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Research Paper

Preventing Post Traumatic Stress Disorder in the general population induced by trauma during the COVID pandemic☆
A simple brief intervention based on cognitive science that could be delivered digitally

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A R T I C L E   I N F O

A B S T R A C T

Most of the recent studies indicated the prevalence of Post-Traumatic Stress Symptoms (PTSS) are increasing after the COVID pandemic around the world. Bo et al. reported PTSS prevalence of 96.2% among the COVID-19-infected people. The sociocultural and individual vulnerability and protective factors may influence onset and maintenance of the symptoms. However, there is significant lack in understanding the risk factors and preventive factors that influence the maintenance of Post-Traumatic Stress symptoms that defines Post-Traumatic Stress Disorder (PTSD).

The digital technology gives us the unique opportunity to assess this risk, to monitor and track this evolution longitudinally. In this research project we aimed to design and develop a smartphone application for longitudinal data collection enabling to (1) predict and follow the evolution of PTSS toward PTSD, (2) assess the relative efficacy of several methods to prevent the evolution of PTSS right after exposure to trauma (1−24 h), (3) educate people about psychological effects that can occur during and after trauma, normalize acute distress and refer to professional help if a disorder is constituted.

We hope that this research project will help to understand how to maximize the self help support during the acute phase (golden hours) after trauma to prevent the transition from PTSS to PTSD.

A video abstract can be found on https://www.youtube.com/watch?v=RZJehj3J8go&feature=emb_title

Background

Pandemic context

The COVID-19 pandemic crisis emerged in the early months of 2020 and rapidly spread through the world (Dong, Du, & Gardner, 2020). Humanity was exposed to a new coronavirus to which it had no immunity. This had dramatic public health consequences due to the virus's high contagiousness and severity (Sansonetti, 2020). Of the 20% infected patients requiring health care services, 40% (8% overall) needed hospitalization; 6% of all infected patients (30% of those needing health care) needed intensive care; and there was a death rate of 0.5%, overwhelming the majority of healthcare systems (Emanuel et al., 2020). In September 2020, prevention measures instituted consist of hand hygiene, maintaining physical distance, self-isolation and mask whenever possible. Due to the

difficulties of implementing these measures - and also considering their intrinsic limitations even if fully applied quarantine was progressively instituted in most countries, despite its economical and psychological negative consequences (Brooks et al., 2020). In September 2020, there are no definite curative therapeutics. Rebranding of some drugs is under trial (Discover team, 2020). In December 2020, several vaccinal projects were validated by different regulation agencies and began to be distributed.

Psychological consequences of trauma and pandemics, the Post-Traumatic Stress Symptoms (PTSS) stage

Several studies have explored the psychological effect of epidemics, such as Severe Acute Respiratory Syndrome (SARS) and H1N1. One study reported that 3.7% of public cases, including 9.6% of "impacted groups" (individuals who have been quarantined or under suspicion of being infected, as well as their friends and family), had experienced depression symptoms since the SARS outbreak (Ko, Yen, Yen, & Yang, 2006). Another study showed an incidence of 17.3% of significant mental symptoms among health care workers during the SARS epidemic (Lu, Shu, Chang, & Lung, 2006). Concerning the study on Post-Traumatic Stress Symptoms (PTSS), Mak, Chu, Pan, Yiu, and Chan (2009) and Lam et al. (2009) both reported that more than 40% of SARS survivors had experienced PTSS at one time during the outbreak. Meanwhile, those respondents who had been isolated, worked in high-risk workplaces -such as SARS wards-, or had friends or close relatives who contacted with SARS were two to three times more likely to develop high levels of PTSS than those who were not exposed to the virus (Wu et al., 2009). Both trauma sequelae and recovery always occur in the context of social-interpersonal contexts, for instance, in interaction with a partner, family, the community, and society (Maercker & Hecker, 2016). Brutal exposure to death induces acute stress up to trauma in the general population. Considering health care providers, this could be worsened by difficulties such as limited social support aggravated by the quarantine (e.g. restrictions to attend funerals, prohibition to attend relatives in nursing homes). Trauma might trigger development of psychopathology, not just PTSS, acute stress disorder or post-traumatic stress disorder (PTSD), but pathological grief, insomnia, depression, suicidal behavior, substance abuse, somatic complaints and somatoform disorder as well. However, PTSD appears as a good candidate for secondary prevention (interventions immediately after the trauma) (Zohar, Juven-Wetzler et al., 2011). Against this background, PTSS should be of consideration during the outbreak of COVID-19.

Neurobiological aspects of trauma

PTSS follows traumatic occurrences outside the range of common human experience such as violent physical assaults, torture, accidents, rape or natural disasters and is characterized by a typical symptom pattern of intrusions, persistence of trauma, relevant stimuli avoidance, emotional numbing and physiological hyper-arousal (American Psychiatric Association, 2013). By definition, it is not just direct experience of actual or threatened death, serious injury or sexual violation, but witnessing in person, learning that the trauma occurred to a close one, experiencing first-hand repeated or extreme exposure to aversive details of the traumatic event (i.e. mass media) as well that can induce a trauma (American Psychiatric Association, 2013).

What is unique about trauma and stressor-related disorders is that we know exactly when they start. And the PTSS core symptom is a traumatic memory. The trauma memories do not become permanent immediately, rather they become consolidated over the course of hours to days (Howie & Ressler, 2020).

The amygdala is the final common region of fear processing and is under constant modulation by the medial prefrontal cortex and by the hippocampus. As in Pavlovian conditioning, a conditioned stimulus, one that was previously a neutral stimulus—for example, a routine activity, a specific location or a sound—is then paired with the unconditioned stimulus of the trauma. Following the fear-trauma association—one trial fear learning–, in the future, that conditioned stimulus associated with the trauma cue reminds and reactivates the fear system all over again. Memory consolidation process starts initially with short-term memory in the very first minutes and hours following the event (Howie & Ressler, 2020). That period of time is the so-called "Golden hour" or "window of opportunity". With the help of some interventions we may alter the trajectory of psychopathological response to trauma exposure in a favorable way by targeting this initial memory consolidation.

Fear memories require protein synthesis in the amygdala for consolidation. Anisomycin, a protein synthesis inhibitor, disrupts traumatic memory consolidation and attenuates Post Traumatic stress response in rats (Cohen et al., 2006). However, this molecule is toxic for humans (Kindt, 2018).

Acute stress after exposure to trauma enhances glutamate release in the frontal lobe, which stimulates excitatory transmission. Memories of aversive events are -at least in part- mediated by the hormone cortisol, which is released during the aversive situation (Philippens, 2020). Benzodiazepines enhance the effect of GABA, the neurotransmitter that is the main glutamate inhibitor in our brains, resulting in sedation, thus blocking the normal response of the hypothalamic-pituitary-adrenal (HPA) axis. Decreased levels of cortisol (Siegelaar et al., 2006) and HPA-axis hypofunction (De Kloet et al., 2006) are associated with PTSD. In various species, including humans, post-traumatic administration of corticosterone/cortisol enhances memory consolidation whereas administration of glucocorticoid receptor antagonists impairs consolidation (Sandi & Rose, 1994).

Alcohol is an indirect GABA agonist. Alcohol mimics GABA effect on the brain and acts as a benzodiazepine (BZD) (Jazvinscak Jembrek & Vlainic, 2015). Thus, it is possible that alcohol consumption right after exposure to acute trauma may increase the risk of PTSD due to its similarity with the BZD mode of action. This risk factor for developing PTSD at an early stage and the association between alcohol dependence and the maintenance of PTSD should be further analysed.

Altogether, transient GABA down-regulation, transient peri-neural nets increase and transient HPA activity increase are consistent with enhancing synaptic plasticity during periods of consolidation.

Based on insights from experimental psychology such as the neuroscience of memory consolidation; the phenomenology of intrusive traumatic memories; and dual tasks in cognitive psychology (which can interfere with holding mental imagery in mind), Holmes and colleagues suggested that engaging in a visuospatial task (i.e., one thought to require mental imagery) during memory consolidation (e.g., first hours post-trauma) competes for working memory resources with mental imagery and thereby interferes with the development of intrusive memories of the trauma (Holmes & Iyaduraui, 2020).

Understanding the memory consolidation process from a biological and a neuroscientific point of view might give us approaches for the secondary prevention of PTSD for instance, in emergency departments (Howie & Ressler, 2020; Schultebraucks et al., 2020). Even though some of the interventions listed above might be promising, there is still a preeminent challenge: how can we identify these "often well-defined points of onset" that would enable the secondary prevention of PTSD. This is limited by (1) the difficulties to target the prevention correctly, (2) the overwhelm-

ing pressure on mental health professionals, and (3) the lack of evidence concerning this intervention.

Treatment once the disorder is established, the PTSD stage

40–50% of patients with PTSD do not respond or only partially respond to antidepressant treatment (Friedman, Marmar, Baker, Sikes, & Farfel, 2007). Psychotherapy, especially exposure therapy (during cognitive behavior therapy or eye movement desensitization and reprocessing) is an efficient treatment (Bradley, Greene, Russ, Dutra, & Westen, 2005). Regardless of the chosen treatment technique, about 40% of subjects present a recurrence of symptoms within the year (Martenyi & Soldatenkova, 2006; Tarrier, Sommerfeld, Pilgrim, & Humphreys, 1999) with a risk of relapse estimated at 20% within five years (Boe, Holgersen, & Holen, 2010).

What is the cost-efficacy of the treatment once the disorder is established

The medico-economic approach aims to assess the direct healthcare costs (e.g. medication, physician visits, hospitalization) and indirect cost of disorders (productivity losses due to work absence and/or early retirement, income losses due to mortality, disability and care seeking etc).

A recent review showed that the annual direct excess costs (cost to the patient) of PTSD ranged from 512 US-$ purchasing power parity –PPP– to 19,435 US-$ (2015 US-$ PPP) and the annual indirect excess costs (cost to the society) were 5,021 US-$ PPP per person (von der Warth, Dams, Grochtdreis, & König, 2020).

Trauma-focused cognitive-behavioural therapy (paired with a selective serotonin re-uptake inhibitor) was found to be cost-effective compared with treatment *as usual* and no treatment (von der Warth et al., 2020).

Early data concerning the COVID-19 Pandemic

In the general population, before the pandemic, the number of patients with PTSD in Europe was estimated at 7.7 million people (Gustavsson et al., 2011).

In China, a study on 285 participants/300 participating residents, among which 124 (43.5%) were currently in Wuhan, and 188 (66%) were previously in Wuhan, reported that the prevalence of PTSS in the hardest-hit areas of China a month after the COVID-19 outbreak was 7% (Liu et al., 2020). Most PTSS cases in the cited study were actually acute stress disorders instead of chronic psychiatric problems. It is suggested that most of these acute episodes resembling PTSS may abate in the ensuing period, and only a minority develops chronic disorders (Bryant, 2003).

According to a not peer-reviewed pre-print, Sun et al. (2020) reported data from an online questionnaire that was completed by 2091 Chinese participants, the prevalence of PTSS among the public in mainland China, one month after the COVID-19 outbreak, was 4.6%.

Considering only the infected population, Bo et al. (2020) surveyed online 714 COVID-19 patients. The mean age of the participants was 50.2 ± 12.9 years, men accounted for 49.1% of the sample, and 25.8% lived alone prior to admission. The prevalence of significant PTSS was 96.2% (95%CI: 94.8%–97.6%).

Limitations for prevention

Difficulties to target the prevention correctly

The identification of individuals at risk represents a significant barrier towards a successful intervention, as 11.8% of individuals develop chronic psychopathology following trauma exposure (Shalev et al., 2019), meaning that blanket interventions may waste roughly 88% of resources when provided to individuals at low risk. Risk factors identified are classified as follows:

(a) pre-traumatic: (1) female sex (16,4% vs 9,2% for males) McLean, Asnaani, Litz, & Hofmann (2011), (2) Less than secondary education, (3) prior interpersonal trauma (Shalev et al., 2019), (4) prior mental illness;
(b) peri-traumatic: current exposure type (interpersonal) or severity (McLean et al., 2011)
(c) post-traumatic: (1) early symptom configuration or severity (i.e. initial Clinician-Administered PTSD Scale for DSM-IV (CAPS) score - Peritraumatic dissociation, (2) memory of the event (Gil, Caspi, Ben-Ari, Koren, & Klein, 2005), (3) Heart rate in the emergency department.

No significant differences were observed by ethnicity, marital status, or age. Another challenge is to identify quickly the location of at-risk people. Data collection on a large scale would allow training predictive models to allow better prevention and follow-up to diagnose early PTSD.

The pressure on mental health professionals is very high and training is insufficient

Unfortunately, the mental health of mental health professionals themselves—who need to handle the consequences of COVID in their wards-is already poor, even in young psychiatrist professionals (Jovanović et al., 2016) and medical students (Frajerman, Morvan, Krebs, Gorwood, & Chaumette, 2019) due to overwork, that can often lead to burn-out. These causes need to be better understood but quantitative work overload (Barrack, Miller, Sotile, Sotile, & Rubash, 2006; Gopal, Glasheen, Miyoshi, & Prochazka, 2005; Jovanović et al., 2016), conflicting levels of dependency, the balance between responsibility and autonomy, young age, or the confrontation with suffering and dying patients appear to be important factors (Frajerman et al., 2019). The increase of the work overload in mental health professionals does not seem to be a good solution to prevent the psychological consequences of COVID. A study among the front-line health workers in China revealed that 71.5% of them are distressed and 50.4% reported symptoms of depression (Lai et al., 2020).

The lack of evidence concerning the efficacy of the intervention

Some therapies were tested in the first hours (24 h or Golden Hours (Zohar, 2018)), and showed that

talking therapy (critical incident stress debriefing) was ineffective and could even worsen the outcome (Mayou, Ehlers, & Hobbs, 2000; Rose, Bisson, Churchill, & Wessely, 2002), by enhancing traumatic memories (Zohar, Yahalom et al., 2011).

Anxiolytics, like benzodiazepines increase the risk of PTSD (Gelpin, Bonne, Peri, Brandes, & Shalev, 1996; Guina, Rossetter, DeRhodes, Nahhas, & Welton, 2015).

There was no evidence to support the efficacy of propranolol in terms of prevention of PTSD or Acute Stress Disorder (Wright et al., 2019).

Hydrocortisone could be useful (Zohar, Juven-Wetzler et al., 2011) but the limited evidence and its adverse effects mean it cannot be recommended for routine use, but could be considered as a preventive intervention for people with severe physical illness or injury, shortly after a traumatic event, as long as there are no contraindications (Wright et al., 2019).

However, by targeting memory consolidation, it may be possible to reduce the frequency of intrusive memories over the subsequent days by aiming for different mechanisms at different levels (e.g., nitrous oxide, sleep deprivation, completing cognitive
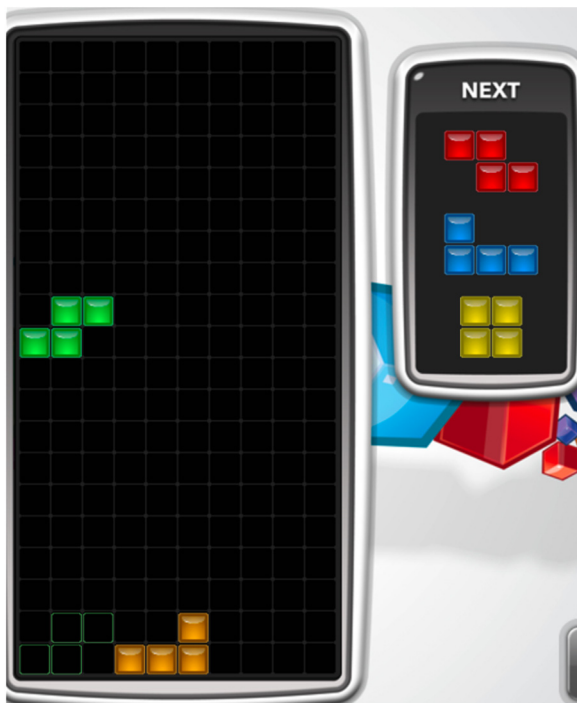
Fig. 1. Tetris®, a vídeo game requiring a visuo spatial effort.

tasks, and imagery rescripting). Preliminary studies, following real-life trauma, showed moderate effect sizes on intrusive memory frequency in the first week post-trauma after visuo-spatial tasks (e.g., Cohen's d of 0.65 in Horsch et al., 2017; Cohen's d of 0.67 in Iyadurai et al., 2018). This approach was used in several contexts of trauma, i.e, after a car accident (Iyadurai et al., 2018) or in traumatised refugees (Kanstrup et al., 2020). For instance, Tetris use (Fig. 1) for 20 min decreased intrusive memories after exposure, even if PTSD did develop in the long term (Iyadurai et al., 2018). This intervention was well-accepted by hospital staff. There were no side effects, it was even perceived as enjoyable. Electro-convulsive therapy is known to disrupt memory consolidation, but it is neither accessible in an emergency context nor ethical as a preventive measure (Iyadurai et al., 2018).

If the early evidence gathered in laboratory settings is correct, any verbal task, even in the form of filling cross words, would increase memorization of the traumatic event, intrusive images and, at the end, the risk of PTSD. We assume that these early specialized interventions (e.g. French debriefing) could be more detrimental than doing nothing. PTSD is a normal reaction to an abnormal situation. However, we claim that an early intervention in the form of talking therapy will be very helpful as soon as the PTSD is constituted (persistence of symptoms one month after trauma). In this circumstance, a national network of early interventions (like cellules d'urgence médico-psychologique, CUMP in France) would be very useful.

The accessibility to psychotherapeutic interventions is limited

Globally, there is a scarcity of adequately trained professionals who provide evidence-based mental health care services, especially concerning psychotherapy (Gargot et al., 2017) and the situation is more disappointing for Low and Middle-Income Countries (Soron, 2016). Digital services offer the possibility to improve psychotherapy training via Cognitive Behavioural Therapy Massive Open Online Courses (Gargot et al., 2020), online journal clubs (Gargot & Holmes, 2018), open source online guidebooks (Lahutina & Gargot, 2019; Sidorova, 2019). Specifically, training in the immediate treatment following trauma is poor,

psychiatry trainees lack knowledge about evidence-based treatments in secondary prevention of stress-related disorders (Frankova & Scheeres, 2020). Furthermore, implementation of these techniques in the field would lead to a higher risk of contamination and spread of the pandemic itself. Thus, development of telemedicine (Soron, 2016) could be useful. However,it is limited by (1) difficulties to access reimbursement (Wilson, Rampa, Trout, & Stimpson, 2017), (2) poor patient and practitioners' acceptance, (3) technical limitation and training. Strikingly, the COVID-19 pandemic seemed to have a positive outcome on telepsychiatry and e-health that do not requires physical contact but facilitate maintaining access to adequate care (Thomas et al., 2020)

An Online platform could (1) identify the at-risk subjects (2) improve scalability of a simple potential cognitive vaccine

We think that online psychotherapy and digital phenotyping (Insel, 2017) could allow to better identify the at-risk population (Carmi, Schultebraucks, & Galatzer-Levy, 2020), could be based on the most up-to-date evidence-based practice (Iyadurai et al., 2018), could allow better scalability without increasing professional overwork (Jovanović et al., 2016), could prevent debriefing practice (that showed no effect or even a detrimental effect) (Zohar, Yahalom et al., 2011) and could lower the risk of spreading the disease by allowing physical distancing.

Acceptability

Iyadurai et al. performed an online survey regarding participants' willingness to receive novel treatment approaches soon after a traumatic event (N = 350) (Iyadurai et al., 2018):

80.2% would be willing to receive a treatment delivered via mobile phone; 85.7% would be willing to play a computer game for 10–20 minutes as part of a treatment to reduce intrusive memories and 67.1% would be willing to stay awake on the first night after a traumatic experience, if it could reduce intrusive memories over a week. These techniques appear to be well accepted by the patients even though there is no feedback from the professionals in this survey.

With this in consideration, we propose a web application (app) available on multiple devices (smartphone, tablet, computer), (1) to monitor the risk of transition from PTSS to PTSD, (2) to evaluate the efficacy of 3 different strategies.

Hypothesis

- Early contact with psychotherapy increases the risk of PTSD.
- Tetris might decrease the risk of PTSD by targeting the consolidation of intrusive memories. Thus, flash backs and nightmares should be the symptoms that will be the most diminished in the Tetris group.
- The "watchful waiting" approach with additional later assessments is a good solution

We expect the best outcome in the Tetris group and the worst in Psychological Treatment.

Method

User experience

Upon accessing the app for the first time, all participants will fill in the information page and accept terms and conditions in order to start using the App, in that way the informed consent will be

registered on the platform. Once the participant has logged in, he or she will be randomly assigned to one of three possible treatment arms intended to prevent progression to PTSD:

(1) standard psychological support (Rose et al., 2002);
(2) support by family and friends (watchful wait)—the participant will be encouraged to seek support from close ones;
(3) playing a video game that requires a visuospatial effort (Tetris) for a fixed time and frequency.

Data to assess Acute Stress Disorder, Post-Traumatic Stress Disorder symptoms, dissociative symptoms and quality of sleep will be gathered using PDI, PDEQ, GAF and PCL-5 Scales. If serious signs or symptoms are detected, the App will encourage the participant to seek professional mental health help. A one-month follow-up will be carried out to assess whether they have developed an actual chronic PTSD.

Recruitment of participants

We plan to target General population with trauma invited by social media or a special number.

Participants will be recruited online via general access. Promotion from mental health services and associations across Europe is planned thanks to European networks of psychiatry trainees and psychiatrists (EFPT, EPA). Emergency and law enforcement services will be contacted. No incentives will be used to promote participation.

Participation will only be granted if participants do not have any risk factors (assessed by the app itself) that require medical attention. After signing the participation agreement, but before accessing the app, participants will have to check whether they fulfil all the inclusion criteria and none of the exclusion criteria:

Inclusion criteria

- Have a smartphone and a basic user knowledge of it
- Have experienced or witnessed a recent trauma (0−24 h)

Exclusion criteria

- The trauma is not related to physical violence by someone in the participant's family. Since the risk can still persist, social evaluation will be necessary to check if the difficulties are preventable and if any legal action is necessary
- The participant does not suffer from any mental health disorder at the moment, since there is a risk of psychiatric decompensation, a psychological or psychiatric evaluation is necessary
- The participant does not have suicidal ideation or has had it in the past, since there is a risk of psychiatric decompensation, a psychological or psychiatric evaluation is necessary
- The participant does not have any psychological follow-up, since there is a risk of psychiatric decompensation, a psychological or psychiatric evaluation is necessary

If needed, the app will will reccomend that the participats get in contact with services where a face to face specialized diagnosis of PTSD can be performed. This is more reliable than an auto questionnaire on an app, and eventually a specific PTSD treatment. This PTSD treatment requires a medical and psychological approach that will not be the objective of our app (see Fig. 2 for the scheduled pipeline).
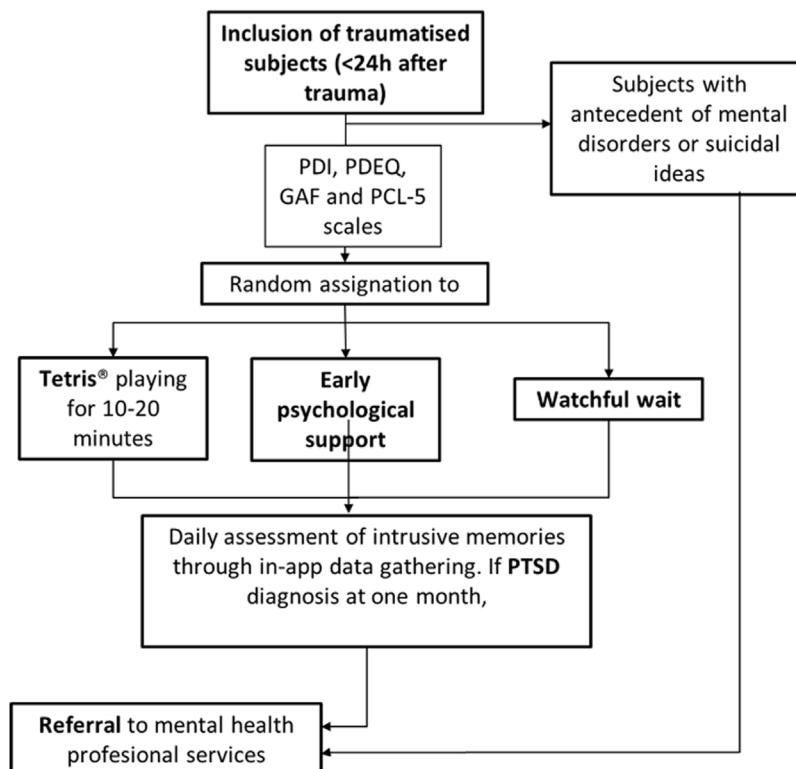

Fig. 2. Flowchart of the proposed study.

Data protection

Data aggregation will be allowed and aggregated by the participants themselves, since the procedure is prospective and takes place online. Providing an email address will be requested. These emails will only be used to log in to the app and to gather each participant's data throughout the time (send reminders for follow-up evaluation).

No personal data (beyond age, sex) that would allow to identify the patient (i.e. personal name and surname, identity document, etc.) will be gathered.

Implementation

To implement such a protocol, several aspects need to be taken into account accordingly: (1) sufficient sample size for a long enough period, (2) ethical and reglementary issues and (3) technical issues.

(1) It is important to reach a large sample size since, fortunately, only 10% of traumatised persons will develop PTSD and that we can expect a high drop-out after one month, especially in the use of a web app. Since the pandemic has no borders, it sounds legitimate to allow a large availability across countries.

Fortunately, networks of young psychiatrists and psychiatric trainees are very active (European Federation of Psychiatric Trainees (EFPT), n.d., Early Careers Psychiatrist Committee (ECPC) of the European Psychiatric Association, World Network of Psychiatric Trainees, n.d.). The project raised a lot of interest and some translations were proposed (Estonian, Greek, Portuguese, Turkish).

(2) Ethical issues are important, since it targets the general population However, it requires thecollection of data and the conformity to the General Data Protection Regulation (GDPR). In the European context, it is necessary to get an ethical committee approval in each country, and to store the data in Europe.

The development of such an application needs collaboration between different cultural and training background. Thus, hackathons are very appropriate to support such projects. This protocol was presented during the EUvsVirus, n.d. Hackathon endorsed by the European Commission. It allowed crossing the perspective on the medical, technical, economical sustainability and visibility of the project. A prototype and a video were carried out during this event.

Concerning the technical aspects, it seems important to have an easily accessible application on different devices (computer,

Fig. 3. FormR, a survey framework allows to: (1) chaining simple surveys into long runs, (2) screening inclusion and exclusion criteria, (3) randomizing subjects, (4) redirecting subjects to external resources.
This complex designs framework looks suitable to implement our solution.

smartphones). Simple survey software is now easily accessible online (Limesurvey, n.d., Surveymonkey, n.d., Google Survey, n.d.). However, such applications do not allowfollow-ups or longitudinal data-collection. Neither do they allow to connect with a more complex program such as a Tetris game (that is programmed in javascript or in Python, for instance) and cannot be easily embedded. There are several paths to resolve this issue. Flutter is an open-source User Interface software development kit created by Google. It allows developers to create applications in different devices. FormR (n.d.) (Fig. 3), is developed by German academics (Arslan, Tata, & Walther, 2018; Arslan, Walther, & Tata, 2020) and aids to create more complex surveys by using R language to generate reminders, live feedback and responsive designs. Concerning the management of several languages, several platforms allow the management of the application in different languages and foster the translation in a systematic and organized way (like localizely, n.d. or weblate, n.d.). Advances in deep learning applied to Natural Languages Processing (like Deepl, n.d.) have allowed to develop automatic translators that can facilitate the work of translators.

Discussion

Prevention in mental health is critical, yet its implementation is lacking. It would be particularly critical during sensitive developmental periods (Arango et al., 2018). In this article, we propose to test how a simple brief intervention based on cognitive science could be delivered digitally. E-mental health approaches like *trauma prevent* could help to (1) decrease the treatment gap, (2) support prevention, (3) better understand the optimal care thanks toa close monitoring and new approaches into assessing mental health. This technology is promising since the preventive app has the potential to reach a wide segment of the population,since the technology only requires access to the internet and is very accessible through a computer or a smartphone.Technicaly, it is simpler and less costly than other e-mental health technologies (iCBT (Andersson, Carlbring, Titov, & Lindefors, 2019), virtual reality (Wechsler, Mühlberger, & Kümpers, 2019) or Social Assistive robotics (Pennisi et al., 2016) (Fig. 4).

Ethical tensions exist in the implementation of new interventions based on technology, especially among vulnerable individuals (Kellmeyer, Biller-Andorno, & Meynen, 2019). To focus on non- psychological support aftera trauma can be frustrating for professionals, who might feel helpless and try to "save" and normalize the patient However, the richness of early traumatic symptomatology seems to be adaptive. Just as there is poor evidence towards decreasing fever after an infection (since fever has an adaptive role), there is a scarcity of evidence informingthat we need to treat PTSS, and some data suggests that it could be detrimental. Trauma is frequent in the population, and resilience could be acquired through family and friends who can watch after their relative and answer to his/her basic needs,and not by a professional debriefing.

The acceptability of a mobile app for early intervention was already assessed in a survey by Iyadurai. However, it will be relevant to assess, at least qualitatively, how the traumatised subjects can react in real life. Kellmeyer proposes priorities for the responsible use of technology (specifically VR) in vulnerable

Fig. 4. Several E-mental health strategies with increasing hardware complexity and professional investment. ICBT: Internet-based Cognitive Behavioural Therapy, SAR: Social Assistive Robotics.

patients that could inform further projects and approaches. In this protocol, we have want to test efficacy of different therapeutic alternatives. We are humanely-oriented and would like to develop the best evidence- based approach in the early phase of trauma, respecting the right of the individual not to share his or her traumatic experience. If he or she wants to share, it should be possible to do so with his/her relative at his/her own pace, thus respecting autonomy and dignity. Beyond the Iyadurai survey and our contact with PTSD patients, who considered also the development of this strategy, it will be important, before the dissemination of the solution, to test and collect early feedback to have a patient-centered design and focus on the special vulnerabilities of traumatised subjects. Finally, meeting a mental health professional can be felt as stigmatising for some people. We propose a protocol where specialist referral is recommended onlywhen there is evidence that it can be useful. Beyond COVID consequences, trauma is very frequent in the general population and such a protocol will still be relevant after the pandemic will be finished.

Conclusion

The COVID19 pandemic is causing traumatic symptoms among the world population, creating the need for simple, cost-effective tools to prevent the onset of PTSD and to properly manage such traumatic situations. Stemming from recent findings on PTSD psychopathology and neurobiology, an app has been devised, aiming to test a novel approach in this regard(Tetris playing), and to gather data to develop more accurate predictive models of progression from trauma to PTSD. This represents a collaborative and global effort from mental health professionals around the globe.

Conflicts of interest

The authors declare no conflicts of interest.

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References

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®).* American Psychiatric Pub.

Andersson, G., Carlbring, P., Titov, N., & Lindefors, N. (2019). Internet interventions for adults with anxiety and mood disorders: A narrative umbrella review of recent meta-analyses. *The Canadian Journal of Psychiatry, 64*(7), 465–470.

Arango, C., Díaz-Caneja, C. M., McGorry, P. D., Rapoport, J., Sommer, I. E., Vorstman, J. A., ... Carpenter, W. (2018). Preventive strategies for mental health. *The Lancet Psychiatry, 5*(7), 591–604.

Arslan, R. C., Walther, M. P., & Tata, C. S. (2020). formr: A study framework allowing for automated feedback generation and complex longitudinal experience-sampling studies using R. *Behavior Research Methods, 52*(1), 376–387. http://dx.doi.org/10.3758/s13428-019-01236-y

Arslan, R. C., Tata, C. S., & Walther, M. P. (2018). *Formr: A study framework allowing for automated feedback generation and complex longitudinal experience sampling studies using R* (version v0.18.3) .

Barrack, R. L., Miller, L. S., Sotile, W. M., Sotile, M. O., & Rubash, H. E. (2006). Effect of duty hour standards on burnout among orthopaedic surgery residents. *Clinical Orthopaedics and Related Research, 449,* 134–137. http://dx.doi.org/10.1097/01.blo.0000224030.78108.58

Bo, H. X., Li, W., Yang, Y., Wang, Y., Zhang, Q., Cheung, T., ... Xiang, Y. T. (2020). Posttraumatic stress symptoms and attitude toward crisis mental health services among clinically stable patients with COVID-19 in China. *Psychological Medicine,* 1–7. http://dx.doi.org/10.1017/S0033291720000999

Boe, J. H., Holgersen, K. H., & Holen, A. (2010). Reactivation of posttraumatic stress in male disaster survivors: The role of residual symptoms. *Journal of Anxiety Disorders, 24*(4), 397–402. http://dx.doi.org/10.1016/j.janxdis.2010.02.003

Bradley, R., Greene, J., Russ, E., Dutra, L., & Westen, D. (2005). A multidimensional meta-analysis of psychotherapy for PTSD. *The American Journal of Psychiatry, 162*(2), 214–227.

Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., . . . Rubin, G. J. (2020). The psychological impact of quarantine and how to reduce it: Rapid review of the evidence. *The Lancet, 395*(10227), 912–920. http://dx.doi.org/10.1016/S0140-6736(20)30460-8

Bryant, R. A. (2003). Early predictors of posttraumatic stress disorder. *Biological Psychiatry, 53*(9), 789–795. http://dx.doi.org/10.1016/S0006-3223(02)01895-4

Carmi, L., Schultebraucks, K., & Galatzer-Levy, I. (2020). Identification, prediction and intervention via remote digital technology: digital phenotyping & deployment of clinical interventions following terror and mass casualty events. In E. Vermetten, I. Frankova, L. Carmi, O. Chaban, & J. Zohar (Eds.), *Risk management of terrorism induced stress: NATO science for peace and security series, sub-series E: Human and societal dynamics* (Vol 148, pp. 175–181). Amsterdam, The Netherlands: IOS Press ISBN 978-1-64368-056-059.

Cohen, H., Kaplan, Z., Matar, M. A., Loewenthal, U., Kozlovsky, N., & Zohar, J. (2006). Anisomycin, a protein synthesis inhibitor, disrupts traumatic memory consolidation and attenuates posttraumatic stress response in rats. *Biological Psychiatry, 60*(7), 767–776. http://dx.doi.org/10.1016/j.biopsych.2006.03.013

De Kloet, C. S., Vermetten, E., Geuze, E., Kavelaars, A., Heijnen, C. J., & Westenberg, H. G. (2006). Assessment of HPA-axis function in posttraumatic stress disorder: Pharmacological and non-pharmacological challenge tests, a review. *Journal of Psychiatric Research, 40*, 550–567. http://dx.doi.org/10.1016/j.jpsychires.2005.08.002

Deepl. (n.d.). *Translator.* https://www.deepl.com/translator.

Discover team, 2020, https://reacting.inserm.fr/response_case/2019-ncov/.

Dong, E., Du, H., & Gardner, L. (2020). An interactive web-based dashboard to track COVID-19 in real time. *The Lancet Infectious Diseases, 20*(5), 533–534. http://dx.doi.org/10.1016/S1473-3099(20)30120-1

Emanuel, E. J., Persad, G., Upshur, R., Thome, B., Parker, M., Glickman, A., . . . Phillips, J. P. (2020). Fair allocation of scarce medical resources in the time of Covid-19. *The New England Journal of Medicine, 382*(21), 2049–2055. http://dx.doi.org/10.1056/nejmsb2005114

European Federation of Psychiatric Trainees. (n.d.). *EFPT.* http://efpt.eu.

EuvsVirus. (n.d.). # EUvsVirus Hackathon + Matchathon challenge https://www.euvsvirus.org.

formr. (n.d.). *formr survey framework.* https://formr.org/.

Frajerman, A., Morvan, Y., Krebs, M. O., Gorwood, P., & Chaumette, B. (2019). Burnout in medical students before residency: A systematic review and meta-analysis. *European Psychiatry, 55*, 36–42. http://dx.doi.org/10.1016/j.eurpsy.2018.08.006

Frankova, I., & Scheeres, K. (2020). Psychiatric trainees' knowledge of treatment in the "Golden hours" following trauma. In E. Vermetten, I. Frankova, L. Carmi, O. Chaban, & J. Zohar (Eds.), *Risk management of terrorism induced stress: NATO science for peace and security series, sub-series E: Human and societal dynamics* (Vol 148, pp. 136–141). Amsterdam, The Netherlands: IOS Press 2020, ISBN 978-1-64368-056-9, p. 140.

Friedman, M. J., Marmar, C. R., Baker, D. G., Sikes, C. R., & Farfel, G. M. (2007). Randomized, double-blind comparison of sertraline and placebo for posttraumatic stress disorder in a Department of Veterans Affairs setting. *Journal of Clinical Psychiatry, 68*(5), 711–720.

Gargot, T. (2020). *Trauma Prevent:Preventing Post Traumatic Stress Disorder in the general population induced by trauma during the COVID pandemic.* Devpost April 22, https://devpost.com/software/proto-trauma-prevent

Gargot, T., & Holmes, E. (2018). *EFPT Journal Club #1 : Tetris in PTSD prevention. 19 September 2018 @ 8:00 pm - 9:00 pm.* European Federation of Psychiatric Trainees September, 19, http://efpt.eu/event/efpt-journal-club-1-tetris-in-ptsd-prevention/https://github.com/Ouphix/presentations/raw/master/Tetris-EFPT.pdf

Gargot, T., Dondé, C., Arnaoutoglou, N. A., Klotins, R., Marinova, P., Silva, R., . . . Sönmez, E. (2017). How is psychotherapy training perceived by psychiatric trainees? A cross-sectional observational study in Europe. *European Psychiatry, 45*, 136–138. http://dx.doi.org/10.1016/j.eurpsy.2017.05.030

Gargot, T., Arnaoutoglou, N. A., Costa, T., Sidorova, O., Liu-Thwaites, N., Moorey, S., . . . Hanon, C. (2020). Can we really teach Cognitive Behavioural Therapy with a Massive Open Online Course? *European Psychiatry, 1–6.* http://dx.doi.org/10.1192/j.eurpsy.2020.29

Gelpin, E., Bonne, O., Peri, T., Brandes, D., & Shalev, A. Y. (1996). Treatment of recent trauma survivors with benzodiazepines: A prospective study. *The Journal of Clinical Psychiatry, 57*(9), 390–394.

Gil, S., Caspi, Y., Ben-Ari, I. Z., Koren, D., & Klein, E. (2005). Does memory of a traumatic event increase the risk for posttraumatic stress disorder in patients with traumatic brain injury? A prospective study. *The American Journal of Psychiatry, 162*(5), 963–969. http://dx.doi.org/10.1176/appi.ajp.162.5.963

Google Surveys. (n.d.), *Surveys.* https://surveys.google.com.

Gopal, R., Glasheen, J. J., Miyoshi, T. J., & Prochazka, A. V. (2005). Burnout and internal medicine resident work-hour restrictions. *Archives of Internal Medicine, 165*(22), 2595–2600. http://dx.doi.org/10.1001/archinte.165.22.2595

Guina, J., Rossetter, S. R., DeRhodes, B. J., Nahhas, R. W., & Welton, R. S. (2015). Benzodiazepines for PTSD: A systematic review and meta-analysis. *Journal of Psychiatric Practice, 21*(4), 281–303. http://dx.doi.org/10.1097/pra.0000000000000091

Gustavsson, A., Svensson, M., Jacobi, F., Allgulander, C., Alonso, J., Beghi, E., . . . Gannon, B. (2011). Cost of disorders of the brain in Europe 2010. *European Neuropsychopharmacology, 21*(10), 718–779.

Holmes, E. A., & Iyaduraui, L. (2020). Can We develop a "Cognitive therapeutic vaccine" for the early hours after trauma to prevent the reccurrence of intrusive memories of trauma? In E. Vermetten, I. Frankova, L. Carmi, O. Chaban, & J. Zohar (Eds.), *Risk management of terrorism induced stress: NATO science for peace and security series, sub-series E: Human and societal dynamics* (Vol 148, pp. 66–71). Amsterdam, The Netherlands: IOS Press.

Horsch, A., Vial, Y., Favrod, C., Harari, M. M., Blackwell, S. E., Watson, P., Iyadurai, L., Bonsall, M. B., & Holmes, E. A. (2017). Reducing intrusive traumatic memories after emergency caesarean section: A proof-of-principle randomized controlled study. *Behaviour Research and Therapy, 94*, 36–47. http://dx.doi.org/10.1016/j.brat.2017.03.018

Howie, H., & Ressler, K. J. (2020). The neurobiology of trauma memory consolidation: Implications for preventing PTSD. In E. Vermetten, I. Frankova, L. Carmi, O. Chaban, & J. Zohar (Eds.), *Risk management of terrorism induced stress: NATO science for peace and security series, sub-series E: Human and societal dynamics* (Vol 148, pp. 33–40). Amsterdam, The Netherlands: IOS Press.

Insel, T. R. (2017). Digital phenotyping: technology for a new science of behavior. *Jama, 318*(13), 1215–1216. http://dx.doi.org/10.1001/jama.2017.11295

Iyadurai, L., Blackwell, S. E., Meiser-Stedman, R., Watson, P. C., Bonsall, M. B., Geddes, J. R., . . . Holmes, E. A. (2018). Preventing intrusive memories after trauma via a brief intervention involving Tetris computer game play in the emergency department: A proof-of-concept randomized controlled trial. *Molecular Psychiatry, 23*(3), 674. http://dx.doi.org/10.1038/mp.2017.23

Jazvinscak Jembrek, M., & Vlainic, J. (2015). GABA receptors: pharmacological potential and pitfalls. *Current Pharmaceutical Design, 21*(34), 4943–4959.

Jovanović, N., Podlesek, A., Volpe, U., Barrett, E., Ferrari, S., Kuzman, M. R., . . . Moscoso, A. (2016). Burnout syndrome among psychiatric trainees in 22 countries: Risk increased by long working hours, lack of supervision, and psychiatry not being first career choice. *European Psychiatry, 32*, 34–41. http://dx.doi.org/10.1016/j.eurpsy.2015.10.007

Kanstrup, M., Kontio, E., Geranmayeh, A., Lauri, K. O., Moulds, M. L., & Holmes, E. A. (2020). A single case series using visuospatial task interference to reduce the number of visual intrusive memories of trauma with refugees. *Clinical Psychology & Psychotherapy.*

Kellmeyer, P., Biller-Andorno, N., & Meynen, G. (2019). Ethical tensions of virtual reality treatment in vulnerable patients. *Nature Medicine, 25*(8), 1185–1188.

Kindt, M. (2018). The surprising subtleties of changing fear memory: A challenge for translational science. *Philosophical Transactions of the Royal Society B: Biological Sciences, 373*, 20170033. http://dx.doi.org/10.1098/rstb.2017.0033

Ko, C. H., Yen, C. F., Yen, J. Y., & Yang, M. J. (2006). Psychosocial impact among the public of the severe acute respiratory syndrome epidemic in Taiwan. *Psychiatry and Clinical Neurosciences, 60*(4), 397–403. http://dx.doi.org/10.1111/j.1440-1819.2006.01522.x

Lahutina, S., & Gargot, T. (2019). Eye movement desensitization and reprocessing July, 1. In *EFPT psychotherapy guidebook*(2nd ed.) Retrieved from: https://epg.pubpub.org/pub/emdr

Lai, J., Ma, S., Wang, Y., Cai, Z., Hu, J., Wei, N., . . . Tan, H. (2020). Factors associated with mental health outcomes among health care workers exposed to Coronavirus disease 2019. *JAMA network open, 3*(3) http://dx.doi.org/10.1001/jamanetworkopen.2020.3976. e203976-e203976.

Lam, M. H., Wing, Y. K., Yu, M. W., Leung, C. M., Ma, R. C., Kong, A. P., . . . Lam, S. P. (2009). Mental morbidities and chronic fatigue in severe acute respiratory syndrome survivors: long-term follow-up. *JAMA Internal Medicine, 169*(22), 2142–2147. http://dx.doi.org/10.1001/archinternmed.2009.384

LimeSurvey GmbH. (n.d.). *LimeSurvey.* https://www.limesurvey.org/.

Liu, N., Zhang, F., Wei, C., Jia, Y., Shang, Z., Sun, L., . . . Liu, W. (2020). Prevalence and predictors of PTSS during COVID-19 outbreak in China hardest-hit areas: Gender differences matter. *Psychiatry Research,* 112921. http://dx.doi.org/10.1016/j.psychres.2020.112921

Localizely. (n.d.). *Home.* https://localizely.com/.

Lu, Y. C., Shu, B. C., Chang, Y. Y., & Lung, F. W. (2006). The mental health of hospital workers dealing with severe acute respiratory syndrome. *Psychotherapy and Psychosomatics, 75*(6), 370–375. http://dx.doi.org/10.1159/000095443

Maercker, A., & Hecker, T. (2016). Broadening perspectives on trauma and recovery: A socio-interpersonal view of PTSD. *European Journal of Psychotraumatology, 7*(1), 29303. http://dx.doi.org/10.3402/ejpt.v7.29303

Mak, I. W. C., Chu, C. M., Pan, P. C., Yiu, M. G. C., & Chan, V. L. (2009). Long-term psychiatric morbidities among SARS survivors. *General Hospital Psychiatry, 31*(4), 318–326. http://dx.doi.org/10.1016/j.genhosppsych.2009.03.001

Martenyi, F., & Soldatenkova, V. (2006). Fluoxetine in the acute treatment and relapse prevention of combat-related post-traumatic stress disorder: Analysis of the veteran group of a placebo-controlled, randomized clinical trial. *European Neuropsychopharmacology, 16*(5), 340–349. http://dx.doi.org/10.1016/j.euroneuro.2005.10.007

Mayou, R. A., Ehlers, A., & Hobbs, M. (2000). Psychological debriefing for road traffic accident victims: Three-year follow-up of a randomised controlled trial. *The British Journal of Psychiatry, 176*(6), 589–593. http://dx.doi.org/10.1192/bjp.176.6.589

McLean, C. P., Asnaani, A., Litz, B. T., & Hofmann, S. G. (2011). Gender differences in anxiety disorders: Prevalence, course of illness, comorbidity and burden of illness. *Journal of Psychiatric Research, 45*(8), 1027–1035. http://dx.doi.org/10.1016/j.jpsychires.2011.03.006

Pennisi, P., Tonacci, A., Tartarisco, G., Billeci, L., Ruta, L., Gangemi, S., . . . Pioggia, G. (2016). Autism and social robotics: A systematic review. *Autism Research, 9*(2), 165–183.

Philippens, I. (2020). Insights from translational neuroscience. In E. Vermetten, I. Frankova, L. Carmi, O. Chaban, & J. Zohar (Eds.), *Risk management of terrorism induced stress: NATO science for peace and security series, sub-series E: Human and societal dynamics* (Vol 148, pp. 21–32). Amsterdam, The Netherlands: IOS Press.

Rose, S. C., Bisson, J., Churchill, R., & Wessely, S. (2002). Psychological debriefing for preventing post traumatic stress disorder (PTSD). *The Cochrane Database of Systematic Reviews,* (2) http://dx.doi.org/10.1002/14651858.cd000560

Sandi, C., & Rose, S. P. (1994). Corticosterone enhances long-term retention in one-day-old chicks trained in a weak passive avoidance learning paradigm. *Brain Research, 647,* 106–112. http://dx.doi.org/10.1016/0006-8993(94)91404-4

Sansonetti, P. H. (2020). *Conférence du Pr Philippe Sansonetti: Covid-19 ou la chronique d'une émergence annoncée [Video].* College de France March, 16, https://www.college-de-france.fr/site/actualites/Covid-19ChroniqueEmergenceAnnoncee.htm

Schultebraucks, K., Shalev, A. Y., Michopoulos, V., Grudzen, C. R., Shin, S. M., Stevens, J. S., ... Marmar, C. R. (2020). A validated predictive algorithm of post-traumatic stress course following emergency department admission after a traumatic stressor. *Nature Medicine, 26*(7), 1084–1088.

Shalev, A. Y., Gevonden, M., Ratanatharathorn, A., Laska, E., Van Der Mei, W. F., Qi, W., ... Matsuoka, Y. J. (2019). Estimating the risk of PTSD in recent trauma survivors: Results of the International Consortium to predict PTSD (ICPP). *World Psychiatry : Official Journal of the World Psychiatric Association (WPA), 18*(1), 77–87. http://dx.doi.org/10.1002/wps.20608

Sidorova, O. (2019). *Cognitive behavioural therapy (CBT). In EFPT psychotherapy guidebook* (2nd ed.) July 5. Retrieved from: https://epg.pubpub.org/pub/cbt

Siegelaar, S. E., Olff, M., Bour, L. J., Veelo, D., Zwinderman, A. H., van Bruggen, G., ... Tijssen, M. A. (2006). The auditory startle response in post-traumatic stress disorder. *Experimental Brain Research, 174,* 1–6.

Soron, T. R. (2016). Telepsychiatry for depression management in Bangladesh. *International Journal of Mental Health, 45*(4), 1–2. http://dx.doi.org/10.1080/00207411.2016.1234305

Sun, L., Sun, Z., Wu, L., Zhu, Z., Zhang, F., Shang, Z., ... Liu, N. (2020). Prevalence and risk factors of acute posttraumatic stress symptoms during the COVID-19 outbreak in Wuhan, China. *medRxiv.* http://dx.doi.org/10.1101/2020.03.06.20032425

SurveyMonkey. (n.d.). *SurveyMonkey.* https://www.surveymonkey.com/.

Tarrier, N., Sommerfeld, C., Pilgrim, H., & Humphreys, L. (1999). Cognitive therapy or imaginal exposure in the treatment of post-traumatic stress disorder. *The British Journal of Psychiatry, 175*(6), 571–575.

Thomas, E. E., Haydon, H. M., Mehrotra, A., Caffery, L. J., Snoswell, C. L., Banbury, A., ... Smith, A. C. (2020). Building on the momentum: Sustaining telehealth beyond COVID-19. *Journal of Telemedicine and Telecare* 1357633X20960638.

von der Warth, R., Dams, J., Grochtdreis, T., & König, H. H. (2020). Economic evaluations and cost analyses in posttraumatic stress disorder: A systematic review. *European Journal of Psychotraumatology, 11*(1), 1753940.

Weblate. (n.d.). Weblate. https://weblate.org/.

Wechsler, T. F., Mühlberger, A., & Kümpers, F. (2019). Inferiority or even superiority of virtual reality exposure therapy in phobias?-A systematic review and quantitative meta-analysis on randomized controlled trials specifically comparing the efficacy of virtual reality exposure to gold standard in vivo exposure in agoraphobia, specific phobia and social phobia. *Frontiers in Psychology, 10,* 1758.

Wilson, F. A., Rampa, S., Trout, K. E., & Stimpson, J. P. (2017). Telehealth delivery of mental health services: an analysis of private insurance claims data in the United States. *Psychiatric Services, 68*(12), 1303–1306. http://dx.doi.org/10.1176/appi.ps.201700017

World Network of Psychiatric Trainees. (n.d.) *WNPT facebook group.* https://www.facebook.com/groups/520657938530318.

Wright, L. A., Sijbrandij, M., Sinnerton, R., Lewis, C., Roberts, N. P., & Bisson, J. I. (2019). Pharmacological prevention and early treatment of post-traumatic stress disorder and acute stress disorder: A systematic review and meta-analysis. *Translational Psychiatry, 9*(1), 1–10. http://dx.doi.org/10.1038/s41398-019-0673-5

Wu, P., Fang, Y., Guan, Z., Fan, B., Kong, J., Yao, Z., ... Hoven, C. W. (2009). The psychological impact of the SARS epidemic on hospital employees in China: exposure, risk perception, and altruistic acceptance of risk. *The Canadian Journal of Psychiatry, 54*(5), 302–311. http://dx.doi.org/10.1177/070674370905400504

Zohar, J. (2018). *Stress related disorders and the "golden hours", European College of Neuro Psychopharmacology Summerschool.* Oxford, https://www.ecnp.eu/early-career-scientists/ecnp-school

Zohar, J., Juven-Wetzler, A., Sonnino, R., Cwikel-Hamzany, S., Balaban, E., & Cohen, H. (2011). New insights into secondary prevention in post-traumatic stress disorder. *Dialogues in Clinical Neuroscience, 13*(3), 301.

Zohar, J., Yahalom, H., Kozlovsky, N., Cwikel-Hamzany, S., Matar, M. A., Kaplan, Z., ... Cohen, H. (2011). High dose hydrocortisone immediately after trauma may alter the trajectory of PTSD: Interplay between clinical and animal studies. *European Neuropsychopharmacology, 21*(11), 796–809. http://dx.doi.org/10.1016/j.euroneuro.2011.06.001