Stress induced by the COVID-19 health situation in a cohort of 111 subjects present in the Bataclan concert hall during the November 2015 terrorist attacks in Paris

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ABSTRACT

Background: The management of the psychological consequences of the COVID-19 pandemic is all the more difficult when subjects suffer from a prior psychiatric illness. BV13 is a 54-month prospective longitudinal cohort study of 111 subjects who were present in the Bataclan concert hall during the November 2015 terrorist attack in Paris.

Objectives: Our first objective was to investigate the association between stress related to the COVID-19 pandemic and PTSD symptoms, notably with respect to two positive risk factors: trait mindfulness and social support. The second was to explore how PTSD severity mediated the relationship between trait mindfulness and COVID-19-induced stress.

Method: The primary endpoint was evaluated using the COVID-19 Peritraumatic Distress Index (CPDI). PTSD symptoms were evaluated using the PTSD Check List Scale (PCL-5) during the sanitary crisis and two years before. Social support was assessed with a Likert scale that measured perceived support from family, friends and the workplace. Trait mindfulness was measured with the 14-item Freiburg Mindfulness Inventory (FMI).

Results: 54 months after the attack, a univariate analysis identified a significant positive correlation between COVID-19 stress (CPDI) and PCL-5 (r = 0.77, p < 0.01), on the one hand, and significant negative correlations with FMI (r = -0.59, p < 0.01), and social support (r = -0.28, p < 0.01) scores, on the other hand. In the multivariate model, CPDI scores were closely associated with PCL-5 scores (p < 0.01) after adjustment for FMI and social support scores. CPDI and FMI scores were significantly associated (p < 0.05), but not CPDI and social support scores (p = 0.89). The PTSD score was a strong mediator of the relationship between trait mindfulness (FMI) and COVID-19 stress (CPDI) scores.

Conclusion: PTSD symptoms diminished the beneficial impact of trait mindfulness on stress related to COVID-19. Our finding highlights that subjects with previous experience of trauma need specific treatment for PTSD symptoms during the COVID-19 crisis.

Estrés inducido por la situación de salud del COVID-19 en una cohorte de 111 sujetos presentes en la sala de conciertos Bataclan durante los atentados terroristas de noviembre del 2015 en París

Antecedentes: El manejo de las consecuencias psicológicas de la pandemia del COVID-19 es aún más difícil cuando los sujetos padecen de una enfermedad psiquiátrica previa. BV13 es un estudio de cohorte longitudinal prospectivo de 54 meses de 111 sujetos que estuvieron presentes en la sala de conciertos Bataclan durante el ataque terrorista de Noviembre del 2015 en París.

Objetivos: Nuestro primer objetivo fue el de investigar la asociación entre estrés relacionado con la pandemia de COVID-19 y síntomas de TEPT, en particular con respecto a dos factores de riesgo positivos: rasgos de atención plena (Mindfulness) y apoyo social. El segundo fue de explorar cómo la severidad del TEPT mediaba la relación entre los rasgos de atención plena y el estrés inducido por COVID-19.

Método: El criterio de evaluación principal se evaluó usando el Índice de Malestar Peri traumático COVID-19 (CPDI en sus siglas en inglés). Los síntomas de TEPT se evaluaron usando la Escala de lista de chequeo para TEPT (PCL-5) durante la crisis sanitaria y dos años antes. El apoyo social fue evaluado con una escala de Likert que media el apoyo percibido por la...
1. Introduction

The current COVID-19 pandemic is an unprecedented challenge for mental health professionals (Peteet, 2020). On the one hand, the crisis is forcing people to live in isolation, and many anxious-depressive conditions have been described as possible consequences (Mengin et al., 2020). On the other hand, this environmental constraint can be perceived as a threat, increasing anxiety and challenging the ability to cope with incertitude (Carleton, 2016), especially in vulnerable subjects. The stress of living through the COVID-19 crisis has been considered as exceptional, as it has revealed a new type of mental and somatic distress (Qiu et al., 2020).

The management of the psychological consequences of the COVID-19 crisis is all the more difficult when subjects suffer from a pre-existing psychiatric illness (Wang et al., 2020). For example, the pandemic has been shown to have a massive psychological impact in a population of Chinese youth, who exhibited intense symptoms of post-traumatic stress disorder (PTSD) (Liang et al., 2020). The intensity of PTSD symptoms have been found to fluctuate, and are greatly influenced by cooccurring symptoms (Shalev, Liberzon, Marmar, & Longo, 2017; Solomon & Mikulincer, 2006). Moreover, a history of trauma is a negative risk factor (Karam et al., 2014). In this context, the current COVID-19 crisis can be considered as a new exposure to a threatening situation that could reactivate PTSD symptoms (Stardo, Steardo, & Verkhovatry, 2020).

BV13 is a 54-month prospective longitudinal cohort study of 111 subjects who were present in the Bataclan concert hall during the November 2015 terrorist attack in Paris. The study evaluates the prevalence and evolution of PTSD among the cohort. As our population had already been exposed to a violent event four years earlier, we anticipated that they would be more vulnerable to the onset of PTSD. Our earlier work revealed that low trait mindfulness was the strongest positive risk factor for PTSD, six months after the terrorist attacks in the cohort (Gilbert et al., 2018). People characterized by mindfulness can be described as resilient individuals who are aware of the transient nature of negative affects (Thompson, Arnkoff, & Glass, 2011). Mindfulness is
also linked to the ability to efficiently manage emotions (Chambers, Gullone, & Allen, 2009).

A perceived good social support has been identified as another positive risk factor for PTSD (Gros et al., 2016). In the current context, social support is a particular challenge, and its impact on coping with the COVID-19 crisis needs to be further investigated (Hossain et al., 2020).

2. Objectives

Our first objective was to investigate the association between stress related to the COVID-19 crisis and PTSD symptoms in the BV 13 cohort, notably with respect to two positive risk factors: trait mindfulness and social support. Secondly, we investigated how PTSD severity mediated the relationship between trait mindfulness and stress induced by the pandemic. Our hypothesis was that PTSD symptomology blocked the protective effect of mindfulness on stress due to COVID-19.

3. Method

3.1. Participants and procedure

Participants were recruited from members of an association for victims of the Paris terrorist attack (Life For Paris). All of the association’s members were invited to participate via an online information sheet that had been endorsed by the association’s board members. The inclusion criterion was that the person had been present in the Bataclan concert hall during the attack. The study was presented as an evaluation of PTSD risk factors based on online self-assessment questionnaires (guidance on completing the questionnaires was provided). The first participant was enrolled on 12 April 2016, and the last on 5 August 2018.

PTSD, social support, mindfulness, and COVID-19 stress data were recorded at 54 months after the attack, between 16 April 2020 and 13 May 2020.

The study was conducted in accordance with all applicable regulatory requirements, and approved by the ethics committee of TOURS OUEST 1 (ClinicalTrials.gov NCT02853513). All volunteers provided written informed consent before participation. Our project received moral and financial support from the French National Center for Scientific Research (CNRS Attentats-Recherche).

3.2. Measures

Socio-demographic information (sex, age, family status, education, and professional status) were collected.

The primary endpoint of the study was evaluated using the COVID-19 Peritraumatic Distress Index (CPDI) (Qiu et al., 2020). The CPDI measures stress related to COVID-19, based on the following scales: frequency of anxiety; depression; specific phobias; cognitive change; avoidance and compulsive behaviours; physical symptoms; and loss of social functioning during the previous week. Scores range from 0–100. A score of 28–51 indicates mild to moderate distress, while a score ≥52 indicates severe distress (Qiu et al., 2020). The questionnaire was first used in China, and translated into French with the permission of the author. We also included an open-ended question regarding the positive or negative effects of the COVID-19 crisis on PTSD symptoms during the first period of isolation in France. Responses were used to classify subjects into three categories: positive, neutral or negative effects.

PTSD symptoms were evaluated using the PTSD Check List Scale (PCL-5) (Ashbaugh et al., 2016) based on DSM-5 criteria (American Psychiatric Association, 2013).

Social support was assessed using a Likert scale that measured perceived support from family, friends and the workplace. Values ranged from 1 (low) to 4 (excellent). Our measure is a sum of the 3 scales.

Trait mindfulness was measured with the 14-item Freiburg Mindfulness Inventory (FMI) (Walach, Buchheld, Buttenmüller, Kleinknecht, & Schmidt, 2006). The Freiburg Mindfulness Inventory-14 is a short form with 14 items developed for people without any background knowledge in mindfulness. Each self-descriptive statement was evaluated using a four-point Likert scale ranging from 1 (strongly disagree) to 4(strongly agree). We used the French validated version. The score range goes from 14 to 52.

3.3. Data analysis

All statistical analyses were performed with R software (version 3.6.3). Apart from core functions we used functions from ggpplot, gvlma, lavaan, mediation and sumpel packages.

None of the participants were excluded.

Measures recorded at 54 months correspond to the first period of isolation during the COVID-19 crisis in France. We also used PCL-5 measures that were collected at 30 months (2 years before the COVID-19 crisis). We made our analysis using both set of PCL-5 measures that we called ‘former’ and ‘actual’.

The univariate analysis used Pearson’s correlation coefficient. Only variables with p-values<0.10 in univariate analyses were used to build a multivariate regression model. The dependent variable was CPDI scores, and PCL-5 FMI and social support scores were
explanatory variables. Significance was set at \( p \)-value<0.05.

Finally, we also investigated the mediating role of PTSD (measured with the PCL-5) in the relation between COVID-19 stress (measured with the CPDI) and trait mindfulness (measured with the FMI).

4. Results

4.1. Descriptive analysis

Our cohort of 111 subjects is characterized by the fact that all subjects experienced the same trauma, at the same time. 15% were injured by firearms. 55% of them stayed inside the theatre for more than an hour during the attack. Women are slightly over-represented (60%), 77% are between 26 and 45 years old. There is no predominant family status. Most are highly educated, and managers are over-represented. 25% of them had already suffered a trauma before.

Subjects were asked whether they thought that the COVID-19 crisis had made their PTSD symptoms worse or better. Half considered that the crisis had had no effect, while a third thought that it had had a negative effect.

According to the CDPI index, 11% suffered from severe distress and 40% from a mild to moderate distress.

4.2. Univariate analysis

The univariate analysis found, on the one hand, a significant positive correlation between COVID-19 stress (CPDI) and actual PCL-5 (\( r = 0.77, p < .01 \)) and significant negative correlations with FMI (\( r = -0.59, p < .01 \)) and social support (\( r = -0.28, p < .01 \)) scores, on the other hand (Figure 1). We obtained similar result using the former PCL-5 scores.

4.3. Multivariate analysis

The multivariate model highlighted that CPDI (COVID stress) was significantly positively associated with actual PCL-5 (PTSD) scores (\( p < .001 \)) after adjustment for FMI and social support scores. Moreover, CPDI and FMI scores were significantly negatively correlated (\( p = .05 \)), but CPDI and social support scores were not (\( p = .89 \)). We obtained similar result using the former PCL-5 scores.

4.4. Mediation analysis

PTSD scores were a strong mediator of the relationship between trait mindfulness (FMI scores) and COVID-19 stress (Figure 2). The analysis found that trait mindfulness was protective against stress induced by the COVID-19 crisis, but that this protection was compromised by the presence of PTSD. Using the former PCL-5 scores we found PCL-5 to be

![Figure 1. COVID-19 stress (CPDI) scores as a function of mindfulness (FMI) and PTSD (PCL-5) scores.](image-url)
5. Discussion

This study examined the impact of the COVID-19 crisis on PTSD symptoms in a prospective cohort of subjects who were directly involved in the Bataclan terrorist attacks in November 2015. The impact is unclear. On the one hand, isolation might help to reduce hyperarousal and avoidance symptoms of PTSD, as subjects are less exposed to potential triggers in the environment. On the other hand, PTSD symptoms might also increase when put in quarantine situation (Wu et al., 2020). The threat to health from COVID-19 itself can have deleterious psychological and social consequences (Brooks et al., 2020).

The impact of the COVID-19 crisis on PTSD symptoms was investigated using the CPDI scale. This found that stress related to COVID-19 was positively associated with PTSD symptoms, measured using the PCL-5 scale. Our findings suggest that the COVID-19 crisis may not only result in PTSD by itself, but also increase the severity of existing PTSD. The positive association is also present with former PCL-5 scores suggesting that subjects suffering from PTSD could be more likely to be distressed by the sanitary crisis.

Furthermore, and consistent with our hypothesis, we found an overall association between COVID-19 stress, PTSD severity and its positive risk factors, trait mindfulness and social support. This suggests that both social support and trait mindfulness help subjects to cope with the perception of the COVID-19 crisis as a threatening environment. We investigated the relationship in more detail, notably trait mindfulness, which appears to be more important than social support. Our analysis found that it was negatively associated with COVID-19 stress scores. The mediation analysis finds not only a significant mediating effect of PCL-5 scores (former and actual) from trait mindfulness to sanitary crisis stress but also a direct significant effect using former PCL-5 scores. This results are consistent with the literature, which shows that trait mindfulness helps in regulating negative emotion and related stress (Chambers et al., 2009).

It appears that the protection offered by trait mindfulness may help therapists to manage the psychiatric consequences of the COVID-19 pandemic. How might this protection work? It should be noted that severe,
prior symptoms of PTSD appear to compromise the protection offered by trait mindfulness. Similarly, severe PTSD symptoms seem to negatively mediate the beneficial relationship between trait mindfulness and stress related to COVID-19. This finding highlights that people who have prior experience of trauma need specific treatment for their PTSD symptoms during the COVID-19 crisis. A possible solution is the development of teleconsultations tailored to this population.

Another hypothesis is that trait mindfulness does not protect all subjects. Those who were protected following their first trauma enjoyed the same protection during the second period of stress resulting from the COVID-19 crisis. An interesting avenue for further studies would be to characterize subjects protected by mindfulness. Psychological support can be difficult to find during a health crisis. This could add to the distress of some patients, and negate the positive effect of isolation on hyperarousal.

Although it may be helpful to develop trait mindfulness to combat stress related to the COVID-19 pandemic, this appears to be useless unless PTSD symptoms from a prior trauma are also addressed.

Our exploratory study paves the way for further investigations. We did not specifically investigate PTSD linked to the COVID-19 crisis, and our population is very specific in terms of trauma. Nevertheless, it seems reasonable to conclude that tertiary prevention of PTSD should include closer follow-up of patients with existing PTSD during an external, global crisis.

Data availability

The data supporting the findings of this study are located on a military server and cannot be accessed publicly but are available upon request from the corresponding author, Dr Lionel Gibert after following the IRBA (French Army Institute for biomedical research) procedure (military data procedure).

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Author contribution

LG, MT and BF conceived and designed the analysis. LG collected the data. LG performed the data analysis under BF supervision. LG and MT wrote the first manuscript. WEH and FD reviewed the scientific part of the manuscript. All authors contributed to and have approved the final submitted version of the manuscript.

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