Persecutory ideation and anomalous perceptual experiences in the context of the COVID-19 outbreak in France: what's left one month later?

COVID-19 AND PSYCHOTIC EXPERIENCES

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Abstract

Purpose: Beyond the effects of the coronavirus pandemic on the public's health, the length of lockdown and its possible psychological impacts on populations is heavily debated. However, the consequences of lockdown on psychotic symptoms has been poorly investigated. Methods: An online survey was run from April 13 to May 11, 2020; a total of 728 French subjects from the general population were included in the study. We assessed the per- ceived impact of the COVID-19 outbreak, length of isolation, diagnosis/symptoms/hospitalisation related to the COVID-19 (oneself and family). Paranoid ideations and hallucination-like experiences were assessed via the Para- noia Scale and the Cardiff Anomalous Perceptions Scale, respectively. Self-reported measures of negative affect, loneliness, sleep diffi culties, jumping to conclusion bias, repetitive thoughts, among others, were also included. Results: Final regression model for paranoia indicated that socio-demographic variables , loneliness, cogni- tive bias, anxiety, experiential avoidance, repetitive thoughts and hallucinations were associated with paranoia ((R2 = 0.45). For hallucinations, clinical variables as well as the quality of sleep, behavioural activation, repetitive thoughts, anxiety and paranoia were associated with hallucinations in our sample (R2 = 0.28). Neither length of isolation nor the perceived impact of the COVID-19 pandemic were associated with psychotic experiences in the fi nal models. Conclusions: No evidence was found for the impact of isolation on psychotic symptoms in the general population in France one month after the lockdown. It nevertheless confirms the preeminent role of several factors previ- ously described in the maintenance and development of psychotic symptoms in the context of a pandemic and lockdown measures.

Introduction

The pandemic of the novel coronavirus disease (COVID-19) has now affected millions of people, including people in France. French people have been under lockdown from Mar 15 until May 11 leading, in many cases, to abrupt changes in 'people's lives, such as working from home or under stressful circumstances, loss of employment, and social and physical distancing with outstanding consequences for 'people's mental and physical health (Cava et al., 2005; Marjanovic et al., 2007). In addition to the uncertainty and stress of the global outbreak, questions about the effects of quarantining on mental and psychological health have quickly emerged.

A recent review by Brooks and colleagues (2020) published at Lancet summarise the currently available knowledge on the psychological effects of quarantine. Mental health issues mostly explored were post-traumatic disorder symptoms, depression, anxiety, loneliness, and insomnia (Brooks et al., 2020). Nevertheless, all studies reviewed by the authors were carried out in situations of quarantine where the person was isolated due to the infection with SARS, Ebola, H1N1 influenza pandemic, among others.

Thus, studies have been carried out in these last few weeks to understand the specific impact of the COVID-19 quarantine on mental health. For instance, Pancani and colleagues (2020) showed, in a sample of 1006 Italians currently locked down, that the length of isolation is associated with worse mental health including higher levels of depression, unworthiness, and helplessness. As for another example, Shevlin and colleagues (2020) who found in a sample of 2025 UK adults increased levels of anxiety, depression and trauma compared to previous populations studies, but not a dramatic increase. Factors that predicted higher levels of mental

health symptoms included young age, high estimates of personal risk, low income, loss of revenue, as well as pre-existing health conditions.

Surprisingly, only a few studies explored whether the current situation or its perceived impact can exacerbate psychotic experiences such as paranoid ideas and hallucinations and/or contribute to the emergence of these experiences in the general population. First, Lopes et al. (2020) found that fear of COVID-19 and political trust were significantly associated with paranoia and hallucinatory experiences in a sample of 361 people in the UK. Length of lockdown was not associated with them. Nevertheless, their study was performed earlier in the lockdown, which might not have been enough time to trigger psychotic-like experiences in the general population. Second, a study by Reed et al. (preprint) found that throughout the lockdown, there was a significant increase in self-reported paranoia with a peak during the reopening. They also reported a positive association between increased paranoia and the number of confirmed cases. Finally, they found that mandated mask wearing lead to increased levels of paranoia. However, it is important to note that Reed et al. (preprint) mainly focused on the relationships between paranoia and belief updating according to a Bayesian meta-learning framework, which is outside the scope of our study and make our two studies difficult to compare.

This reduced number of studies is despite evidence is despite evidence showing that sleep-related problems (Reeve et al., 2015), aggravated social isolation and loneliness as a result of the lockdown (Lamster et al., 2017; Michalska da Rocha et al., 2018), emotional distress (Delespaul et al., 2002; Lincoln et al., 2009) and worry/rumination (Badcock et al., 2011; Startup et al., 2016) are significant predictors of psychotic symptoms in clinical and non-clinical populations (Butler et al., 2019; Reeve et al., 2018). For instance, many studies have shown that isolation is associated with increased frequency of hallucinatory experiences (Davis et al., 1961; Kellerman et al., 1977; Zubek et al., 1961). Moreover, sleep deprivation has been found

to increase paranoia and hallucinations in a sample of non-clinical volunteers (Reeve et al., 2018).

Indeed, the vulnerability-stress model emphasizes the role of stress in the emergence of psychotic experiences (Lecomte et al., 2019; Nuechterlein et al., 1994). Many studies have found consistent evidence showing that emotional reactivity to stress is a vulnerability marker for psychosis (Myin-Germeys and van Os, 2007). Moreover, theoretical models of hallucinations highlight the fundamental role of negative emotions in the emergence and maintenance of auditory hallucinations (Birchwood, 2003; Freeman and Garety, 2003; Morrison, 2001). Similarly, theoretical models of paranoia place anxiety and worry as predictors of paranoia (Startup et al., 2016). Therefore, the recent outbreak of COVID-19, the lockdown and the exposure to sensationalized news about crises are here important stress-inducing events that can predispose individuals to paranoia and hallucinations.

The goal of the present study is, therefore, to add to the current literature information about the impact of the COVID-19 pandemic and lockdown on psychotic experiences. More specifically, we sought to study which factors are associated with paranoid ideas and hallucinations during the lockdown period. Our main correlates of psychotic experiences can be divided into five groups. We adopted Freeman and Garety's model (2014) of paranoia and their general model of psychotic symptoms (Garety et al., 2001) to guide the inclusion of our variables. According to their models, when facing stressful situations (e.g., COVID-19, lack of sleep, social isolation, etc.), individuals might interpret internal and external events in a different way because of different cognitive (i.e., jumping to conclusion) and emotional (i.e., anxiety, repetitive thoughts, emotion regulation strategies) factors, which ultimately will result in increased paranoid ideas. Likewise, stressful situations are suggested to trigger hallucinations, notably through cognitive and affective changes. Cognitive and emotional processes associated with hallucinations include repetitive thinking and intrusive thoughts (Badcock et al., 2011; Gracie et al., 2007),

negative affect such as depression and anxiety (Delespaul et al., 2002; Hartley et al., 2014), and experiential avoidance (Goldstone et al., 2011; Langer et al., 2010).

Therefore, we first included the social-demographic variables (e.g., age, gender and level of education) as well as clinical variables (e.g., cannabis consumption, previous mental health disorders diagnosis). Second, we assessed the length and perceived impact of the lockdown and participant exposure to the virus (COVID-19 related triggers). Third, we also added measures of sleep quality, level of activity and loneliness during the quarantine (Contextual triggers). Forth, we included a measure of jumping to conclusion bias (JTC), which describes an individual's tendency to make a hasty decision on the basis of little evidence. JTC is the reasoning bias most consistently associated with delusions and particularly paranoid ideations in both clinical (Dudley et al., 2016) and non-clinical samples (Freeman et al., 2008). Fifth, in light of previous studies highlighting the role of emotional processes we included measures of emotion regulation (i.e., experiential avoidance, cognitive restructuring and catastrophization), emotional distress (i.e., anxiety) and repetitive thoughts. Finally, we considered the role of paranoia (for the hallucination model) and hallucinations (for the paranoia model) since they often appear together.

First, we hypothesize that mainly negative affect, loneliness, sleep quality as well as the perception of the impact of the COVID-19 pandemic, and length of isolation (number of days since the beginning of lockdown in France) will be associated with hallucinations. Second, based on previous studies (e.g., Freeman et al., 2008), we hypothesize that emotion regulation (catastrophizing), negative affect, worry, loneliness, sleep quality, as well as the length of isolation, and perception of the impact of the COVID-19 pandemic will be associated with paranoia.

The hypothesis of the study was pre-registered (https://osf.io/gxy79/). Based on the literature, we made a few corrections in our hypothesis. For instance, we added both sleep quality (Reeve et al., 2015) and loneliness (Lamster et al., 2017) as a predictor of paranoia.

Materials and methods

Participants

Our sample was recruited in the general population through online social media, through university websites and via acquaintances of the authors with a snowball procedure. Moreover, each participant was requested to invite at least three friends, family members, or acquaintances to take part in the study. Inclusion criteria consisted of being 18 years old or more and being fluent in French. Participants did not receive any compensation for participating in the study.

In total, 1154 participants started the study, but only 733 complete all scales, including the Paranoia Scale. Fewer participants completed both the measure of paranoia and hallucination-like experiences (N = 719). Participants who failed at least two validation questions (6 questions were included in the study) were excluded (N = 5). Two participants completed the whole survey in less than 15 minutes (but more than 12 minutes), which can be considered a short completing time. We decided not to exclude them because they failed none of the 6 validity questions. In total, 728 participants who consented to participate and complete at least the Paranoia Scale were included in the final sample.

Participants could access the survey through a web-link, and then they were directed to the introductory page. The survey guarantees the anonymity of data handling by assigning a random numeric code to participants. No identifying data were requested. Participants' consent was obtained by asking them to click "Continue". Participants could drop out of the study at any time by simply closing the web browser. Participants were told that the goal of the present study was to investigate the impact of lockdown on our mental health.

The study was carried out according to the code of ethics of the World Medical Association (Declaration of Helsinki). Ethical clearance was provided by Centre Hospitalier Universitaire de Montpellier, IRB-MTP_2020_04_202000449.

Data is available at https://osf.io/gxy79/.

Measures

Socio-demographic variables: Participants completed a series of questions about the socio-demographic characteristics, including sex, age, nationality, education level, professional status, and family situation.

Clinical measures: Participants provided information about current and past mental health diagnosis (i.e., "*I currently suffer from a psychiatric pathology diagnosed by a psychiatrist or psychologist"*), mental health treatment (i.e., "*I regularly consult a mental health professional, i.e. a psychologist, a psychotherapist or a psychiatrist"* and *"I am currently taking medication due to psychological difficulties"*) and drugs consumption.

COVID-19 related measures: Participants were requested to complete different questions about their perception of the lockdown and security measures as well as the impact of the lockdown. The latter question covered different domains, including the effect of the lockdown on French's lifestyle, economy, mental health and health system, as well as its impact on one's psychological and physical health and finances. Participants were requested to rate whether they agree with the statement, and if they did, they also evaluate their levels of preoccupation and distress. Finally, participants were requested to assess whether they or someone close to them was infected by the COVID-19 (received a diagnosis), presented symptoms of COVID-19 (e.g, fever) and/or was hospitalized.

The *Behavioural Activation for Depression Scale* – BADS (Kanter et al., 2007) is a 10-item scale assessing behavioural activation. Each item is rated on a 7-point scale (from 0 to 6). For the total scale, higher scores indicate higher behavioural activation.

The *UCLA Loneliness Scale* (Russell, 1996) is a 20-item measure that assesses how often a person feels disconnected from others. Items are rated on a 4-point rating scale ranging from 1 (never) to 4 (always). Higher scores indicate higher levels of loneliness.

The Pittsburgh Sleep Quality Index – PSQI (Buysse et al., 1989) is a subjective measure of sleep. It measures seven domains: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction over the last month. Scoring of the answers is based on a 1 to 4 Likert Scale. In the current study, we assessed only two domains (three questions): use of sleep medication and daytime dysfunction. The total score (Sleep Quality) was calculated by adding the three scores. Missing data was replaced using Median imputation. The missing data was the result of a problem when defining the survey parameters in Qualitrcs.

The *Brief Experiential Avoidance Questionnaire* – BEAQ (Gámez et al., 2014) is a self-report questionnaire designed to measure experiential avoidance, that is, the unwillingness to remain in contact with distressing emotions, thoughts and other experiences. Items are rated on a 6-point scale ranging from 1 (strongly disagree) to 6 (strongly agree). This brief version is composed of 15 items.

The *Cognitive Emotional Regulation Questionnaire* - CERQ (Garnefski and Kraaij, 2007) is a 36-item scale designed to evaluate nine cognitive strategies used to regulate emotions in response to negative or unpleasant events. In the present study, we focused on two: Catastrophizing and Putting into perspective (or cognitive reappraisal) because previous studies have found that catastrophizing and impaired cognitive reappraisal are important correlated of paranoia (Startup et al., 2007; Westermann et al., 2014).

The *Perseverative Thinking Questionnaire* – PTQ (Ehring et al., 2011). The PTQ was developed to propose a transdiagnostic measure of the core characteristics of negative repetitive thinking, such as the repetitiveness, the intrusiveness, or the difficulty of disengaging, and the perceived unproductiveness of RNT. The PTQ is a 15-item scale. Items are rated on a 5-point scale ranging from 0 (never) to 4 (almost always).

The *Cognitive Bias Questionnaire for Psychosis* - CBQp (Peters et al., 2013). The CBQp was developed to capture 5 cognitive distortions including jumping to conclusions,For the purpose of the study, we focused on the six items of the CBQp related to the jumping to conclusion bias (JTC). The potential range of scores was 6–18.

The *Depression Anxiety and Stress Scale* – DASS (Lovibond & Lovibond, 1994) is a scale measuring negative affect including depression, anxiety and stress. Each item is scored on a 4-point scale (0-never; 4-all the time). Higher scores indicate greater levels of negative affect.

The *Paranoia Scale* – PS (Fenigstein and Vanable, 1992) is a 20-item self-report questionnaire developed to assess the frequency of subclinical levels of paranoia. It is scored on a 1–5 Likert scale with scores ranging from 20–100.

The *Cardiff Anomalous Perceptions Scale* – CAPS (Bell et al., 2006) is a self-report scale designed to assesses a range of hallucination-like experiences. It consists of 32 items, with yes/no as response options.

The *Validation questions.* Six items were added to detect random completion or attention lapses (e.g., "please answer 'A few' to this question (validity question)" or "please do not reply the question below"), and simulation of psychotic symptoms (Moritz et al., 2013; e.g., "I was abducted by aliens" or " Do you ever see white mice or other small animals that no one else can see (hallucinations)?").

For all measures, participants were requested to consider only the period of lockdown while completing the questionnaires.

Statistical Analyses

Mean, and the standard deviation was calculated for all variables. Correlations and multiple linear regression analysis were used to test the relationship between the dependent variables and the independent variables. Regressions were performed in R with the *lm* (linear model) function. Moreover, we perform, regression diagnostics including tests of normality of residuals (Normal Probability Plot), homoscedasticity (Plot of residuals versus predicted value), independence (Durbin-Watson statistic) of Residuals, Non-linearity, and multicollinearity (VIF < 2). The function *Normalize()* was employed to improve the model. Dummy variables were created for the categorical variables. For all models, we calculated the Akaike's information criterion (AIC) (Akaike 1973; Burnham & Anderson 2002; Garamszegi 2010), an estimate of relative quality of statistical models. The significance level for our analyses was set at $p < 0.05$. All statistical analyses were performed using the R Studio.

Additional supplementary analyses are reported in Supplementary data.

Results

Descriptive Variables

Descriptive characteristics of the sample are presented in Table 1 (for continuous variables) and Table 2 (for categorical variables).

Insert Table 1 and 2 here

Paranoia

After Benjamini and Hochberg correction, paranoia was found to be statistically correlated to age, perceived impact of lockdown, sleep quality, loneliness, experiential avoidance, behavioural activation, catastrophization, repetitive thoughts, cognitive bias, negative affect and hallucinations (see Table 1 supplementary data). Mann-whitey test and Kruskal-Wallis rank sum test showed statistically significant differences in paranoia when considering the following independent variables: Education, Diagnosis of Mental disorder, Past Mental disorder, Currently seeing a mental health professional, and Currently taking medication for a mental disorder (see Table 2 supplementary data).

Regression

Seven different models were tested for paranoia (see supplementary data for all models). First, we entered only the socio-demographic variables (Model 1). Although sex was not related to paranoia, we decided to keep it in the final model due to the important number of female (vs male) in our sample. We created a dummy variable for education (three levels; i.e., less than 12 years of education, 12-15 years of education – bachelor degree, and more than 15 years). Second, we also included clinical variables (Model 2).

Third, we entered the COVID-19 related triggers (Model 3). Forth, in Model 4, quality of sleep during the quarantine, behavioural activation and loneliness were added (Contextual triggers). Fifth, the cognitive factors were included (Model 5) followed by the emotional ones (Model 6). Finally, in Model 7, we also included hallucinations. The choice of anxiety was based on theoretical grounds (Freeman & Garety, 2014) and in order to avoid collinearity issues. Entering the total score of the DASS resulted in multicollinearity.

As it can be seen in Table 3, most clinical and COVID-19 related variables were no longer statistically associated with paranoia once we entered in the model the affective and cognitive processes that are commonly associated with paranoia. Together with the socio-demographic (sex, age and education > 15 years) variables, loneliness, cognitive bias, anxiety, experiential avoidance, repetitive thoughts and hallucinations were associated with paranoia.

Insert here Table 3

Additional analyses using Multi-model Averaging were conducted to produce a predictive model through multi-model inference and model averaging. It performs an automated model selection by generating all model combinations possible and, subsequently, provide a selection of models based on their AIC. Paranoia's Model 7 was used in the analyses, which were conducted using R package MuMIn (Bartón, 2020). The resulted model with lowest AIC contained 10 predictors (i.e., Age, Anxiety, Experiential Avoidance, Hallucination-proneness, Jumping to Conclusions bias, Education, Repetitive thoughts, Loneliness, Past mental health disorders and Sex). Variables found to be statistically significant predictors were the same as the current Model 7 (New model: $R^2 = 0.447$, $R^2_{ajd} = 0.438$; more detailed results in Supplementary Data). ANOVA was employed to compare the fit of the two models (model 7 and this new model). The difference between the two models in terms of fit was not statistically significant, $F = 0.828$, $p = 0.567$.

Hallucinations and Other unusual experiences

After Benjamini and Hochberg correction, hallucinations were found to be statistically correlated to all variables except for the length of isolation and reappraisal (see Table 1 supplementary data). Moreover, Mann-whitey test showed statistically significant differences in hallucinations when considering the following independent variables: Diagnosis of Mental disorder, Past Mental disorder, Currently seeing a mental health professional, and Currently taking medication for a mental disorder (see Table 1 supplementary data).

Regression

The same steps adopted to test the models for paranoia were adopted here (Table 4; but see supplementary data for all models). The only difference here is that paranoia was entered in the final step. Again, we choose to include here only anxiety considering previous studies showing that it is "the most prominent emotion during hallucinations" and that "reports of anxiety intensity exceeded baseline levels before the first report of auditory hallucinations" (Delespaul, et al., 2002, abstract). Moreover, we decided to keep only one of the DASS scores to avoid multicollinearity problems. Like before, we also decided to keep sex and education in the model.

As it can be seen in Table 4, in Model 7, diagnosis of a mental disorder, currently taking medication, quality of sleep, behavioural activation, repetitive thoughts, anxiety and paranoia were associated with hallucinations in our sample. Having a diagnosis was associated with having more hallucinatory experiences. Medication use was negatively associated with hallucinations. Lower sleep quality (higher score) was associated with reporting more hallucinations. Surprisingly, behavioural activation was positively associated with hallucinations. Repetitive intrusive thoughts, anxiety and paranoia were positively associated with hallucinations.

Insert here table 4

Influential outliers were found in the model as well as issues with the normality of residuals. Exclusion of outliers did not improve the model; neither changed the results. We decided to report the model without excluding them. Nevertheless, caution is necessary when generalizing our findings.

As for paranoia, additional analyses using Multi-model Averaging were conducted in order to produce a predictive model for hallucinations. Hallucination's Model 7 was used in the analyses (Table 4s). The resulted model with the lowest AIC contained 7 predictors (i.e., Medication, Mental Disorder, Behavioural Activation, Anxiety, Paranoia, Repetitive Thoughts and Sleep Quality). Variables found to be statistically significant predictors were the same as the current Model 7 (New model: $R^2 = 0.276$, $R^2_{ajd} = 0.269$; more detailed results in Supplementary Data). ANOVA was employed to compare the fit of the two models (model 7 and this new model). The difference between the two models in terms of fit was not statistically significant, $F = 0.618$, $p = 0.814$.

Discussion

The actual pandemic of the new Coronavirus disease (COVID-19) has led many countries to impose lockdown to a large proportion of their population to avoid spreading the disease further. France, for example, has been put on lockdown for eight weeks. As indicated by a recent review (Brooks et al., 2020), past experiences revealed that more extended quarantine is associated with poorer psychological outcomes. Surprisingly, no study has yet explored whether the length of lockdown and its perceived impact can exacerbate psychotic

experiences, including paranoid ideas and hallucinations in the general population. This is despite the report of several cases of brief psychotic disorder triggered or exacerbated by the fear of the coronavirus (Fischer et al., 2020). The goal of the present study was to evaluate the impact of the length of the quarantine and perceived impact associated with the COVID-19 pandemic on paranoid ideation and hallucinations in the general population and also to examine an integrative model of psychotic symptoms in the context of the lockdown imposed by COVID-19 pandemic.

Overall, despite cumulative evidence and scientific reports that the COVID-19 pandemic and, particularly, isolation affects mental health and particularly financial worry, y or loneliness in the general population (Asmundson and Taylor, 2020; Tull et al., 2020), our results did not support such a conclusion regarding paranoid ideations and hallucinations and other unusual perceptual experiences. Firstly, the average score of paranoid ideations (M = 35.58; SD = 12.32) and hallucinations (M = 3.73; SD = 4.68) was similar or inferior to those previously found in the general community populations outside pandemic conditions. For instance, for paranoia, Hajdúk et al. (2019), in the UK, reported a mean score of 39.35 (SD = 12.39), while in another study (2014) conducted in Portugal, they found the mean score for the Paranoia Scale of 44.20 (SD = 10.61). Regarding hallucinations and other unusual perceptual experiences, the validation study of the CAPS (Bell et al., 2006), in the UK, found a mean of 7.3 (SD = 5.8; participants were much younger in their study, mean age = 21.6, SD = 5.4). As for another example, Moseley and colleagues (in preparation), in a large multi-country sample (including France), reported a mean for the CAPS of 4.68. Thus, there is no evidence of abnormal levels of psychotic symptoms in our sample one month after the confinement.

Secondly, the length of isolation was found to be correlated with neither paranoia ideas nor hallucinations. These results corroborate a recent study by Lopes et al. (2020) who found that length of lockdown was not associated with psychotic experiences in the general

population. Instead, fear of COVID-19 and political trust were significantly associated with paranoia and hallucinatory. Moreover, contrary to our hypothesis, even though the perceived impact of the COVID-19 pandemic was initially related to psychotic symptoms, in our regression analyses, their effect was small and became non-significant once we considered other contextual factors that are commonly associated with hallucinations and paranoia such as sleep difficulties (Reeve et al., 2015), and loneliness (Lamster et al., 2017). Moreover, neither the presence of COVID-19 symptoms nor the presence of a family member with a diagnosis was associated with reporting more psychotic-like experiences. Unfortunately, because of the small number of participants reporting a diagnosis of COVID-19 or hospitalizations due to it, we could not test whether these variables were associated with increased psychotic symptoms.

Regarding our paranoia model, the variables entered in the model that explained 44% of the variance of paranoid ideations were loneliness, jumping to conclusions bias, anxiety, experiential avoidance and hallucinations. These findings partially support our hypothesis. Age, sex and education were also correlated to paranoia (Freeman et al., 2008; Freeman and Garety, 2014). Our model of paranoia during the COVID-19 pandemic fits well with the threat anticipation model (Freeman, 2007; Freeman and Garety, 2014), which proposes a multi-factorial account of the formation and maintenance of persecutory delusions comprising *affective processes* (e.g., anxiety) (Freeman and Garety, 2003); *anomalous experiences* (e.g., perceptual anomalies), *worry*, *reasoning biases* (e.g., jumping to conclusions), and finally *social factors*, such as adverse or stressful events and environments. One of the main contributions of our findings is that we reproduce and extend the threat anticipation model under exceptional conditions corresponding to the defining global health crisis of our time.

The variables that were associated with hallucinations were anxiety, a current diagnosis of mental disorder, and currently taking medication. It also included reduced sleep quality, higher levels of behavioural activation, repetitive negative thinking and paranoia ideation that

all together explain 27% of hallucination. These results corroborate some of our hypothesis and also previous studies showing the importance of anxiety (Delespaul et al., 2002), quality of sleep (Reeve et al., 2015), and repetitive thinking (Badcock et al., 2011; Gracie et al., 2007) as important factors contributing to hallucinatory experiences. Surprisingly, behavioural activation was positively associated with hallucinations in the regression model (although not in the correlation analyses). Multicollinearity problems were not detected. Theoretically, these results contradict the idea that individuals who are more engaged in meaningful activities might report fewer hallucinations in daily life. The interaction with another variable might be contributing to this finding, despite the absence of multicollinearity problems. The next step in our comprehension of how the COVID-19 outbreak could lead to increase psychotic symptoms and specifically paranoia will be to consider running a network analysis (e.g. Contreras et al., 2020). Indeed, network analyses allow us to assess the dynamics between core psychological psychotic-related mechanisms instead of only looking at the predictors of psychotic experiences. Following the work of Contreras et al. (2020) who found that feeling of being close to others negatively predicted paranoia at the next time point, we thus could hypothesize that length of isolation and perception of the impact of COVID 19 would be associated with worry and loneliness. In turn, worry and loneliness would be related to depression, anxiety and reduced sleep quality, and also paranoia. Future studies using network analysis are needed and could open new perspectives in our comprehension of the psychological impact of the COVID 19 pandemic.

Our study has several limits. First, this is a transversal study, and it is still too soon to forecast the medium-term consequences of the confinement. Second, our sample comes from the general population without restricted access to the internet. Our results need to be confirmed in populations that are socially or economically fragile, belonging to an immigrant or minority group of the population with a higher risk of developing paranoid ideations (Lopes, et al., 2020).

Similarly, even if it was not the aim of our study, our results cannot be generalized to clinical populations. Future studies are needed to explore specifically the short and long-term consequences of the correlates on psychotic symptoms in populations facing difficulties in accessing timely health services (Yao et al., 2020). Third, considering we recruited mainly via social media, our sample might not be representative of the general population. Regarding the representativity of our sample, 13% of our participants were students, 7% unemployed, and 15% retired. Mean age was 44.9. However, 76% were female, and 80% of our sample had an education degree. When compared to national estimates from the French National Institute of Statistics and Economic Studies (Institut National de la Statistique et des Études Économiques, INSEE), our sample is representative in terms of age, marital status, and profession. Nevertheless, women and highly educated participants are over-represented. Here, one limitation of our study is the lack of information participants' residential area (e.g., rural, small urban or large urban areas), which prevent us from determining whether it had an impact in our main variables (i.e., paranoia, COVID-19 related variables). The use of crowdsourcing platforms might be a potential solution to recruit samples that are more representative of a specific particular population. Forth, we had no face to face interview to properly assess diagnosis. Therefore, the data regarding the proportion of participants suffering from a mental health disorder should not be generalized. Finally, it is also vital to mention limitations in measuring paranoia as a trait in a survey as opposed to using experimental paradigms that aim to induce or manipulate paranoid thinking (e.g. Saalfeld et al., 2018; Barnby et al., 2020). Indeed, several models of paranoid ideation (i.e. « The sensitization model (Freeman, 2007)) suggest that paranoid thinking arises from complex interactions between the context (particularly environmental and interpersonal) stressors and genetic vulnerabilities. Future studies might employ experimental paradigms such as those derived from game theory that requires participants to make paranoia attribution. Importantly, these paradigms can be easily

adapted to internet-based contexts and, therefore, can be of major interest in our understanding of psychotic experiences in the context of the pandemic outbreak.

In conclusion, the association between length of isolation and psychotic symptoms in the general population in France was not statistically significant. Our findings indicate that although the perceived impact of lockdown is associated with increased paranoid ideas and hallucinatory experiences, other factors are more significant contributors to our final model. Contrary to what one might have feared (Troyer et al., 2020), the COVID-19 pandemic does not appear to be a direct risk factor for psychotic symptomology, at least in the French population with an average lockdown length above one month. One could, however, hypothesize that the pandemic and the lockdown might maximize other relevant risk factors. Finally, our study confirms the preeminent role of several cognitive, emotional and contextual factors previously described in the maintenance and development of psychotic symptoms in the context of an epidemic and lockdown measures.

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Author contributions:

Catherine Bortolon: Conceptualization, Methodology, Data analyses, Writing Original draft; **Delphine Capdevielle**: Writing- Reviewing and Editing; **Julien Dubreucq**: Writing-Reviewing and Editing; **Stéphane Raffard**: Conceptualization, Methodology and Writing-Reviewing and Editing

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Table 1.

Characteristics of a sample of 728 subjects from the general population

	Mean	SD
Age	44.90	15.95
Covid-19 related triggers		
Perceive impact of the quarantine	23.36	5.36
Associated Preoccupation	25.21	9.97
Associated Stress	20.05	11.14
Length of Isolation	38.23	8.42
Contextual triggers		
Sleep quality	1.99	1.77
Behavioral Activation	31.39	9.42
Loneliness	40.31	9.66
Cognitive and Emotional factors		
Experiential Avoidance	48.83	12.65
Reappraisal	15.49	3.62
Catastrophisation	5.84	2.41
Repetitive thoughts	22.97	13.01
Jumping to conclusion bias	9.51	1.74
Negative Affect	13.96	11.33
Anxiety	3.11	3.59
Depression	4.91	4.67

Stress	5.94	4.63
Paranoia	35.58	12.32
Hallucination *	3.73	4.68

Note : * N = 714

Table 2.

Number (N) and percentage (%) for the categorical variables

	N	%
Sex		
Female	554	76.10
Male	173	23.76
Missing	1	0.1
Education		
Elementary School	2	0.20
Secondary School	9	1.24
High School	129	17.72
Bachelor's Degree	228	31.32
'Master's degree	295	40.52
PhD	65	8.93
Family Situation		
Single	191	26.24
Married	222	30.49
In a couple	186	25.55
Divorced	111	15.25
Widower	18	2.47
Profession		
Student	97	13.32

Employee	302	41.50
Independent worker	90	12.36
Retired	112	15.38
Unemployed	52	7.14
Incapacity to work	21	2.88
Other	54	7.42
Nationality		
French	691	94.92
Other	37	5.08
Country		
France	714	98.08
Other	14	1.92
Self-report Diagnosis of Mental Disorder		
No	634	87.09
Yes	80	10.99
Depression	31	38.75
Anxiety Disorders	20	25
Schizophrenia/Psychosis	3	3.75
Bipolar Disorder	6	7.5
Eating Disorder	2	2.5
Personality Disorder	8	10
Autism Spectrum Disorder	6	7.5

Other	4	5
Prefer not to say	14	1.92
Self-report Past Mental Disorder		
No	546	75.00
Yes	165	22.66
Depression	117	70.90
Anxiety Disorders	21	12.72
Schizophrenia/Psychosis	2	1.21
Bipolar Disorder	6	3.63
Eating Disorder	7	4.24
Personality Disorder	2	1.21
Autism Spectrum Disorder	1	0.60
Other	8	4.84
Prefer not to say	17	2.34
Currently seeing a mental health professional		
No	595	81.73
Yes	128	17.58
Prefer not to say	5	0.69
Currently taking medication		
No	619	85.03
Yes	102	14.01
Prefer not to say	7	0.96

Cannabis consumption		
No	698	95.88
Yes	30	4.12
Diagnosis of COVID-19		
No	711	97.66
Yes	17	2.34
Familiy diagnosed COVID-19		
No	564	77.47
Yes	164	22.53
COVID-19 symptoms (e.g., fever)		
No	642	88.19
Yes	86	11.81
Family hospitalised due to COVID-19		
No	712	97.80
Yes	16	2.20
Hospitalised due to COVID-19		
No	727	99.86
Yes	1	0.14

Table 3.

Regression Models for Paranoia. (N = 714)

	Paranoia				
Model 7	*Estimates*	*CI*	*p*	R^2 / R^2 adjusted	F
(Intercept)	3.90	-4.31 – 12.12	0.351	0.452 / 0.439	31.81***
Age	**-0.08**	**-0.13 – -0.04**	**0.001**		
Sex	**2.67**	**1.04 – 4.29**	**0.001**		
Education (12-15 years)	-1.55	-3.54 – 0.44	0.126		
Education (> 15 years)	**-2.54**	**-4.43 – -0.66**	**0.008**		
Diagnosis of Mental Disorder	-0.75	-3.66 – 2.17	0.615		
Past Mental Disorder	1.49	-0.19 – 3.16	0.082		
Currently seeing a mental health professional	-0.87	-3.06 – 1.32	0.435		
Currently taking medication	1.77	-0.70 – 4.24	0.160		
Perceived impact of the quarantine	-0.08	-0.23 – 0.07	0.314		
Sleep quality	-0.17	-0.66 – 0.33	0.513		
Behavioural Activation	0.04	-0.06 – 0.14	0.426		
Loneliness	**0.36**	**0.27 – 0.45**	**<0.001**		

Jumping to conclusion Bias	**1.22**	**0.76 – 1.68**	**<0.001**
Anxiety	**0.60**	**0.32 – 0.88**	**<0.001**
Experiential Avoidance	**0.08**	**0.01 – 0.14**	**0.016**
Repetitive Thoughts	**0.08**	**0.00 – 0.15**	**0.048**
Catastrophisation	0.24	-0.13 – 0.62	0.198
Hallucinations	**0.54**	**0.36 – 0.72**	**<0.001**

Note: *** $p < < 0.001$

Table 4.

Regression Models for Hallucinations. (N = 714)

	Hallucinations				
Model 7	*Estimates*	*CI*	*p*	R^2 / R^2 adjusted	F
(Intercept)	-3.27	-6.56 – 0.02	0.051	0.283 / 0.264	15.23**
Age	-0.00	-0.02 – 0.01	0.605		
Sex	-0.42	-1.08 – 0.24	0.209		
Education (12-15 years)	-0.11	-0.91 – 0.69	0.793		
Education (> 15 years)	-0.16	-0.92 – 0.59	0.670		
Diagnosis of Mental Disorder	**1.46**	**0.29 – 2.62**	**0.014**		
Past Mental Disorder	0.46	-0.22 – 1.13	0.184		
Currently seeing a mental health professional	-0.32	-1.20 – 0.55	0.468		
Currently taking medication	**-1.33**	**-2.32 – -0.34**	**0.008**		
Perceived impact of the quarantine	0.01	-0.06 – 0.07	0.866		
Sleep quality	**0.31**	**0.11 – 0.50**	**0.003**		
Behavioural Activation	**0.06**	**0.02 – 0.09**	**0.004**		
Loneliness	0.02	-0.02 – 0.05	0.398		
Cognitive bias	-0.05	-0.24 – 0.14	0.586		
Repetitive Thoughts	**0.04**	**0.01 – 0.07**	**0.012**		
Experiential Avoidance	0.01	-0.02 – 0.03	0.533		

Anxiety	**0.31**	**0.19 – 0.42**	**<0.001**
Catrastropisation	-0.08	-0.23 – 0.07	0.321
Paranoia	**0.09**	**0.06 – 0.12**	**< 0.001**

Note: *** $p < < 0.001$