (30/03/2020) and IRB-MTP_2020_12_202000436 (08/04/2020).

2.2. Statistical analyses

Depression and anxiety were defined by a PHQ-9 score $\geq$ 10 and GAD-7 score $\geq$ 10 (i.e. severe symptomatology). SI (suicidal item of PHQ-9 score > 0) was analysed only in the PP sample.

Baseline characteristics (socio-demographic variables, psychopathology, and psychological outcomes) were described using medians (minimum - maximum) and numbers (frequency, percentages) for quantitative and qualitative variables, respectively. The significance of between-group differences was evaluated with the Mann-Whitney test, Fisher's exact test, or Chi square test. Analyses were performed with the R software ("R Core Team (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.," n.d.).

2.2.1. Changes in mental health outcomes

For depression, anxiety and SI, multivariate mixed logistic models with logit link function and Likelihood Ratio Test (LRT) (*lme4* package: (Bates et al., 2015)) were used to identify significant changes, defined as categorical variables, across the different periods. A subject random effect was included to consider the intra-subject correlation. Potential confounders were also taken into account by considering sociodemographic variables, psychopathology as fixed effects. The covariate effects on the outcome variations across periods were also studied by testing the interactions between each covariate and the periods. Main effects were tested without including interactions. Mean marginal probabilities and their 95 % confidence intervals (CI) were computed for each period by covariate level from the bigger model fitted (i.e. including the focal interaction) using the *emmeans* package (Lenth et al., 2021).

The same procedure was applied to characterize the changes in habits and mental state.

2.2.2. Identifying risk factors/protective factors of mental health outcomes at three different time points

This analysis focused on periods involving significant variation in potential risk/protective factors (i.e. after the first lockdown, during the second lockdown in 2020, and during the curfew period in 2021). For results during the first lockdown, see (Olié et al., 2021). For each period, risk/protective factors of mental health outcomes were estimated using multivariate logistic models. Effects were first estimated separately for each factor adjusted for socio-demographic and psychopathology only, and tested using LRT. Effects were then estimated independently by adjusting simultaneously for all meaningful factors (i.e. variables with significant univariate association, *p*-value <0.20, excluding depression, anxiety, psychological pain and insomnia). To limit collinearity in the models, meaningful factors and confounders were selected using a stepwise procedure (backward/forward with AIC criterion) and Odds Ratios (OR) and 95 % CI were computed.

2.2.3. Identifying dynamic risk factors/protective factors that play a role in mental health outcomes

For each of the three periods of interest, changes in habits (e.g. physical activity, virtual contacts) and in mental state (e.g. loneliness, boredom, social support) were estimated by calculating the difference of the score/level for the considered variable after and before the event. Changes were then categorized in three classes: decreased, no change, or increased. The effect of these dynamic variables on the three psychological outcomes after each event was tested separately using multivariate logistic models and LRT. To estimate the effect of the dynamic variable that does not depend on the outcome level or the considered

variable level before the event, these two components were also included in the model:

$$Y_{after} = \text{Sociodemographic variable} + Y_{before} + X_{before} + \Delta X_{after-before},$$

where Y is the outcome, X is the variable of interest and ΔX is the change of X after the considered event. Effects were also adjusted for socio-demographic variables, and adjusted OR, 95 % CI, and *p*-values were computed.

3. Results

In total, 296 PP accepted to participate in this on-line survey. Their sociodemographic data and lifetime/current (at inclusion) psychopathology are described in Table 1. At inclusion, nineteen participants declared to have been suspected of or infected by COVID-19.

3.1. Changes in mental health outcomes and exposure factors across time

There was no period effect for depression, anxiety, and SI (Table 2). The global level of depression and anxiety did not change across time neither. The frequency of going out and of physical activity, and the levels of loneliness, boredom and social support, insomnia, and fear of COVID-19 for relatives significantly changed over time (Table 3). Specifically, loneliness and boredom decreased after the end or ease of lockdowns and increased after the reinstatement of restrictive measures (Table 3).

Table 1
Description of the sample during the first lockdown.

Variable	Levels	PP Median [min;max]/N(%) N = 296
Socio-demography		
Sex	Women	221(74.7)
	Men	75(25.3)
Age		39[18;77]
High school grad	No	93(37.2)
	Yes	157(62.8)
Marital status	Couple	159(53.7)
	Single	137(46.3)
Lifetime psychopathology		
Bipolar disorder	No	157(54.7)
	Yes	130(45.3)
Anxious disorder	No	111(38.7)
	Yes	176(61.3)
Eating disorder	No	226(83.1)
	Yes	46(16.9)
Alcohol abuse or dependance	No	225(78.9)
	Yes	60(21.1)
Substance abuse or dependance	No	244(85)
	Yes	43(15)
Suicide attempt	No	148(50)
	Yes	148(50)
Current psychological outcomes		
Depression (PHQ9 $\geq$ 5)	[0;4]	112(37.8)
	[5;27]	184(62.2)
Depression (PHQ9 $\geq$ 10)	[0;9]	192(64.9)
	[10;27]	104(35.1)
Anxiety (GAD7 $\geq$ 5)	[0;4]	134(45.3)
	[5;21]	162(54.7)
Anxiety (GAD7 $\geq$ 10)	[0;9]	212(71.6)
	[10;21]	84(28.4)
Suicidal ideation	No	214(72.3)
	Yes	82(27.7)

GAD7: Generalized Anxiety Disorder; HC: healthy controls; PHQ-9: Patient Helath Questionnaire; PP: psychiatric patients; SI: suicidal ideation.

Table 2

Evolution of the negative psychological outcomes (depression, anxiety and suicidal ideation).

Variable	Levels	17th March-11th May 2020	25th May-28th June 2020	10th-23rd Aug 2020	17th–30th Nov 2020	12th Feb 5th March 2021	p-value (LRT)	p-value interaction (LRT)
Depression (PHQ-9 score ≥ 10) (N = 224 subjects)								
Period		0.223 [0.133;0.349]	0.196 [0.113;0.318]	0.225 [0.129;0.361]	0.291 [0.166;0.459]	0.196 [0.103;0.341]	0.61	
Lifetime suicide attempt	No	0.126 [0.055;0.264]	0.113 [0.048;0.247]	0.14 [0.059;0.298]	0.193 [0.074;0.418]	0.134[0.05;0.314]	0.0003	0.98
	Yes	0.314 [0.173;0.501]	0.274 [0.143;0.459]	0.302 [0.156;0.505]	0.373 [0.192;0.598]	0.248 [0.112;0.463]		
Lifetime bipolar disorder	No	0.213 [0.108;0.377]	0.165 [0.078;0.316]	0.217 [0.105;0.395]	0.345 [0.173;0.57]	0.24[0.112;0.442]	0.007	0.33
	Yes	0.207 [0.095;0.396]	0.209 [0.094;0.401]	0.205 [0.086;0.414]	0.188 [0.068;0.422]	0.097 [0.029;0.277]		
Lifetime anxious disorder	No	0.143 [0.063;0.296]	0.056[0.02;0.147]	0.079 [0.028;0.204]	0.143 [0.049;0.35]	0.045 [0.013;0.147]	<0.0001	0.12
	Yes	0.295 [0.166;0.467]	0.352 [0.204;0.535]	0.369 [0.211;0.56]	0.421 [0.235;0.633]	0.379[0.2;0.598]		
Lifetime eating disorder	No	0.192 [0.106;0.324]	0.149 [0.077;0.267]	0.204 [0.109;0.35]	0.301 [0.162;0.488]	0.16[0.077;0.305]	0.001	0.25
	Yes	0.405 [0.151;0.723]	0.496 [0.202;0.793]	0.336 [0.103;0.689]	0.239 [0.051;0.648]	0.434 [0.117;0.816]		
Lifetime alcohol abuse or dependence	No	0.188 [0.101;0.324]	0.148 [0.075;0.271]	0.157 [0.078;0.291]	0.263 [0.134;0.451]	0.165 [0.078;0.314]	0.001	0.43
	Yes	0.296 [0.108;0.592]	0.371 [0.141;0.679]	0.499 [0.214;0.785]	0.311 [0.089;0.676]	0.222 [0.041;0.657]		
Lifetime substance abuse or dependence	No	0.185 [0.098;0.321]	0.145 [0.073;0.267]	0.163 [0.081;0.301]	0.262 [0.133;0.451]	0.166 [0.079;0.318]	0.002	0.48
	Yes	0.308 [0.112;0.611]	0.408 [0.152;0.725]	0.473 [0.185;0.779]	0.305 [0.082;0.684]	0.201 [0.035;0.636]		
Anxiety (GAD-7 score ≥ 10) (N = 224 subjects)								
Period		0.171[0.1;0.277]	0.139 [0.078;0.237]	0.118 [0.063;0.21]	0.146 [0.076;0.263]	0.184 [0.099;0.316]	0.53	
Lifetime suicide attempt	No	0.135 [0.065;0.261]	0.126 [0.058;0.251]	0.091 [0.039;0.2]	0.104 [0.039;0.248]	0.204[0.09;0.397]	0.32	0.71
	Yes	0.209 [0.111;0.358]	0.153 [0.076;0.286]	0.148 [0.07;0.289]	0.188 [0.086;0.362]	0.166 [0.073;0.335]		
Lifetime bipolar disorder	No	0.147 [0.074;0.269]	0.098 [0.045;0.198]	0.107 [0.049;0.218]	0.153 [0.068;0.308]	0.215 [0.105;0.392]	0.5	0.27
	Yes	0.201[0.1;0.365]	0.199 [0.097;0.365]	0.128 [0.054;0.274]	0.131 [0.05;0.301]	0.126 [0.046;0.302]		
Lifetime anxious disorder	No	0.133 [0.061;0.268]	0.055[0.02;0.14]	0.043 [0.014;0.131]	0.035 [0.008;0.132]	0.031 [0.008;0.114]	<0.0001	0.03
	Yes	0.223 [0.127;0.362]	0.238 [0.135;0.384]	0.204 [0.11;0.347]	0.269 [0.143;0.448]	0.37[0.209;0.565]		
Lifetime eating disorder	No	0.156 [0.087;0.263]	0.153 [0.084;0.262]	0.109 [0.055;0.204]	0.131 [0.064;0.248]	0.156 [0.079;0.287]	0.32	0.31
	Yes	0.269 [0.098;0.553]	0.105 [0.031;0.303]	0.182 [0.053;0.467]	0.277 [0.071;0.658]	0.413 [0.126;0.773]		
Lifetime alcohol abuse or dependence	No	0.157 [0.087;0.267]	0.106 [0.055;0.197]	0.102 [0.05;0.195]	0.127 [0.061;0.247]	0.17[0.086;0.306]	0.1	0.62
	Yes	0.218 [0.082;0.466]	0.333 [0.136;0.612]	0.188 [0.063;0.443]	0.224 [0.066;0.54]	0.21[0.049;0.577]		
Lifetime substance abuse or dependence	No	0.162[0.09;0.273]	0.11[0.057;0.201]	0.094 [0.046;0.181]	0.124 [0.059;0.24]	0.147 [0.074;0.272]	0.05	0.4
	Yes	0.186 [0.064;0.432]	0.329 [0.122;0.633]	0.268 [0.09;0.574]	0.254 [0.069;0.607]	0.495[0.135;0.86]		
Suicidal ideation (N = 224 subjects)								
Period		0.078 [0.031;0.184]	0.072 [0.028;0.173]	0.074 [0.028;0.182]	0.083 [0.03;0.209]	0.049 [0.016;0.139]	0.75	
Lifetime suicide attempt	No	0.023 [0.006;0.082]	0.023 [0.006;0.085]	0.028 [0.007;0.101]	0.062 [0.016;0.216]	0.033 [0.008;0.131]	0.0006	0.25
	Yes	0.192[0.08;0.396]	0.17[0.067;0.367]	0.166 [0.063;0.371]	0.128 [0.044;0.322]	0.08[0.024;0.232]		
Lifetime bipolar disorder	No	0.12[0.045;0.283]	0.117 [0.043;0.282]	0.112 [0.039;0.278]	0.169 [0.06;0.394]	0.053 [0.015;0.165]	0.04	0.25
	Yes	0.042 [0.012;0.141]	0.035 [0.009;0.123]	0.041 [0.01;0.148]	0.023 [0.005;0.107]	0.056 [0.012;0.222]		
Lifetime anxious disorder	No	0.044 [0.013;0.137]	0.023 [0.006;0.086]	0.047 [0.013;0.16]	0.035 [0.008;0.144]	0.006 [0.001;0.044]	0.002	0.23
	Yes	0.142 [0.059;0.304]	0.161 [0.068;0.338]	0.13 [0.051;0.293]	0.163 [0.061;0.367]	0.139 [0.049;0.335]		
	No						0.31	0.91

Table 2 (*continued*)

Variable	Levels	17th March-11th May 2020	25th May-28th June 2020	10th-23rd Aug 2020	17th–30th Nov 2020	12th Feb 5th March 2021	p-value (LRT)	p-value interaction (LRT)
Lifetime eating disorder		0.072 [0.028;0.176]	0.069 [0.026;0.171]	0.064 [0.023;0.166]	0.085 [0.03;0.22]	0.047 [0.015;0.139]		
	Yes	0.148[0.03;0.489]	0.121 [0.023;0.442]	0.181 [0.035;0.575]	0.096 [0.012;0.472]	0.087 [0.011;0.439]		
Lifetime alcohol abuse or dependence	No	0.068 [0.024;0.176]	0.052 [0.017;0.142]	0.063 [0.021;0.172]	0.073 [0.024;0.204]	0.036 [0.011;0.115]	0.21	0.58
	Yes	0.102 [0.021;0.371]	0.206 [0.049;0.565]	0.108 [0.022;0.4]	0.106 [0.018;0.436]	0.16[0.021;0.625]		
Lifetime substance abuse or dependence	No	0.07[0.025;0.182]	0.06[0.021;0.163]	0.077 [0.026;0.203]	0.092 [0.031;0.244]	0.046 [0.014;0.142]	0.87	0.51
	Yes	0.098 [0.019;0.374]	0.127 [0.024;0.459]	0.048 [0.007;0.254]	0.042 [0.006;0.259]	0.053 [0.005;0.373]		

GAD7: Generalized Anxiety Disorder 7; PHQ-9:Patient health Questionnaire 9.

Adjusted mean marginal probability to show mild or severe symptomatology (depending on the studied sample) and 95 % confidence intervals taken from longitudinal logistic multivariate mixed models adjusted for socio-demography. Main effects (period, history of depression and diagnosis) were tested without considering the effect of the interaction with periods.

Table 3

Evolution of habits and mental state during the follow up.

Variable	17th March-11th May 2020	25th May-28th June 2020	10th-23rd Aug 2020	17th–30th Nov 2020	12th Feb 5th March 2021	p-value (LRT)
Going out (>2 to 3 times a week)	0.293[0.195;0.415]	0.692[0.566;0.794]	0.932 [0.874;0.965]	0.809 [0.687;0.891]	0.863[0.758;0.927]	<0.0001
Physical activity (>1 time a week)	0.494[0.335;0.655]	0.426[0.274;0.594]	0.351 [0.209;0.524]	0.266 [0.141;0.445]	0.335[0.187;0.524]	0.04
Virtual contacts (nearly every day)	0.315[0.215;0.436]	0.311[0.209;0.434]	0.441 [0.314;0.576]	0.299 [0.187;0.443]	0.31[0.193;0.456]	0.17
Written contacts (nearly every day)	0.356[0.247;0.482]	0.293[0.195;0.416]	0.424 [0.298;0.561]	0.336 [0.214;0.485]	0.396[0.261;0.549]	0.27
Loneliness (Likert >3)	0.718[0.6;0.812]	0.439[0.315;0.57]	0.304 [0.198;0.435]	0.648 [0.498;0.773]	0.571[0.417;0.712]	<0.0001
Social support (Likert >7)	0.532[0.387;0.671]	0.492[0.347;0.639]	0.424[0.281;0.58]	0.296 [0.173;0.458]	0.333[0.199;0.502]	0.009
Boredom (often)	0.306[0.203;0.434]	0.153[0.089;0.251]	0.146 [0.082;0.246]	0.356 [0.223;0.515]	0.266[0.155;0.416]	0.0003
Fear COVID (Likert >3)	0.33[0.201;0.491]	0.28[0.163;0.438]	0.319 [0.186;0.491]	0.294[0.16;0.475]	0.336[0.187;0.528]	0.91
Fear COVID for relatives (Likert >6)	0.59[0.443;0.723]	0.426[0.288;0.576]	0.391 [0.254;0.547]	0.458 [0.297;0.629]	0.472[0.308;0.642]	0.044
Insomnia (ISI > 14)	0.114[0.061;0.202]	0.165[0.092;0.278]	0.202 [0.114;0.333]	0.116 [0.056;0.225]	0.224[0.121;0.378]	0.05
Psychological pain (Likert >8)	0.098[0.055;0.167]	0.075[0.041;0.135]	0.082 [0.044;0.149]	0.121 [0.065;0.216]	0.125[0.066;0.224]	0.36

N = 224 psychiatric patients.

Adjusted marginal mean probability and 95 % confidence intervals taken from logistic multivariate mixed models at each period. Global median was chosen as Cut-offs for likert scale. The LRTs test the null hypothesis of no change across time.

3.2. Current and dynamic predictors of negative psychological state after the end of the first lockdown

3.2.1. Depression (PHQ-9 score ≥ 10)

According to the univariate analyses (Table 4), depression was associated with current anxiety (OR [95 % CI] = 1.41 [1.3;1.56]), psychological pain (OR [95 % CI] = 1.79 [1.53;2.17]), and insomnia (OR [95 % CI] = 1.26 [1.18;1.35]).

After adjustment for meaningful factors (see Table 4 and Fig. 1), depression was independently associated with history of anxious disorder (OR [95 % CI] = 2.66 [1.02;7.40]), eating disorder (OR [95 % CI] = 3.97 [1.31;12.74]), psychotropic use change (OR [95 % CI] = 9.69 [2.94;35.55]), daily virtual contacts (OR [95 % CI] = 0.22 [0.067;0.68]), daily physical activity (OR [95 % CI] = 0.07 [0.007;0.46]), and loneliness (OR [95 % CI] = 1.33[1.11;0.1.60]).

Modified frequency of physical activity, social support, frequency of virtual contacts, loneliness, boredom, insomnia, and maximum psychological pain related to modified lockdown constraints (vs. no habit modification) were associated with depression after the first lockdown (Table 7).

3.2.2. Anxiety (GAD-7 score ≥ 10)

In univariate analyses (Table 4), anxiety was associated with current depressive symptoms (OR [95 % CI] = 1.30 [1.22;1.41]), insomnia (OR [95 % CI] = 1.22[1.15;1.30]), and psychological pain (OR [95 % CI] = 1.65 [1.41;1.97]),

After adjustment for meaningful factors (see Table 4 and Fig. 1), anxiety was independently associated with history of bipolar disorder (OR [95 % CI] = 4.38 [1.86;11.07]), daily physical activity (OR [95 % CI] = 0.12 [0.02;0.62]), psychotropic use change (OR [95 % CI] = 12.52 [3.55;51.82]), social support (OR [95 % CI] = 0.83 [0.68;0.99]), boredom (sometime: OR [95 % CI] = 4.15 [1.27;16.05]; often/continually: OR [95 % CI] = 5.59 [1.39;25.61]), and fear of contamination for relatives (OR [95 % CI] =1.46 [1.24;1.76]).

Modified frequency of virtual contacts, loneliness, boredom, fear of contamination for relatives, insomnia, and maximum psychological pain related to modified lockdown constraints (vs. no modification of habits) were additional factors involved in anxiety after the first lockdown end (Table 7).

Table 4

Effects of lifetime psychopathology, contemporaneous habits and mental state on depression, anxiety and suicidal ideation the after the break of the first lockdown.

Variable	Levels	Depression PHQ9 ≥ 10		Anxiety GAD7 ≥ 10		Suicidal ideation		Suicidal ideation (adjusted for depression)	
		OR [95 % IC] N = 232	p-value	OR [95 % IC] N = 232	p-value	OR [95 % IC] N = 231	p-value	OR [95 % IC] N = 231	p-value
Bipolar disorder	No	1	0.5	1	0.02	1	0.05	1	0.002
	Yes	1.234 [0.67;2.274]		2.097 [1.104;4.04]		0.526 [0.265;1.013]		0.201 [0.064;0.554]	
Anxious disorder	No	1	0.0001	1	0.0005	1	0.0008	1	0.18
	Yes	3.546 [1.856;7.101]		3.311 [1.666;7.015]		3.174 [1.591;6.749]		1.92[0.75;5.18]	
Eating disorder	No	1	0.01	1	0.95	1	0.55	1	0.91
	Yes	2.626 [1.219;5.731]		1.028 [0.444;2.293]		1.287 [0.553;2.889]		0.937 [0.301;2.791]	
Alcohol abuse or dependence	No	1	0.15	1	0.02	1	0.15	1	0.73
	Yes	1.737 [0.824;3.637]		2.53 [1.189;5.361]		1.76 [0.804;3.759]		0.809 [0.227;2.638]	
Substance abuse or dependence	No	1	0.15	1	0.01	1	0.6	1	0.75
	Yes	1.806 [0.806;4.007]		2.947 [1.306;6.653]		1.259 [0.518;2.895]		0.821 [0.233;2.671]	
Past Suicide attempt	No	1	0.05	1	0.35	1	0.0007	1	0.008
	Yes	1.777 [0.995;3.209]		1.335 [0.728;2.47]		3.031 [1.585;6.032]		3.367 [1.365;8.923]	
Depression (PHQ9)		NA	NA	1.305 [1.22;1.413]	<0.0001	1.402 [1.288;1.554]	<0.0001	NA	NA
Anxiety (GAD7)		1.415 [1.298;1.566]	<0.0001	NA	NA	1.237 [1.16;1.328]	<0.0001	1.001 [0.906;1.102]	0.99
Psychological pain (Likert)		1.794 [1.526;2.174]	<0.0001	1.648 [1.415;1.973]	<0.0001	2.09 [1.683;2.719]	<0.0001	1.478 [1.163;1.962]	0.0008
Anger state (STAXI)		1.263 [1.187;1.353]	<0.0001	1.199 [1.137;1.273]	<0.0001	1.15 [1.096;1.211]	<0.0001	0.991 [0.922;1.062]	0.8
Insomnia (ISI)		1.26 [1.184;1.351]	<0.0001	1.218 [1.148;1.302]	<0.0001	1.132 [1.076;1.196]	<0.0001	0.853 [0.767;0.939]	0.0009
Suicidal ideation	No	1	<0.0001	1	<0.0001	NA	NA	NA	NA
	Yes	30.216 [13.402;75.53]		7.161 [3.623;14.616]		NA		NA	
Loneliness (Likert)		1.437 [1.283;1.626]	<0.0001	1.375 [1.226;1.556]	<0.0001	1.548 [1.362;1.786]	<0.0001	1.217 [1.018;1.466]	0.03
Boredom	Never	1	<0.0001	1	<0.0001	1	0.0001	1	0.68
	Sometimes	1.945 [0.892;4.484]		3.298 [1.321;9.485]		2.378 [1.011;6.121]		1.686 [0.53;5.841]	
	Often/ continually	8.423 [3.448;22.066]		13.753 [4.951;43.978]		7.575 [2.932;21.451]		1.455 [0.359;5.977]	
Social support (Likert)		0.727 [0.634;0.825]	<0.0001	0.786 [0.691;0.89]	0.0001	0.707 [0.614;0.807]	<0.0001	0.839 [0.698;1.004]	0.06
Fear COVID (Likert)		1.061 [0.949;1.186]	0.3	1.205 [1.071;1.362]	0.002	0.999 [0.884;1.124]	0.98	0.899 [0.751;1.066]	0.22
Fear COVID for relatives (Likert)		1.124 [1.02;1.244]	0.02	1.29[1.15;1.462]	<0.0001	1.091 [0.984;1.214]	0.1	0.98 [0.849;1.133]	0.78
Virtual contacts	Rarely	1	0.002	1	0.1	1	0.004	1	0.13
	Several a week	0.432 [0.206;0.895]		0.537 [0.252;1.143]		0.7[0.333;1.477]		1.283 [0.476;3.581]	
	Every day	0.244 [0.109;0.527]		0.428 [0.193;0.937]		0.263 [0.109;0.611]		0.414 [0.119;1.347]	
Written contacts	Rarely	1	0.14	1	0.45	1	0.08	1	0.16
	Several a week	0.527 [0.223;1.232]		0.579 [0.241;1.408]		0.416 [0.171;0.999]		0.307 [0.089;1.039]	
	Every day	0.411 [0.169;0.985]		0.596 [0.243;1.473]		0.371 [0.148;0.914]		0.391 [0.103;1.441]	
Going out	1 a week or less	1	0.07	1	0.01	1	0.22	1	0.047
	2 to 3 a week	0.513 [0.204;1.271]		0.26 [0.099;0.663]		1.375 [0.536;3.773]		6.679 [1.494;37.101]	
	Every other day	0.577 [0.205;1.596]		0.395 [0.137;1.096]		0.657 [0.199;2.12]		1.72 [0.298;10.346]	
	Every day	0.302 [0.118;0.757]		0.22 [0.085;0.554]		0.67 [0.252;1.878]		3.998 [0.895;21.411]	
Physical activity	Never	1	0.007	1	0.007	1	0.02	1	0.44
	1 a week	0.484 [0.221;1.024]		0.466 [0.205;1.009]		0.354 [0.139;0.826]		0.741 [0.229;2.299]	
	Several a week	0.553 [0.269;1.113]		0.364 [0.162;0.775]		0.703 [0.334;1.442]		1.902 [0.666;5.608]	
	Every day	0.153 [0.034;0.494]		0.204 [0.045;0.656]		0.242 [0.054;0.779]		1.307 [0.173;7.47]	
Alcohol use change	No comsumption	1	0.69	1	0.68	1	0.87	1	0.85

(*continued on next page*)

Table 4 (*continued*)

Variable	Levels	Depression PHQ9 ≥ 10		Anxiety GAD7 ≥ 10		Suicidal ideation		Suicidal ideation (adjusted for depression)	
		OR [95 % IC] N = 232	p-value	OR [95 % IC] N = 232	*p*-value	OR [95 % IC] N = 231	p-value	OR [95 % IC] N = 231	*p*-value
	As usual	1.321 [0.679;2.563]		1.222 [0.598;2.469]		0.881 [0.425;1.783]		0.786 [0.29;2.062]	
	Change	1.009 [0.466;2.129]		1.383 [0.634;2.954]		0.814 [0.352;1.788]		0.766 [0.231;2.384]	
Tobacco use change	no Comsumption	1	0.14	1	0.94	1	0.2	1	0.11
	As usual	1.64 [0.795;3.362]		1.014 [0.447;2.199]		1.164 [0.528;2.475]		0.572 [0.177;1.709]	
	Change	0.611 [0.241;1.411]		0.87 [0.356;1.977]		0.452 [0.146;1.162]		0.205 [0.031;0.963]	
Psychoactive intake change	No comsumption	1	0.0002	1	<0.0001	1	0.048	1	0.39
	As usual	1.543 [0.76;3.206]		0.945 [0.449;2.015]		1.601 [0.767;3.455]		1.115 [0.396;3.241]	
	Change	5.992 [2.508;14.958]		6.231 [2.635;15.445]		3.067 [1.257;7.585]		0.483 [0.117;1.818]	
Psychiatric care	No	1	0.44	1	0.44	1	0.48	1	0.71
	Teleconsultation	1.438 [0.778;2.655]		1.377 [0.723;2.615]		1.591 [0.825;3.069]		0.96 [0.374;2.415]	
	Face to face	1.075 [0.271;3.615]		0.53 [0.078;2.152]		1.688[0.426;5.7]		1.751 [0.263;9.444]	
		0.361 [0.018;2.503]		0.47 [0.024;3.234]		2.042 [0.263;11.624]		3.831 [0.184;36.636]	
Pursuit drug treatment	No	1	0.19	1	0.11	1	0.07	1	0.13
	Yes	0.417 [0.161;1.074]		0.395 [0.154;1.023]		0.373 [0.144;0.991]		0.964 [0.233;4.492]	
	NA	0.481 [0.16;1.429]		0.323 [0.104;0.982]		0.71 [0.241;2.133]		3.013 [0.612;16.755]	

GAD7: Generalized Anxiety Disorder; ISI: Insomnia Severity Scale; NA: Not Applicable. PHQ-9:Patient health Questionnaire; STAXI: Spielberger Anger State Trait Inventory.

Odds Ratio and their 95 % confidence intervals of each factor were estimated independently from a multivariate logistic model adjusted for socio-demography. For suicidal ideations, extra models were fitted, adjusted for socio-demography and depression level using PHQ9 depression score. Effects were tested with LRT and *p*-values are presented.

3.2.3. Suicidal ideation

According to the univariate analyses (Table 4), SI was associated with current depressive symptoms (OR [95 % CI] = 1.40 [1.29;1.55]), anxiety symptoms (OR [95 % CI] = 1.24 [1.16;1.33]), psychological pain (OR [95 % CI] = 2.09 [1.68;2.72]), and insomnia (OR [95 % CI] = 1.13 [1.07;1.19]). When adjusted for depression, SI remained associated with psychological pain (OR [95 % CI] = 1.48[1.16;1.96]), and insomnia (OR [95 % CI] = 0.85[0.77;0.94]).

After adjustment for depressive state and meaningful factors (see Table 4 and Fig. 1), SI remained independently associated with depression (OR [95 % CI] = 1.62 [1.41;1.93]), history of bipolar disorder (OR [95 % CI] = 0.08 [0.019;0.25]), history of suicide attempt (OR [95 % CI] = 4.13 [1.52;12.30]), going out (2–3 times/week: OR [95 % CI] = 9.97 [1.89;69.30]; daily: OR [95 % CI] = 7.95 [1.53;54.82]), and physical activity (several times/week: OR [95 % CI] = 4.21 [1.20;16.38]; daily: OR [95 % CI] = 10.64 [1.46;86.06]).

Modified frequency of outing, social support, loneliness, boredom, insomnia, and maximum psychological pain related to modified lockdown constraints (vs. no habit modification) were additional factors involved in SI after the first lockdown end (Table 7).

3.3. Current and dynamic predictors of negative psychological state during the second lockdown

3.3.1. Depression (PHQ-9 score ≥ 10)

According to the univariate analyses (Table 5), depression was associated with current anxiety symptomatology (OR [95 % CI] = 2.32 [1.78;3.37]), psychological pain (OR [95 % CI] = 2.17 [1.68;3]), and insomnia (OR [95 % CI] = 1.21 [1.13;1.31]).

After adjustment for meaningful factors (see Table 5 and Fig. 1), depression was independently associated with history of anxious disorder (OR [95 % CI] = 4.16 [1.24;15.51]), psychotropic use change (OR [95 % CI] = 9.21 [1.78;61.47]), physical activity (once/week: OR [95 % CI] = 0.14 [0.02;0.72]; several times/week: OR [95 % CI] = 0.33 [0.06;1.62]; daily: OR [95 % CI] = 2.72 [0.49;16.38]), usual tobacco user (OR [95 % CI] = 0.04 [0.006;0.201]), loneliness (OR [95 % CI] = 1.37 [1.11;1.71]), social support (OR [95 % CI] = 0.67 [0.50;0.87]), and boredom (sometimes: OR [95 % CI] = 6.59 [1.23;53.10]; often/continually: OR [95 % CI] = 14.60 [2.45;124.69]).

Changes in the frequency of going out, loneliness and boredom, insomnia and maximum psychological pain related to modified lockdown constraints (vs. no habit modification) were additional factors involved in depression during the second lockdown (Table 7).

3.3.2. Anxiety (GAD-7 score ≥ 10)

According to the univariate analyses (Table 5), anxiety was associated with current depressive symptoms (OR [95 % CI] = 1.40 [1.27;1.60], psychological pain (OR [95 % CI] = 2.06 [1.58;2.89]), and insomnia (OR [95 % CI] = 1.20 [1.12;1.30].

After adjustment for meaningful factors (see Table 5 and Fig. 1), anxiety was independently associated with psychotropic use change (OR [95 % CI] = 9.38 [2.10;50.7]), treatment observance (not treated: OR [95 % CI] = 3.17 [0.41;28.16]), virtual contacts (several times/week: OR [95 % CI] = 1.90 [0.55;7.008]; daily: OR [95 % CI] = 0.42 [0.11;1.53]), and loneliness (OR [95 % CI] = 1.63 [1.34;2.08]).

Changes in the frequency of going out and of virtual contacts, loneliness, insomnia, and maximum psychological pain related to modified lockdown constraints (vs. no habit modification) were additional factors involved in anxiety during the second lockdown (Table 7).

3.3.3. Suicidal ideation

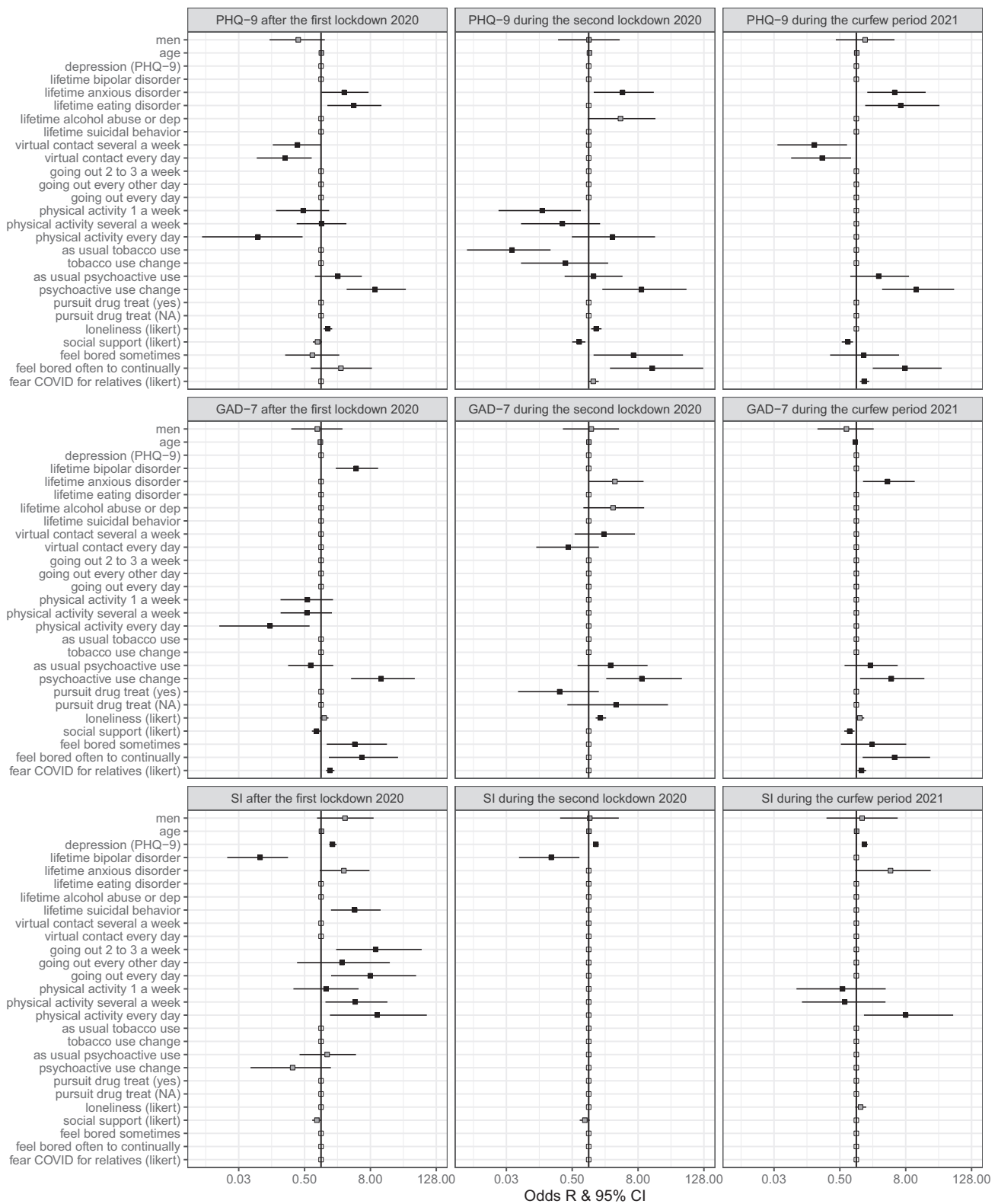According to the univariate analyses (Table 5), SI was associated

Fig. 1. Adjusted effect of risk/protective factors on mental health outcomes at different points of follow-up.
Risk/protective factors Odd Ratios (square) and 95 % confidence intervals estimated from best multivariate logistic models after the stepwise AIC procedure for each outcome (in row: Depression PHQ-9 score > 9, Anxiety GAD-7 score > 9, SI (PHQ-9)) at each focal period (in column). Abscissa is in log scale. White, gray and black squares represent respectively excluded factors (from the stepwise AIC procedure), no significant factors (i.e. kept in the model with LRT *p*-value ≥0.05) and significant factors (kept in the model with LRT *p*-value ≤0.05). The vertical line represents the reference level (Odd Ratio = 1). A factor may be considered significantly associated with the outcome when 95 % confidence intervals of one of its levels do not include 1 or when 95 % confidence intervals of at least two different levels do not include their Odds Ratio counterpart.

Table 5
Effects of diagnosis, contemporaneous habits and psychopathology on the mental state after the beginning of the second lockdown.

Variable	Levels	Depression PHQ9 ≥ 10		Anxiety GAD7 ≥ 10		Suicidal ideation		Suicidal ideation (adjusted for depression)	
		OR [95 % IC] N = 141	p-value	OR[95 % IC] N = 141	p-value	OR[95 % IC] N = 140	p-value	OR [95 % IC] N = 140	p-value
Bipolar disorder	No	1	0.48	1	0.83	1	0.06	1	0.01
	Yes	0.758[0.343;1.641]		0.913[0.39;2.099]		0.438 [0.171;1.047]		0.169 [0.031;0.71]	
Anxious disorder	No	1	0.004	1	0.0009	1	0.005	1	0.52
	Yes	3.115[1.418;7.21]		4.622 [1.826;13.435]		3.41 [1.42;9.005]		1.564 [0.395;6.493]	
Eating disorder	No	1	0.88	1	0.37	1	0.88	1	0.17
	Yes	1.086[0.369;3.079]		1.65[0.545;4.857]		1.089 [0.338;3.226]		0.248 [0.029;1.76]	
Alcohol abuse or dependence	No	1	0.28	1	0.2	1	0.44	1	0.36
	Yes	1.631[0.672;3.948]		1.846[0.72;4.664]		1.448 [0.556;3.635]		0.491 [0.097;2.182]	
Substance abuse or dependence	No	1	0.62	1	0.37	1	0.95	1	0.42
	Yes	1.275[0.475;3.357]		1.593[0.56;4.398]		1.03[0.349;2.8]		0.523 [0.097;2.444]	
Suicide attempt	No	1	0.008	1	0.05	1	0.08	1	0.86
	Yes	2.672[1.283;5.743]		2.186 [0.989;5.021]		2.016 [0.922;4.577]		0.898 [0.25;3.091]	
Depression (PHQ9)				1.401 [1.267;1.602]		1.378 [1.257;1.552]	<0.0001	NA	NA
Anxiety (GAD7)		2.321[1.785;3.368]	<0.0001			1.405 [1.261;1.604]	<0.0001	1.072 [0.907;1.272]	0.41
Psychological pain (Likert)		2.171[1.686;3]	<0.0001	2.063 [1.585;2.895]	<0.0001	1.942 [1.517;2.662]	<0.0001	1.264 [0.92;1.837]	0.16
Anger state (STAXI)		1.284[1.182;1.416]	<0.0001	1.281 [1.178;1.414]	<0.0001	1.253 [1.159;1.371]	<0.0001	1.08 [0.967;1.214]	0.17
Insomnia (ISI)		1.21[1.132;1.306]	<0.0001	1.203 [1.122;1.302]	<0.0001	1.177 [1.103;1.268]	<0.0001	0.976 [0.875;1.085]	0.66
Suicidal ideation	No	1	<0.0001	1	<0.0001	NA	NA	NA	NA
	Yes	139.749 [33.173;1094.207]		36.087 [12.394;127.815]		NA		NA	
Loneliness (Likert)		1.645[1.407;1.976]	<0.0001	1.674 [1.412;2.053]	<0.0001	1.556 [1.329;1.872]	<0.0001	1.102 [0.874;1.395]	0.41
Boredom	Never	1	<0.0001	1	<0.0001	1	<0.0001	1	0.56
	Sometimes	3.39[1.05;13.261]		3.8[1.044;18.316]		1.767 [0.502;7.193]		0.822 [0.116;6.013]	
	Often/continually	27.617 [8.367;114.852]		17.241 [4.937;82.836]		11.709 [3.685;46.464]		1.743 [0.277;11.624]	
Social support (Likert)		0.785[0.672;0.906]	0.0008	0.819 [0.699;0.951]	0.009	0.727 [0.611;0.852]	<0.0001	0.81 [0.624;1.037]	0.09
Fear COVID (Likert)		1.052[0.929;1.191]	0.42	1.009[0.88;1.155]	0.89	0.94 [0.816;1.075]	0.37	0.8[0.61;1.015]	0.07
Fear COVID for relative (Likert)		1.229[1.067;1.436]	0.004	1.172 [1.005;1.386]	0.043	1.064 [0.924;1.235]	0.4	0.729 [0.551;0.935]	0.01
Virtual contacts	Rarely	1	0.07	1	0.02	1	0.02	1	0.28
	Several a week	0.716[0.297;1.713]		0.605[0.24;1.512]		0.748 [0.302;1.849]		2.116 [0.448;11.293]	
	Every day	0.359[0.142;0.877]		0.255 [0.089;0.682]		0.25 [0.084;0.682]		0.633 [0.134;2.972]	
Written contact	Rarely	1	0.6	1	0.53	1	0.25	1	0.68
	Several a week	0.806[0.311;2.095]		0.735 [0.267;2.047]		1.147 [0.429;3.201]		1.914 [0.376;10.91]	
	Every day	0.621[0.239;1.614]		0.56[0.201;1.565]		0.553 [0.192;1.604]		1.16 [0.225;6.333]	
Going out	1 a week or less	1	0.002	1	0.03	1	0.07	1	0.32
	2 to 3 a week	0.333[0.086;1.181]		0.366 [0.095;1.334]		0.441 [0.118;1.596]		1.398 [0.167;12.205]	
	Every other day	0.512[0.113;2.202]		0.547[0.12;2.388]		0.78 [0.178;3.341]		5.56 [0.583;60.209]	
	Every day	0.139[0.04;0.435]		0.195[0.058;0.62]		0.259 [0.081;0.828]		1.331 [0.17;11.204]	
Physical activity	Never	1	0.002	1	0.01	1	0.22	1	0.32
	1 a week	0.255[0.087;0.681]		0.214 [0.056;0.667]		0.708 [0.25;1.896]		5.166 [0.93;34.933]	
	Several a week	0.193[0.064;0.517]		0.334 [0.108;0.922]		0.332 [0.1;0.939]		1.549 [0.15;13.809]	
	Every day	0.581[0.17;1.868]		1.071[0.306;3.59]		0.843 [0.207;2.953]		1.55 [0.191;11.292]	
	No comsumption	1	0.56	1	0.62	1	0.85	1	0.33

Table 5 (*continued*)

Variable	Levels	Depression PHQ9 ≥ 10		Anxiety GAD7 ≥ 10		Suicidal ideation		Suicidal ideation (adjusted for depression)	
		OR [95 % IC] N = 141	p-value	OR[95 % IC] N = 141	p-value	OR[95 % IC] N = 140	p-value	OR [95 % IC] N = 140	p-value
Alcohol use change									
	As usual	0.745[0.32;1.69]		0.879 [0.347;2.152]		1.228 [0.504;2.949]		1.773 [0.432;7.711]	
	Change	1.34[0.458;3.86]		1.565 [0.503;4.762]		1.307 [0.393;4.035]		0.363 [0.044;2.541]	
Tobacco use change	No comsumption	1	0.04	1	0.04	1	0.1	1	0.65
	As usual	0.391[0.12;1.082]		0.472 [0.123;1.456]		0.468 [0.126;1.393]		0.464 [0.075;2.339]	
	Change	2.243[0.76;6.954]		3.054 [0.988;9.765]		2.168 [0.71;6.533]		1.042 [0.193;5.615]	
Psychoactive intake change	No comsumption	1	<0.0001	1	0.0002	1	0.02	1	0.44
	As usual	1.507[0.643;3.603]		1.264[0.489;3.33]		1.898 [0.766;4.902]		0.645 [0.133;2.902]	
	Change	11.832 [3.844;41.792]		8.828 [2.886;29.839]		4.632 [1.585;14.165]		0.328 [0.052;1.789]	
Psychiatric care	No	1	0.81	NA	NA	1	0.66	1	0.63
	Tele consultation	1.446[0.685;3.063]		NA		1.571 [0.699;3.552]		0.683 [0.174;2.495]	
	Face to face	1.112[0.145;6.265]		NA		1.72 [0.222;9.789]		0.337 [0.008;9.574]	
	Emergency /hospitalization	1.253 [0.045;35.235]		NA		2.747 [0.096;78.941]		7.507 [0.135;520.695]	
Pursuit drug treatment	No	1	0.12	1	0.02	1	0.34	1	0.67
	Yes	0.264[0.067;0.943]		0.171 [0.041;0.637]		0.423 [0.117;1.554]		2.356 [0.305;20.584]	
	NA	0.302[0.065;1.284]		0.353 [0.074;1.547]		0.332 [0.068;1.514]		2.938 [0.251;36.86]	

GAD7: Generalized Anxiety Disorder; ISI: Insomnia Severity Scale; NA: Not Applicable. PHQ-9:Patient health Questionnaire;; SI: suicidal ideation; STAXI: Spielberger Anger State Trait Inventory.

Odds Ratio and their 95 % confidence intervals of each factor were estimated independently from a multivariate logistic model adjusted by socio-demography. For suicidal ideations, extra models were fitted, adjusted for socio-demography and depression level using PHQ9 depression score. Effects were tested with LRT and *p*-values are presented.

with current depressive symptoms (OR [95 % CI] = 1.38 [1.26;1.55]), anxious symptoms (OR [95 % CI] = 1.40 [1.26;1.60]), psychological pain (OR [95 % CI] = 1.94 [1.52;2.66]), and insomnia (OR [95 % CI] = 1.18 [1.10;1.27]). When adjusted for current depressive symptoms, these associations did not remain significant.

After adjustment for depressive state and meaningful factors (see Table 5 and Fig. 1), SI was independently associated with current depressive symptoms (OR [95 % CI] = 1.36 [1.24;1.52]), and history of bipolar disorder (OR [95 % CI] = 0.21 [0.053;0.676]).

Changes in the frequency of going out, loneliness and boredom, insomnia and maximum psychological pain related to modified lockdown constraints (vs. no habit modification) also influenced SI during second lockdown (Table 7).

3.4. Current and dynamic predictors of negative psychological state after the end of the second lockdown

3.4.1. Depression (PHQ-9 score ≥ 10)

According to the univariate analyses (Table 6), depression was associated with current anxiety symptomatology (OR [95 % CI] = 1.424 [1.282;1.62]), psychological pain (OR [95 % CI] = 1.542 [1.311;1.871]), and insomnia (OR [95 % CI] = 1.232 [1.145;1.341]]).

After adjustment for meaningful factors (see Table 6 and Fig. 1), depression was independently associated with history of anxious disorder (OR [95 % CI] = 5.04 [1.59;18.51]), eating disorder (OR [95 % CI] = 6.47 [1.45;33.11]), psychotropic treatment change (OR [95 % CI] = 12.42 [2.96;61.47]), virtual contacts (several times/week: OR [95 % CI] = 0.17 [0.036;0.68]; daily: OR [95 % CI] = 0.24 [0.064;0.80]),

social support (OR [95 % CI] = 0.70 [0.54;0.87]), boredom (sometime: OR [95 % CI] = 1.37 [0.33;6.05]; often/continually: OR [95 % CI] = 7.78 [2.00;36.30]), and fear of contamination for relatives (OR [95 % CI] = 1.39 [1.16;1.72]).

Changes in the frequency of loneliness, boredom, insomnia, and psychological pain related to modified lockdown constraints (vs. no habit modification) also were involved in depression after the second lockdown (Table 7).

3.4.2. Anxiety (GAD-7 score ≥ 10)

According to the univariate analyses (Table 6), anxiety was associated with current depressive symptoms (OR [95 % CI] = 1.27 [1.18;1.386]), psychological pain (OR [95 % CI] = 2.513 [1.836;3.78]), and insomnia (OR [95 % CI] = 0.177 [1.101;1.27]).

After adjustment for meaningful factors (see Table 6 and Fig. 1), anxiety remained independently associated with age (OR [95 % CI] = 0.96 [0.92;0.99]), history of anxious disorder (OR [95 % CI] = 3.71 [1.33;11.69]), psychotropic treatment change (OR [95 % CI] = 4.37 [1.17;17.56]), social support (OR [95 % CI] = 0.76 [0.60;0.93]), boredom (often/continually: OR [95 % CI] = 4.99 [1.30;22.33]), and fear of contamination for relatives (OR [95 % CI] = 1.25 [1.047;1.51]).

Changes in the level of loneliness, and frequency of boredom, insomnia and maximum psychological pain related to modified lockdown constraints (vs. no habit modification) also influenced anxiety after the second lockdown end (Table 7).

3.4.3. Suicidal ideation

According to the univariate analyses (Table 6), SI was associated

Table 6
Effects of lifetime psychopathology, contemporaneous habits and on mental state depression, anxiety and suicidal ideation the break of the second lockdown.

Variable	Levels	Depression PHQ9 ≥ 10		Anxiety GAD7 ≥ 10		Suicidal ideation		Suicidal ideation (adjusted for depression)	
		OR [95 % IC] N = 138	p-value	OR [95 % IC] N = 138	p-value	OR [95 % IC] N = 138	p-value	OR [95 % IC] N = 138	p-value
Bipolar disorder	No	1	0.09	1	0.14	1	0.97	1	0.047
	Yes	0.497[0.209;1.124]		0.532 [0.217;1.233]		1.016 [0.417;2.398]		5.029 [1.022;33.252]	
Anxious disorder	No	1	0.0001	1	<0.0001	1	<0.0001	1	0.01
	Yes	5.027 [2.152;12.759]		6.922 [2.706;20.421]		8.539 [2.955;31.351]		7.725 [1.511;51.787]	
Eating disorder	No	1	0.1	1	0.3	1	0.36	1	0.75
	Yes	2.56[0.834;8.038]		1.811 [0.577;5.613]		1.752 [0.515;5.627]		1.341 [0.208;8.61]	
Alcohol abuse or dependence	No	1	0.47	1	0.54	1	0.18	1	0.78
	Yes	1.49[0.496;4.339]		1.415 [0.446;4.27]		2.193 [0.681;6.782]		0.749 [0.099;5.435]	
Substance abuse or dependence	No	1	0.37	1	0.24	1	0.86	1	0.69
	Yes	1.753[0.497;6.083]		2.131 [0.591;7.592]		0.882 [0.18;3.387]		0.648 [0.07;5.184]	
Past suicide attempt	No	1	0.44	1	0.32	1	0.33	1	0.35
	Yes	1.347[0.635;2.883]		0.668 [0.299;1.466]		1.525 [0.656;3.639]		2.029 [0.467;9.945]	
Depression (PHQ9)		NA	NA	1.27[1.18;1.386]	<0.0001	1.487 [1.314;1.764]	<0.0001	NA	NA
anxiety (GAD7)		1.424[1.282;1.62]	<0.0001	NA	NA	1.378 [1.242;1.563]	<0.0001	1.14[0.99;1.325]	0.07
Psycho pain (Likert)		1.542[1.311;1.871]	<0.0001	2.513 [1.836;3.78]	<0.0001	1.973 [1.527;2.738]	<0.0001	1.475 [1.067;2.24]	0.02
Anger (STAXI)		1.402[1.261;1.598]	<0.0001	1.282 [1.18;1.416]	<0.0001	1.282 [1.146;1.352]	<0.0001	1.007 [0.889;1.135]	0.91
Insomnia (ISI)		1.232[1.145;1.341]	<0.0001	1.177 [1.101;1.27]	<0.0001	1.206 [1.12;1.315]	<0.0001	0.901 [0.773;1.035]	0.14
Suicidal ideation	No	1	<0.0001	1	<0.0001	NA	NA	NA	NA
	Yes	101.214 [25.562;701.041]		16.601 [6.444;47.469]		NA		NA	
Loneliness (Likert)		1.429[1.24;1.677]	<0.0001	1.462 [1.255;1.743]	<0.0001	1.764 [1.436;2.277]	<0.0001	1.621 [1.174;2.417]	0.002
boredom	Never	1	<0.0001	1	<0.0001	1	0.0001	1	0.75
	Sometimes	1.991[0.654;6.647]		3.049 [0.903;12.406]		1.241 [0.33;4.913]		0.704 [0.086;6.013]	
	Often/continually	12.302 [4.138;42.764]		16.075 [4.882;67.129]		8.438 [2.681;31.879]		1.28 [0.166;9.997]	
Social support (Likert)		0.75[0.629;0.881]	0.0004	0.749 [0.624;0.885]	0.0006	0.716 [0.588;0.857]	0.0002	0.765 [0.548;1.03]	0.08
Fear COVID (Likert)		1.1[0.965;1.257]	0.15	1.185 [1.031;1.371]	0.02	1.045[0.9;1.211]	0.56	0.776 [0.548;1.043]	0.09
Fear COVID for relative (Likert)		1.263[1.102;1.469]	0.0006	1.257 [1.088;1.478]	0.002	1.178 [1.016;1.386]	0.03	0.773 [0.541;1.061]	0.11
Virtual contacts	Rarely	1	0.16	1	0.18	1	0.08	1	0.61
	several a week	0.524[0.211;1.279]		0.798 [0.32;1.989]		0.496 [0.184;1.297]		0.474 [0.088;2.338]	
	Every day	0.423[0.165;1.052]		0.412 [0.149;1.09]		0.317 [0.105;0.886]		0.546 [0.103;2.781]	
Written contact	Rarely	1	0.09	1	0.43	1	0.02	1	0.52
	Several a week	0.442[0.158;1.21]		0.587 [0.203;1.694]		0.278 [0.088;0.835]		0.336 [0.047;2.154]	
	Every day	0.329[0.118;0.895]		0.503 [0.177;1.434]		0.225 [0.071;0.674]		0.593 [0.108;3.228]	
Going out	1 a week or less	1	0.16	1	0.07	1	0.06	1	0.91
	2 to 3 a week	0.957[0.216;4.237]		1.116 [0.247;5.213]		0.761 [0.164;3.608]		0.642 [0.03;11.232]	
	Every other day	0.719[0.161;3.176]		0.844 [0.185;3.936]		0.457 [0.092;2.223]		0.606 [0.029;11.033]	
	Every day	0.363[0.094;1.394]		0.339 [0.084;1.409]		0.223 [0.052;0.96]		0.435 [0.032;4.86]	
Physical activity	Never	1	0.46	1	0.48	1	0.33	1	0.38
	1 a week	0.626[0.234;1.617]		0.582 [0.21;1.543]		0.482 [0.15;1.404]		0.976 [0.14;6.498]	
	Several a week	0.488[0.178;1.267]		0.581 [0.211;1.528]		0.477 [0.149;1.384]		0.478 [0.069;3.003]	
	Every day	0.97[0.284;3.133]		0.42[0.086;1.56]		1.19 [0.319;4.079]		3.671 [0.474;33.096]	
Alcohol use change	No comsumption	1	0.78	1	0.56	1	0.15	1	0.37

Table 6 (*continued*)

Variable	Levels	Depression PHQ9 ≥ 10 OR [95 % IC] N = 138	p-value	Anxiety GAD7 ≥ 10 OR [95 % IC] N = 138	p-value	Suicidal ideation OR [95 % IC] N = 138	p-value	Suicidal ideation (adjusted for depression) OR [95 % IC] N = 138	p-value
	As usual	0.753[0.313;1.758]		0.636 [0.252;1.537]		0.381 [0.129;1.017]		0.374 [0.065;1.875]	
	Change	1.02[0.331;2.967]		0.66 [0.188;2.044]		0.594 [0.148;1.977]		0.329 [0.041;2.164]	
Tobacco use change	No comsumption	1	0.4	1	0.62	1	0.9	1	0.44
	As usual	1.289[0.457;3.45]		0.698 [0.206;2.047]		1.299 [0.408;3.782]		1.034 [0.134;7.047]	
	Change	1.978[0.723;5.36]		1.368 [0.474;3.779]		1.022 [0.295;3.106]		0.323 [0.044;1.948]	
Psychoactive intake change	No comsumption	1	0.0006	1	0.02	1	0.003	1	0.63
	As usual	2.727[1.044;7.879]		1.388 [0.538;3.76]		2.52 [0.831;8.949]		0.577 [0.082;3.891]	
	Change	9.453[2.94;33.938]		4.747 [1.524;15.696]		8.61 [2.454;34.796]		1.278 [0.165;9.864]	
Psychiatric care	No	1	0.47	NA	NA	NA	NA	NA	NA
	Teleconsultation	1.795[0.823;3.948]		NA		NA		NA	
	Face to face	1.61[0.071;18.362]		NA		NA		NA	
		3.073 [0.113;83.895]		NA		NA		NA	
Pursuit drug treatment	No	1	0.24	1	0.71	1	0.5	1	1
	Yes	0.437[0.109;1.735]		0.618 [0.157;2.658]		0.422 [0.105;1.837]		0.912 [0.038;12.92]	
	NA	0.89[0.179;4.405]		0.842 [0.164;4.52]		0.458 [0.08;2.582]		0.961 [0.032;18.927]	

GAD7: Generalized Anxiety Disorder; ISI: Insomnia Severity Scale; NA: Not Applicable. PHQ-9:Patient health Questionnaire; STAXI: Spielberger Anger State Trait Inventory Odds Ratio and their 95 % confidence intervals of each factor were estimated independently from a multivariate logistic model adjusted by socio-demography. For suicidal ideations, extra models were fitted, adjusted for socio-demography and depression level using PHQ9 depression score. Effects were tested with LRT and p-values are presented.

with current depressive symptoms (OR [95 % CI] = 1.487 [1.314;1.764]), anxiety symptoms (OR [95 % CI] = 1.378 [1.242;1.563]), psychological pain (OR [95 % CI] = 1.973 [1.527;2.738]), and insomnia (OR [95 % CI] = 1.206 [1.12;1.315]]). When adjusted for current depressive symptoms, SI was associated with psychological pain (OR [95 % CI] = 1.475[1.067;2.24]).

After adjustment for depressive state and meaningful factors (see Table 6 and Fig. 1), SI remained independently associated with current depressive symptoms (OR [95 % CI] = 1.40 [1.26;1.62]), and daily physical activity (OR [95 % CI] = 7.98 [1.38;59.02]).

Changes in the level of loneliness and boredom related to modified lockdown constraints (vs. no habit modification) also were involved in SI after the second lockdown end (Table 7).

4. Discussion

The main results of this study on the effects on mental health of the different stay-at-home orders in France during the COVID-19 pandemics in patients with history of depressive episode in the last 2 years before inclusion) that high loneliness and boredom were independent risk factors of depressive symptomatology during the second lockdown, whereas social support was a protective factor. Loneliness, but not boredom, also was a risk factor of anxious symptomatology during the second lockdown. Moreover, depressive and anxious states were influenced by the changes in loneliness and boredom levels across periods (i. e. loneliness and boredom decreased after the end or ease of lockdowns and increased after the reinstatement of restrictive measures).

Our results add information on the reversibility of the impact of loneliness and boredom on mental health, as indicated by the finding that the significant decrease of loneliness and boredom level after the first lockdown protected against depressive symptomatology and anxiety. Depression and anxiety have been previously positively correlated with high/medium disruption of socializing activities, healthy eating,

sleep, and leisure activities (compared with low disruption) at the beginning of the COVID-19 pandemic and following a period of high COVID-19 incidence (Hou et al., 2021). Therefore, measures to overcome loneliness and boredom must be implemented to reduce their negative psychological consequences during lockdowns. Four primary strategies to reduce loneliness have been identified: 1) improving social skills, 2) enhancing social support, 3) increasing the opportunities for social interaction, and 4) addressing maladaptive social cognition. A meta-analysis showed that cognitive behavioral therapy is the most successful intervention to address maladaptive social cognition (Masi et al., 2011). Interestingly, internet-based cognitive behavioral therapy has shown its effectiveness to reduce loneliness (Shapira et al., 2021), with a maintained gain at 4 months follow-up (Käll et al., 2021). It highlights that internet-based psychological treatments could be a way to deliver evidence-based treatments to populations with low access to care, such as during restrictive periods.

Other effective interventions that are feasible during the COVID-19 pandemic have been identified: mindfulness, lessons on friendship, robotic pets, and social facilitation software (Williams et al., 2021). A recent randomized controlled trial showed that a layperson-delivered, empathy-oriented short telephone call programme reduces loneliness, depression, and anxiety within 4 weeks (Kahlon et al., 2021). People who are in quarantine should be advised to stave off boredom and offered practical advice on stress management techniques (Brooks et al., 2020), such as mindfulness (LePera, 2011) and creative behaviors (Mann and Cadman, 2014).

Loneliness is a critical determinant of well-being and is associated with higher rates of anxiety, depression and SI (Antonelli-Salgado et al., 2021; Beutel et al., 2017; Calati et al., 2019). Indeed, loneliness during the pandemic has been strongly associated with more severe depression and SI (Killgore et al., 2020; Morina et al., 2021). In our study, we confirmed this association when considering depressive symptomatology. It suggests that the management of loneliness and depression is

Table 7

Effects of dynamic factors (change in habits or psychosocial factors) on depression, anxiety and suicidal ideation during the transitions between lockdown and unrestricted periods or vice-versa.

Dynamic variables	Levels	Depression PHQ9 ≥ 10		Anxiety GAD7 ≥ 10		Suicidal ideation	
		OR [95 % IC]	p-value	OR [95 % IC]	p-value	OR [95 % IC]	p-value
After the break of the first lockdown							
Going out (N = 230)	Decrease	0.64[0.138;2.752]	0.54	0.885[0.185;3.625]	0.07	0.119[0.017;0.674]	0.04
	Increase	0.666[0.303;1.463]		0.383[0.165;0.872]		0.609[0.224;1.642]	
Physical activity (N = 231)	Decrease	1.929[0.743;5.188]	0.03	2.662[0.977;7.648]	0.12	0.946[0.296;2.996]	0.2
	Increase	0.375[0.133;0.968]		0.84[0.305;2.181]		0.362[0.106;1.117]	
Virtual contacts (N = 232)	Decrease	2.543[1.144;5.776]	0.045	2.719[1.231;6.158]	0.02	2.169[0.818;5.898]	0.18
	Increase	0.892[0.338;2.281]		0.794[0.285;2.147]		2.269[0.716;7.323]	
Written contacts (N = 230)	Decrease	1.34[0.584;3.046]	0.41	1.868[0.808;4.315]	0.23	2.027[0.751;5.55]	0.37
	Increase	0.577[0.191;1.631]		1.842[0.602;5.645]		1.057[0.285;3.637]	
Loneliness (Likert) (N = 232)	Decrease	0.167[0.059;0.437]	<0.0001	0.239[0.084;0.643]	0.008	0.399[0.118;1.274]	0.01
	Increase	1.008[0.37;2.71]		0.774[0.273;2.139]		2.255[0.722;7.315]	
Social support (Likert) (N = 232)	Decrease	1.495[0.664;3.417]	0.02	1.557[0.676;3.666]	0.25	4.487[1.545;14.47]	0.01
	Increase	0.392[0.14;1.046]		0.725[0.274;1.898]		1.23[0.376;4.142]	
Boredom (N = 232)	Decrease	0.374[0.146;0.904]	0.002	0.489[0.186;1.209]	<0.0001	0.7[0.239;1.978]	0.006
	Increase	3.553[1.253;10.221]		12.104[3.879;41.614]		6.298[1.867;21.797]	
Fear of COVID (Likert) (N = 232)	Decrease	0.558[0.23;1.327]	0.1	1.123[0.467;2.718]	0.52	1.992[0.663;6.292]	0.15
	Increase	1.624[0.712;3.742]		1.668[0.683;4.107]		2.625[0.947;7.617]	
Fear of COVID for relative (Likert) (N = 231)	Decrease	1.019[0.461;2.303]	0.82	0.322[0.137;0.743]	0.02	0.622[0.237;1.649]	0.55
	Increase	1.314[0.499;3.541]		0.635[0.235;1.701]		0.94[0.297;3.004]	
Insomnia (ISI) (N = 231)	Decrease	0.511[0.133;2.01]	<0.0001	0.482[0.121;2.035]	<0.0001	1.046[0.26;4.338]	0.005
	Increase	5.294[1.55;21.049]		3.267[0.941;13.675]		4.343[1.187;18.21]	
Psychological pain (Likert) (N = 231)	Decrease	0.241[0.081;0.676]	<0.0001	0.206[0.073;0.551]	<0.0001	0.156[0.041;0.517]	<0.0001
	Increase	6.043[1.983;20.78]		2.269[0.841;6.501]		1.656[0.522;5.573]	
After the order of the second lockdown							
Going out (N = 124)	Decrease	2.754[0.871;9.002]	0.005	3.34[1.076;10.738]	0.006	3.043[1.009;9.789]	0.01
	Increase	0.109[0.012;0.756]		0.134[0.011;1.113]		0.201[0.023;1.348]	
Physical activity (N = 124)	Decrease	1.318[0.372;4.669]	0.45	2.469[0.726;9.076]	0.29	2.031[0.593;7.27]	0.5
	Increase	0.519[0.136;1.802]		0.866[0.231;3.029]		0.992[0.298;3.136]	
Virtual contacts (N = 124)	Decrease	2.775[0.883;9.283]	0.12	4.684[1.447;16.918]	0.01	1.882[0.614;5.856]	0.11
	Increase	0.643[0.133;2.854]		0.541[0.098;2.694]		0.305[0.05;1.461]	
Written contacts (N = 124)	Decrease	1.507[0.487;4.694]	0.72	1.64[0.532;5.042]	0.52	1.984[0.669;5.99]	0.29
	Increase	1.483[0.326;6.744]		0.645[0.131;2.972]		0.573[0.111;2.601]	
Loneliness (Likert) (N = 122)	Decrease	0.164[0.017;1.244]	<0.0001	0.144[0.017;1.021]	<0.0001	0.328[0.047;2.06]	0.0001
	Increase	12.478[2.79;75.439]		6.579[1.379;41.763]		7.153[1.696;39.498]	
Social support (Likert) (N = 122)	Decrease	2.378[0.728;8.472]	0.35	1.887[0.597;6.481]	0.28	2.793[0.867;10.106]	0.06
	Increase	1.668[0.458;6.19]		0.648[0.168;2.367]		0.617[0.156;2.281]	
Boredom (N = 123)	Decrease	0.644[0.101;3.451]	0.02	0.589[0.133;2.33]	0.67	0.647[0.135;2.759]	0.03
	Increase	4.646[1.442;16.834]		1.149[0.367;3.505]		3.734[1.256;12.066]	
Fear of COVID (Likert) (N = 124)	Decrease	1.828[0.589;5.844]	0.43	1.632[0.547;4.969]	0.52	2.684[0.879;8.825]	0.19
	Increase	0.843[0.256;2.73]		0.805[0.226;2.766]		1.121[0.33;3.811]	
Fear of COVID for relatives (Likert) (N = 124)	Decrease	0.709[0.193;2.519]	0.57	0.722[0.203;2.441]	0.66	1.788[0.539;6.046]	0.63
	Increase	1.453[0.468;4.711]		1.328[0.432;4.226]		1.303[0.422;4.144]	
Insomnia (ISI) (N = 124)	Decrease	0.975[0.055;17.969]	0.002	2.009[0.114;68.133]	0.003	0.463[0.028;6.942]	0.004
	Increase	7.944[0.44;198.842]		13.272[0.692;534.938]		2.955[0.178;53.35]	
Psychological pain (Likert) (N = 124)	Decrease	0.055[0.005;0.36]	<0.0001	0.068[0.008;0.403]	<0.0001	0.258[0.051;1.162]	0.0006
	Increase	6.723[1.337;48.241]		3.077[0.725;16.356]		3.723[1;17.115]	
After the break of the second lockdown							
Going out (N = 100)	Decrease	3.802[0.843;18.206]	0.06	2.283[0.519;9.981]	0.19	6.177[1.254;34.661]	0.07
	Increase	0.314[0.044;1.895]		0.329[0.055;1.722]		2.281[0.366;16.45]	
Physical activity (N = 100)	Decrease	0.619[0.09;3.642]	0.81	1.821[0.345;9.514]	0.08	3.499[0.537;24.597]	0.3
	Increase	0.7[0.158;2.828]		0.222[0.035;1.03]		2.269[0.512;10.055]	
Virtual contacts (N = 100)	Decrease	2.573[0.535;12.386]	0.21	0.702[0.089;3.83]	0.88	2.653[0.439;15.279]	0.43
	Increase	3.333[0.766;16.654]		1.146[0.292;4.521]		2.041[0.465;9.315]	
Written contacts (N = 100)	Decrease	0.653[0.117;3.24]	0.84	0.338[0.039;1.949]	0.43	0.721[0.073;4.784]	0.95
	Increase	0.766[0.173;3.289]		0.591[0.141;2.36]		1.02[0.222;4.731]	
Loneliness (Likert) (N = 97)	Decrease	0.58[0.098;3.447]	0.04	0.089[0.01;0.602]	0.003	0.601[0.083;4.656]	0.02
	Increase	3.522[0.638;26.086]		1.047[0.221;5.35]		4.896[0.721;51.239]	
Moral support (Likert) (N = 99)	Decrease	0.823[0.157;3.991]	0.15	0.866[0.199;3.659]	0.23	3.339[0.683;19.878]	0.19
	Increase	0.21[0.029;1.179]		0.298[0.058;1.328]		0.877[0.149;5.172]	
Boredom (N = 99)	Decrease	0.547[0.111;2.478]	0.02	0.294[0.042;1.574]	0.002	1.432[0.303;6.91]	0.02
	Increase	8.769[1.666;58.05]		10.42[2.131;63.388]		10.238[1.91;68.998]	
Fear of COVID (Likert) (N = 100)	Decrease	1.268[0.292;5.731]	0.68	0.723[0.145;3.447]	0.17	1.665[0.349;8.418]	0.71
	Increase	1.843[0.47;7.687]		2.685[0.67;12.178]		1.734[0.426;7.855]	
Fear of COVID for relative (Likert) (N = 100)	Decrease	1.081[0.256;4.821]	0.9	0.629[0.15;2.652]	0.73	1.154[0.223;6.534]	0.38
	Increase	0.763[0.157;3.693]		1.074[0.265;4.516]		2.991[0.57;19.571]	
Insomnia (ISI) (N = 100)	Decrease	0.144[0.012;1.384]	0.002	0.083[0.006;0.954]	0.001	0.204[0.016;2.804]	0.04
	Increase	1.769[0.214;16.248]		0.959[0.117;8.909]		1.34[0.168;14.491]	
Psychological pain (Likert) (N = 98)	Decrease	0.125[0.019;0.599]	0.02	0.221[0.039;1.099]	0.0002	0.742[0.136;4.116]	0.02
	Increase	0.872[0.173;4.61]		7.445[1.273;62.246]		10.106[1.261;124.22]	

an efficient strategy to reduce suicidal risk in mood disordered patients. Fountoulakis et al. (Fountoulakis et al., 2022) proposed a multiple step model concerning the effect of the pandemic on mental health in which anxiety comes first, followed by depression, and then suicidality. Our results may suggest that loneliness experienced during lockdowns participates in anxiety, promotes depression, especially when boredom is present, and increases the risk of suicide.

Interestingly, tobacco use was a risk factor of depressive symptomatology only during the second lockdown. Tobacco consumption could be part of dysfunctional strategies to cope with loneliness and negative feelings, such as depression. Indeed, the odds of smoking more during lockdown were associated with higher subjective stress due to the COVID-19 pandemic (Koopmann et al., 2021). Moreover, current mental disorder has been associated with tobacco use as a coping strategy to deal with COVID-19 (Martínez-Cao et al., 2021). In addition, fear of contamination for relatives was a risk factor of anxiety during the non-restrictive periods, i.e. when exposure is higher.

Our findings confirm that virtual contacts and physical activity must be encouraged to prevent negative mental health outcomes, in accordance with previous literature data (Stonerock et al., 2015; Yang et al., 2020).

In patients without history of anxious disorder, the anxiety level progressively decreased during the study period. This is in agreement with previous results showing that individuals with anxiety disorders are more likely to experience psychological strain during the COVID-19 pandemic and might overestimate potential threats (Bendau et al., 2021). As expected, psychotropic treatment changes were a risk factor of depression and anxiety independently of restrictive measures. It might reflect the worsening of psychological state.

The present results must be interpreted in the light of some limitations. First, our findings may not be generalizable because participation was voluntary and by internet, thus excluding patients who did not have internet access. Second, loneliness and boredom were not assessed using validated scales. We did not investigate the financial burden/worry, which is a contributing factor to mental health (Zavlis et al., 2021), because we wanted to limit the number of questions/questionnaires to increase the survey acceptability. Third, lifetime psychopathology was diagnosed in pre-pandemic period without information about psychological status in the interval between the semi structured interview and inclusion in this study. Nevertheless, it allows to identify risk factors of poor psychological outcomes in more naturalistic approach. Fourth, we did not consider COVID-19 status of participants which has been associated with depression (Ceban et al., 2021; Renaud-Charest et al., 2021). However, a minority of patients (less than 1participant out of 5) have declared to have been suspected of or infected by the virus.

To conclude our study gives some insights into the importance of environmental factors, such as loneliness and boredom, on different mental health outcomes, that could be used to develop interventions and guidelines to mitigate the impact of the COVID-19 pandemic on the most vulnerable people.

CRediT authorship contribution statement

Emilie Olié wrote the protocol, secured funding for the project, obtained administrative approvals, supervised the project, contributed substantially to data interpretation, and drafted the article. Myriam Benramdane contributed substantially to the acquisition of clinical data and their interpretation. Jonathan Dubois performed the statistical analyses and contributed substantially to data interpretation. Philippe Courtet and Sébastien Guillaume contributed substantially to data interpretation. All authors revised the article and gave their final approval of the version to be published.

Conflict of Interest

None.

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