Web App for Emotional Management During the COVID-19 Pandemic: Platform Development and Retrospective Analysis of Its Use Throughout Two Waves of the Outbreak in Spain

Sara Guila Fidel Kinori, Gerard Carot-Sans, Andrés Cuartero, Damià Valero-Bover, Jordi Piera-Jiménez, Rosa Roma Monfa, Elisabet Garcia, Pol Pérez Sust, Jordi Blanch, Josep Antoni Ramos-Quiroga

Table of Contents

Web App for Emotional Management During the COVID-19 Pandemic: Platform Development and Retrospective Analysis of Its Use Throughout Two Waves of the Outbreak in Spain

Sara Guila Fidel Kinori[1, 2] PhD; Gerard Carot-Sans[3, 4] PhD; Andrés Cuartero[3, 5] BSc; Damià Valero-Bover[3, 4] BSc, MSc; Jordi Piera-Jiménez[3, 4, 6] BSc, MSc; Rosa Roma Monfa[3] BSc, MBA; Elisabet Garcia[3] BSc, MBA; Pol Pérez Sust[3, 7] BSc, MSc; Jordi Blanch[3] MD; Josep Antoni Ramos-Quiroga[1, 2] MD, PhD

[1]Hospital Universitari Vall d'Hebron Barcelona ES
[2]Universitat Autònoma de Barcelona Barcelona ES
[3]Servei Català de la Salut Barcelona ES
[4]Digitalization for the Sustainability of the Healthcare System (DS3) Sistema de Salut de Catalunya Barcelona ES
[5]Sistema d'Emergències Mèdiques L'Hospitalet de Llobregat ES
[6]Open Evidence Research Group Universitat Oberta de Catalunya Barcelona ES
[7]Departament de Salut Barcelona ES

Corresponding Author:
Sara Guila Fidel Kinori PhD
Hospital Universitari Vall d'Hebron
Passeig de la Vall d'Hebron, 119
Barcelona
ES

Abstract

Background: Quarantines and nationwide lockdowns dictated for containing the spread of the COVID-19 pandemic may lead to distress and increase the frequency of anxiety and depression symptoms among the general population. During the national lockdown of the first wave of the COVID-19 epidemic in Spain, we developed and launched a Web App aimed at promoting emotional self-care in the general population and facilitate contact with healthcare professionals.

Objective: To describe the Web App development and analyze its utilization pattern throughout two successive waves of the COVID-19 epidemic in Spain.

Methods: The Web App targeted all individuals aged 18 years or more and was designed by adapting the contents of a mobile App for adjuvant treatment of post-traumatic stress disorder (i.e., the PTSD Coach App) to the general population and the pandemic/lockdown scenario. We retrospectively assessed the utilization pattern of the Web App using data systematically retrieved from Google Analytics. Data were grouped into three time periods, defined using a joinpoint analysis of COVID-19 incidence in our area: first wave, between-wave period, and second wave.

Results: The resulting Web App, named gestioemocional.cat, maintains the navigation structure of the PTSD Coach App, with three main modules: tools for emotional self-care, a self-assessment test, and professional resources for on-demand contact. The self-assessment test combines the Patient Health Questionnaire-2 (PHQ-2) and the 7-item Generalized Anxiety Disorder Scale (GAD-7) and offers professional contact in the advent of high level of depression and anxiety; contact is prioritized according to a screening questionnaire administered at the time of obtaining individual consent to be contacted. The tools for emotional self-care can be accessed either on-demand or symptom-driven. The utilization analysis showed a high number of weekly accesses during the first wave. In this period, press releases regarding critical events of the pandemic progression and government decisions on containment measures were followed by a utilization peak, irrespective of the sense (i.e., positive or negative) of the information. Positive information pieces (e.g., relaxation of containment measures due to a reduction of COVID-19 cases) resulted in a utilization peak immediately after the press release, followed by a successive decline in utilization. The second wave was characterized by a lower and less responsive utilization of the Web App.

Conclusions: mHealth tools may help the general population coping with stressful conditions associated with the pandemic scenario. Future studies shall investigate the extent of the potential benefits of these tools in the general (i.e., without diagnosed mental illnesses) population and the strategies to reach as many people as possible. Clinical Trial: Not applicable

Preprint Settings

1) Would you like to publish your submitted manuscript as preprint?

✔ **Please make my preprint PDF available to anyone at any time (recommended).**
Please make my preprint PDF available only to logged-in users; I understand that my title and abstract will remain visible to all users.
Only make the preprint title and abstract visible.
No, I do not wish to publish my submitted manuscript as a preprint.

2) If accepted for publication in a JMIR journal, would you like the PDF to be visible to the public?

✔ **Yes, please make my accepted manuscript PDF available to anyone at any time (Recommended).**
Yes, but please make my accepted manuscript PDF available only to logged-in users; I understand that the title and abstract will remain v
Yes, but only make the title and abstract visible (see Important note, above). I understand that if I later pay to participate in <a href="http

Original Manuscript

Original Paper

Web App for Emotional Management During the COVID-19 Pandemic: Platform Development and Retrospective Analysis of Its Use Throughout Two Waves of the Outbreak in Spain

Fidel-Kinori, SG[a,b]; Carot-Sans, G[c,d]; Cuartero-Barbanoj, A[e,c]; Valero-Bover, D[c,d]; Piera-Jimenez, J[c,d,f];

Romà-Monfà, R[c]; Garcia-Ribatallada, E[c]; Perez-Sust, P[c,g]; Blanch-Andreu, J[c]; Ramos-Quiroga, JA[a,b].

[a] Hospital Universitari Vall d'Hebron, Barcelona, Spain

[b] Universitat de Autònoma de Barcelona, Bellaterra, Spain

[c] Servei Català de la Salut, Barcelona, Spain

[d] Digitalization for the Sustainability of the Healthcare System (DS3), Sistema de Salut de

Catalunya, Barcelona, Spain

[e] Sistema d'Emergències Mèdiques, L'Hospitalet de Llobregat, Spain

[f] Open Evidence Research Group, Universitat Oberta de Catalunya, Barcelona, Spain

[g] Departament de Salut, Barcelona, Spain

Abstract

Background: Quarantines and nationwide lockdowns dictated for containing the spread of the COVID-19 pandemic may lead to distress and increase the frequency of anxiety and depression symptoms among the general population. During the national lockdown of the first wave of the COVID-19 outbreak in Spain, we developed and launched a Web App to promote emotional self-care in the general population and facilitate contact with healthcare professionals.

Objective: To describe the Web App and analyse its utilization pattern throughout two successive waves of the COVID-19 outbreak in Spain.

Methods: The Web App targeted all individuals aged 18 years or more and was designed by adapting the contents of a mobile App for adjuvant treatment of post-traumatic stress disorder (i.e., the PTSD Coach App) to the general population and the pandemic/lockdown scenario. We retrospectively assessed the utilization pattern of the Web App using data systematically retrieved from Google Analytics. Data were grouped into three time periods, defined using a join point analysis of COVID-19 incidence in our area: first wave, between-wave period, and second wave.

Results: The resulting Web App, named gesioemocional.cat, maintains the navigation structure of the PTSD Coach App, with three main modules: tools for emotional self-care, a self-assessment test, and professional resources for on-demand contact. The self-assessment test combines the Patient Health Questionnaire-2 (PHQ-2) and the 7-item Generalized Anxiety Disorder Scale (GAD-7) and

offers professional contact in the advent of a high level of depression and anxiety; contact is prioritized according to a screening questionnaire administered at the time of obtaining individual consent to be contacted. The tools for emotional self-care can be accessed either on-demand or symptom-driven. The utilization analysis showed a high number of weekly accesses during the first wave. In this period, press releases regarding critical events of the pandemic progression and government decisions on containment measures were followed by a utilization peak, irrespective of the sense (i.e., positive or negative) of the information. Positive information pieces (e.g., relaxation of containment measures due to a reduction of COVID-19 cases) resulted in a sharp increase in utilization immediately after information release, followed by a successive decline in utilization. The second wave was characterized by a lower and less responsive utilization of the Web App.

Conclusions: mHealth tools may help the general population coping with stressful conditions associated with the pandemic scenario. Future studies shall investigate the effectiveness of these tools among the general population—including individuals without diagnosed mental illnesses—and strategies to reach as many people as possible.

Trial Registration: Not applicable

Keywords: Web App; Emotional management; Lockdown; COVID-19; Post-traumatic Stress Disorder; Anxiety; Quarantine

Introduction

In the last months, most countries worldwide have experienced uncontrolled outbreaks of the coronavirus disease 2019 (COVID-19) soon after reporting the first case. The rapid spread of its causing agent, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has led to an unprecedented overburdening of healthcare systems, prompting many governments to dictate strict lockdowns for containing the outbreak.

While such indiscriminate strategies have succeeded in containing SARS-CoV-2 spread and reducing mortality [1], evidence warns on many psychological harms potentially associated with quarantines [2], particularly among older and dependent people and those with previous psychiatric pathologies [3–5]. Alongside the quarantine-specific stressors, the uncertainty associated with the pandemic scenario and impossibility of accompanying loved ones during their hospital stay or end-of-life stage has contributed to psychological overwhelming in many cases [6].

The use of mobile- and web-based technologies for health (mHealth and eHealth, respectively) has been shown to improve access to healthcare services under confinement situations. In the last years, information and communication technologies (ICT) (including mHealth and eHealth solutions) for people with mental health needs have been gradually incorporated into routine care, also in social groups not considered regular digital consumers, such as older people [7]. A successful example of ICT-based solutions for mental health is the mobile App for managing post-traumatic stress disorder (i.e., the PTSD Coach app), developed by the Veterans Affairs National Centre for PTSD and the Department of Defence National Centre for Telehealth & Technology [8]. The PTSD Coach app has been translated to many languages—including Spanish, a translation led by our team [9]—, and it is currently used in our Psychiatry Department as an adjuvant to face-to-face therapy for PTSD.

The Catalan Health Service, which provides universal healthcare to a population of 7.7 million inhabitants in North-East Spain, has a long tradition of implementing ICT solutions for promoting integrated care and increasing the efficiency and quality of healthcare delivery. The overloading of the healthcare system experienced during the COVID-19 outbreak boosted the implementation of various digital health strategies to counteract the collapse of many health resources [10]. To our knowledge, by the time of the national lockdown in our country, no mHealth solutions had been developed for supporting people with mental health needs in a quarantine or lockdown context. Thus,

considering the limited access of people to the healthcare system and the potential of ICT-based solutions to bridge these gaps, we aimed to develop a Web App platform for supporting emotional management among the general population during the COVID-19 outbreak in our country. The existence of the PTSD Coach App provided us with an opportunity to develop such a Web App quickly and offer it to the local population timely.

We present herein the development, main characteristics, and launch of the Web App, named gestioemocional.cat ("emotionalmanagement" in Catalan), and a retrospective analysis of its use throughout alternate periods of lockdown and ease of social distancing measures.

Methods

Design Objectives

The Web App was developed in response to a requested by the Catalan Health System and Catalan Ministry of Health to provide Catalonia citizens (North-East Spain) with support for coping with the emotional struggle associated with the COVID-19 pandemic and the national lockdown. The Web App was designed to seek two main objectives: (1) to provide users with tools and guidance for emotional self-assessment and care, and (2) to establish a communication channel to reach healthcare professionals in the advent of worsening of mental health symptoms.

The Web App targeted all individuals aged 18 years or more with the capacity to use a mobile App or Website. Spain has a high smartphone penetration rate [11], for which the Web App had the potential to reach a significant part of the population. Still, technical requirements of the Web App were minimized to facilitate access. Furthermore, to achieve high acceptability and on-demand use of the Web App [12], we decided to store the least information possible and not keep the user's historical records.

Web App Development

The government request for developing the Web App was made on March 26, 2020. A panel of experts consisting of two clinical psychologists with expertise in psychological trauma and crisis intervention and two psychiatrists of the Catalan Health System coordinated and oversaw the Web App development and content generation. Considering the limited time for developing the Web App and the effectiveness of the previously developed PTSD Coach App, we used it as a starting point to translate its contents and adapt them to a lockdown/pandemic scenario when necessary.

The panel of experts reviewed all items of the PTSD Coach App and grouped them into three categories: (1) items that could be translated into local languages without changes in their content, (2) items that required adaptation due to cultural differences, need for broadening the clinical scope to cover anxiety and depression symptoms, or adequateness to the quarantine/pandemic scenario, and (3) items to be removed for definite inappropriateness according to the intended use of the App. Owing to the urgency of Web App development, items review was based on the clinical criteria and expertise of panel members. Of note, two of them had contributed to developing and translating the PTSD Coach App and had, therefore, in-depth knowledge of the rationale behind each item. The resulting contents were used to building the Web App using the corporate colours and design of the Catalan Health System. The authors of the PSTD Coach App kindly provided permission to adapt and translate their App.

Time Frame and Launching Strategy of the Web App

The first case of COVID-19 in Spain was officially reported in late January 2020. The Spanish government halted crowded events on March 9, 2020 and dictated a state of alarm and a national lockdown on March 13, 2020. The lockdown started a progressive easing on May 10, 2020 and was definitely lifted on June 20, 2020.

The Web App gestioemocional.cat was launched by the Catalan Health Department on April 15, 2020. Information regarding the Web App was disseminated using TV and radio advertisements, which were released through the channels of the public corporation.

Utilization Analysis and Statistics

Data for utilization analysis of the Web App were gathered from Google Analytics. The main objective of the utilization analysis was to describe the number of users throughout the analysed period. We used a script to systematize queries for retrieving information on daily accesses to the Web App. For the longitudinal analysis of the Web App use, the number of events was transformed into a logarithmic scale and plotted against a timeline covering the period from the Web App launch on April 15, 2020, to dataset closure on December 16, 2020. Key events regarding outbreak progression (i.e., relevant press releases on epidemiological information and government decisions) and the time window of each wave of the outbreak were added to the plot. The two waves of the COVID-19 outbreak were defined using a join point regression analysis of publicly available data on COVID-19 incidence in our area. A permutation test with 0.05 confidence and 4,499 permutations was used as described elsewhere [13]. Differences in the distribution of test scores on each of the priority levels in the three investigated periods (i.e., first wave, second wave, and between-waves period) were assessed using a Pearson's Chi-squared test and setting the significance threshold at a two-sided alpha value of 0.05. The rest of the analyses were descriptive, and no other hypothesis tests were conducted. All analyses and plots were performed on R package [14].

Results

Platform Components

The gestioemocional.cat Web App has the same navigation structure as the PTSD Coach app. Table 1 summarizes the changes introduced to the PTSD Coach items to adapt them to the intended use of the gestioemocional.cat Web App; the resulting list of items was translated to the local languages (i.e., Spanish and Catalan). Figure 1 outlines the navigation structure of the Web App. The main menu provides the user with access to three sections: (1) resources for emotional management, (2) tools for self-assessment, and (2) professional resources.

Table 1. Summary of content changes for adaptation of the PTSD Coach app into gestioemociona.cat webapp.[a]

	PTSD Coach app contents	Gestioemocional.cat contents	Rationale for change
Main menu			
	Manage symptoms	Resources for emotional management	Wording change (no specific syndrome).
	Take assessment	Self-assessment tools	–
	Healthcare resources	Healthcare resources	–
	Learn	-	Intended for an on-demand use; no personal history recorded.
Symptoms			
	Remind of trauma	Painful memories	Wording adapted to a broader scope
	Disconnected from	Self-isolation	Wording adapted to a

	people		quarantine context
	Disconnected from reality	Disconnected from reality	–
	Sad/ hopelessness	Sadness or hopelessness	–
	Worried / Anxious	Worries	Wording adapted to a broader scope
	Angry	Negative emotions	Wording adapted to a broader scope
	Unable to sleep	Unable to sleep	–
Tools			
	Ambient sounds	Ambient sounds	–
	Body scan	Body scan	–
	Change your perspective	Change your perspective	–
	Contact with others	Contact with others	–
	Deep breathing	Deep breathing	–
	Grounding	Grounding	–
	Inspiring quotes	Inspiring quotes	–
	Leisure activities	Leisure: time alone	Wording adapted to a quarantine context
	Mindfulness	Mindfulness	–
	Muscle relaxation	Muscle relaxation	–
	Observe thoughts	Observe thoughts	–
	Relationship tools	Relationship tools	–
	Sleep tools	Help falling asleep	–
	Soothe the senses	Soothe the senses	–
	Soothing images	Soothing images	–
	Thought shifting	Thought shifting	–
	Time out	Time out	–
	RID: coping with triggers	[Removed]	In a non-PTSD setting, no specific trigger is expected
	Calming thoughts (user uploaded)	[Removed]	No personal section and/or user history was included
	Schedule worry time	[Removed]	Intended for an on-demand use
	Positive imagery	[Removed]	No personal section and/or user history was included
	My feelings	[Removed]	No personal section and/or user history was included
Self-assessment			
	3 items (evaluate your state, assessment history,	Evaluate your state	No personal section and/or user history were included

	schedule self-assessment)		
	PCL-5	PHQ-2	Broadening of assessment scope (anxiety and depressive symptoms expected)
		GAD-7	
Professional resources			
	User can choose or be redirected towards Crisis Resources, Professionals Care or choose persons in his social network	Exhaustive list of phone numbers for general health and mental health support	Adapted to local resources

ªUnchanged contents (i.e., rationale for change dashed) were directly translated to the local languages (i.e., Catalan and Spanish) without content changes.
GAD-7: 7-item Generalized Anxiety Disorder Scale. PCL-5: PTSD Checklist for DSM-5. PHQ-2: patient health questionnaire-2. PTSD: post-traumatic stress disorder.

Resources for emotional management

The section "resources for the emotional management" can be accessed through two pathways: symptom-guided and resource-type-guided (Figure 1). Symptoms include painful memories, self-isolation, disconnection from reality, sadness or hopelessness, worries, negative emotion, and sleeping disturbances. All these symptoms have been identified as very common during quarantines and lockdowns in the context of the COVID-19 pandemic [15,16]. Resource types include body scan (i.e., audio-guided), change your perspective (i.e., random text messages to rationalize distress thoughts), connect with others (i.e., list of ideas/tips for establishing interpersonal relationships under a quarantine context), deep breathing (i.e., audio-guided technique for emotional regulation trough breathing), grounding (i.e., list of tips for helping to be fully present for whatever is occurring right here and now), inspirational phrases, use of personal leisure time (i.e., list proposed activities to be performed during the lockdown), mindfulness exercises, progressive relaxation, observe thoughts (i.e., audio-guided techniques to help coping with distress thoughts), relationships improvements (i.e., list of tips to improve peer communication), help falling asleep (i.e., list of proposals for sleeping better), calm the senses, relaxing images, thought shifting (i.e., list of phrases to be repeated over five minutes using a countdown tool), and time-out (i.e., list of proposals to change the environment when remaining quarantined).
Irrespective of the pathway chosen to access the section "resources for the emotional management", the Web App suggests a particular resource based on the user's distress level, assessed using a single-item questionnaire (i.e., what is your distress level? [use the arrows to indicate how you feel]) and rated on a 0-10 scale. Users can select the distress level either stepwise—using up and down arrows—or using a distress thermometer with an intensity colour code (Figure 1)

Self-assessment

The self-assessment section is based on two questionnaires for a mental health assessment with a Spanish version adapted and validated: the Patient Health Questionnaire-2 (PHQ-2) [17] and the 7-item Generalized Anxiety Disorder Scale (GAD-7) [18]. The PHQ-2 questionnaire is intended as a

first-step approach to identify depressive symptoms based on the frequency of depressed mood and anhedonia. While not recommended for depression diagnosis or monitoring, it is considered useful for screening for depression, which is the most common psychological conditions in clinical practice and research; individuals who screen positive should be further evaluated with the PHQ-9 to determine whether they meet the criteria for a depressive disorder [19]. The Spanish version of the PHQ-2 questionnaire has shown good reliability and validity in identifying depressive symptoms in the primary care setting [20]. The GAD-7 questionnaire was developed for its use in primary care, and it has high sensitivity in identifying symptoms of the anxiety spectrum. The Spanish validation of the questionnaire has shown good reliability and validity [21]. To facilitate self-assessment, the two questionnaires were merged into a single questionnaire. The combination of the PHQ and GAD-7 questionnaires for a joint assessment of anxiety and depression has shown high internal reliability and strong convergent and construct validity when assessing its association with other mental health, quality of life, and disability measures [22]. All items of the combined questionnaire refer to the frequency of symptoms within the past two weeks and are rated on a 4-point scale where 0 means "never", 1 "less than seven days", 2 "more than seven days", and 3 "almost every day".

The results of the two questionnaires are combined to provide four priority levels of care needs (Figure 2). Users with low scores in the PHQ-2 and GAD-7 scales (i.e., suggestive of mild symptoms of anxiety and depression) are encouraged to the routine use of self-management and self-assessment tools to either maintain (level 4) or improve (level 3) their emotional health status. Conversely, users with high scores in the PHQ-2 and GAD-7 scales (i.e., suggestive of severe anxiety and depressive symptoms) are offered phone contact with professionals of the emergency medical service. Users who agree to be contacted by a healthcare professional are redirected to a consent form, which collects minimum personal data. Contacts are prioritized based on the combined result of the self-assessment questionnaire (i.e., 1 or 2) and a screening form asking about six extreme mental health conditions: suicide ideation, loss of a loved one due to COVID-19, family member admitted to hospital due to COVID-19, living with someone at high risk of severe illness or with COVID-19 symptoms, current psychiatric treatment, and previous psychiatric treatment. Affirmative responses to these questions gave the highest priority, irrespective of the self-assessment questionnaire result (Figure 2).

Scheduled phone calls are performed by the same professionals attending calls from people who reach the emergency medical service seeking mental health support. Once the phone contact has been established, healthcare professionals perform an independent assessment, irrespective of the contact source (i.e., direct call to emergency medical services or scheduled call through the Web App).

Healthcare resources

The section "healthcare resources" allows the user to proactively contact community resources, including general health information, emergency medical service, general government information office, the user's primary care centre, and the office for women under gender violence. Additional resources include the Galatea Foundation, aimed at providing support to healthcare professionals, the Official College of Psychologists, which can respond to population demands and transfer cases to public healthcare professionals, and the Vall d'Hebron Coronavirus Section, a web platform available 24 hours a day, 7 days a week for attending concerns related to emotional and social impact of the COVID-19 pandemic.

Utilization

Between April 15, 2020 (i.e., the launch date) and December 16, 2020, the Web App reported 582,826 accesses. Figure 3 shows the longitudinal analysis of the number of users and critical events of pandemic progress. During the last period of the national lockdown, the daily number of users peaked concomitantly with key news or government actions released by the press. Most of the press releases announcing changes on containment measures were immediately followed by a utilization

peak, irrespective of the sense of these changes (i.e., increasing or easing restrictions). Immediately after announcing ease of restrictions (e.g., the start of the de-escalation plan), the daily number of users remarkably decreased. The decrease was particularly abrupt when Barcelona, the most populated area, entered the first phase of the de-escalation plan.

The number of users during the second wave of the outbreak was persistently lower than that in the first wave. During this period, Web App utilization was less sensitive to the announcement of government measures.

Progression of self-assessment

During the investigated period, the Web App recorded 142,337 self-assessment tests: 124,087 (87.2%) during the first wave, 8,510 (6.0%) during the period between waves, and 9,740 (6.8%) during the second wave. The Chi-squared test revealed significant differences regarding the distribution of percentages across the priority levels (obtained from the self-assessment module) between the investigated periods (Figure 4). The percentage of tests scoring for priority levels 1 or 2 (associated with more severe symptoms of anxiety and depression) was higher in the second wave and between-waves periods. Overall, the offer of professional help was accepted in 8,588 cases (11.4% of all cases with priority level 1 or 2 and, therefore, triggering the message of professional help offer).

Discussion

Principal Results

In this manuscript, we describe a Web App aimed at providing the general population with self-care and self-assessment tools for emotional health during the lockdown associated with the COVID-19 pandemic and establishing a new communication channel between the population and healthcare professionals. In addition to reporting the characteristics of the Web App, we analysed the utilization pattern of the Web App during the first ten months of the COVID-19 outbreak in Spain. The frequency of use of the Web App was particularly high during the first wave of the outbreak in Spain and progressively declined until reaching a baseline activity below 1,000 weekly accesses after halting the national lockdown. During the first wave, the number of accesses peaked after press releases associated with the pandemic progression or changes in the containment measures dictated by the government. Interestingly, positive news (e.g., relaxation of social distancing measures) were immediately followed by a sharp increase in utilization and a successive decline. The between-waves and second wave periods were characterized by a less responsive pattern of Web App users.

The self-assessment module of the Web App, designed to work as a sentinel for detecting severe mental health symptoms and proactively offer direct contact with healthcare professionals, was mostly used during the first wave. However, the scores of the self-assessment questionnaire were higher after the first wave, suggesting a higher proportion of people with mental healthcare in the second wave and between-waves periods.

Limitations

The development and launching of the Web App were strongly influenced by the urgency and overloading of the healthcare system, which challenged the design of an adequate assessment strategy of the platform. We chose the PTSD coach app because of the symptom overlapping between post-traumatic stress disorder and those reported elsewhere for lockdown situations, particularly regarding anxiety and depression. One of the advantages of the PTSD coach app was the body of evidence on its effectiveness for self-management of mental health needs. However, owing to the shift in the target population (i.e., from people diagnosed with post-traumatic stress disorder to

the general population), effectiveness of our Web App cannot be assumed and should be confirmed in future studies. Of note, the complicated scenario in which the Web App should be assessed will strongly challenge the trial conduct.

Another important limitation of our retrospective analysis was the limited data stored, which precluded more exhaustive assessments of behaviour patterns among users (e.g., to discriminate between entries of new users and regular access of the same user). However, because of the negative correlation that often exists between App use/demand and permissions for accessing private data [12], we were afraid that collecting too much data from users might be a barrier to Web App utilization. Of note, the government announcement of launching a COVID-19 tracer app raised many privacy concerns among the population and was strongly criticized. In light of this general perception, we prioritized the acceptability of the Web App over the capacity of collecting personal information. As a result, our database for the retrospective analysis lacked important information that might have helped to understand behaviour patterns among users. One of the most remarkable consequences of this limitation is the lack of data at a user level, which precludes discriminating between entries of new users and regular access of the same user. More importantly, the lack of historical records of users prevents us from analyzing improvement or worsening of mental health state. Finally, we could not analyse Web App utilization according to socioeconomic status, which has been highlighted as a source of inequality in other aspects associated with access to COVID-19 resources [23,24]. Nevertheless, while all these limitations compromise analytical approaches of the Web App, the absence of personal questions and no need for signing in are likely to promote the platform use, in line with the overarching goal of the project, which was to help the population during the stressful circumstances of the lockdown.

Comparison with Prior Work

To our knowledge, by the time of developing the Web App, no other mHealth solutions for promoting emotional self-care in the general population during a lockdown or quarantine situation had been launched or published. The closest example of a mHealth tool that matched our aim was the PTSD Coach App, which was innovative in the sense that users can access tools through two alternative pathways: on-demand and symptom-driven [8]. Although the PTSD Coach App was designed as adjuvant to face-to-face therapy for PTSD, its authors suggested that it could also help people not receiving psychological treatment [25,26]. Further experiences also showed good usability and ease of cultural adaptation of the App [9], encouraging us to adapt its contents to a lockdown and pandemic scenario in our country.

Although we cannot directly compare the utilization patterns of our Web App with other mHealth or eHealth solutions for lockdown contexts, the trends observed in our analysis are consistent with information reported elsewhere. For instance, the increased consumption of alcohol and drug abuse reported during this period in our area [16] could likely be attributed to increased anxiety symptoms, grief processes, and difficulties associated with intensive cohabitation [27,28]. Likewise, other countries have reported increased demand for attention from people with mental health needs during nationwide lockdowns associated with the COVID-19 pandemic [29,30].

The design of our retrospective analysis precludes drawing strong conclusions regarding the reasons behind the observed trend towards a less responsive utilization of the Web App in the second wave of the outbreak. However, this finding is consistent with the "pandemic fatigue" phenomenon highlighted by the WHO and defined as an expected and natural response to a prolonged public health crisis [31]. This type of reaction might correspond to M. Seligman's Paradigm on learned helplessness, which describes a passive behaviour exhibited by a subject after enduring repeated aversive stimuli beyond their control. It is worth noticing, however, that self-assessment tests more often scored priority levels 1 or 2 during the between-wave and second wave periods, suggesting that people with higher mental health needs were more likely to retain the Web App utilization after the first wave.

Finally, the fact that 8,588 self-assessment tests ended up with a scheduled phone call with healthcare professionals for mental health support indicates that the Web App has emerged as an additional communication channel for seeking professional help. The number of phone contacts represents a low percentage (11.4%) of the total situations in which professional support was offered. However, this finding is consistent with current evidence, which suggests that most people with common mental health problems do not seek professional help [32,33].

Conclusions

In the first year of the COVID-19 pandemic, various authors have stressed the need to promote original and creative ways to help people cope with the new and stressful conditions behind the pandemic [34,35]. We did not want to miss the opportunity to adapt mHealth tools with proven efficacy in self-management of stressful situations to the pandemic scenario. Future studies shall investigate to what extent this tool helps people coping with the pandemic scenario and address strategies for making as many people as possible aware of this resource.

Acknowledgements

Conflicts of Interest

None declared.

Abbreviations

COVID-19: coronavirus disease 2019
ICT: information and communication technologies
GAD-7: Generalized Anxiety Disorder Scale
PHQ-2: Patient Health Questionnaire-2
PTSD: post-traumatic stress disorder
SARS-CoV-2: severe acute respiratory syndrome coronavirus 2
WHO: World Health Organization

References

1.   Flaxman S, Mishra S, Gandy A, Unwin HJT, Mellan TA, Coupland H, et al. Estimating the effects of non-pharmaceutical interventions on COVID-19 in Europe. Nature. 2020;

2. Mohamad Marzuki MF, Yaacob NA, bin Yaacob NM, Abu Hassan MR, Ahmad SB. Usable Mobile App for Community Education on Colorectal Cancer: Development Process and Usability Study. JMIR Hum Factors. 2019;6(2):e12103.

3. Holmes EA, O'Connor RC, Perry VH, Tracey I, Wessely S, Arseneault L, et al. Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science. The Lancet Psychiatry. 2020;

4. Yang Y, Li W, Zhang Q, Zhang L, Cheung T, Xiang Y-T. Mental health services for older adults in China during the COVID-19 outbreak. The Lancet Psychiatry. 2020;7(4):e19.

5. Arango C. Lessons Learned From the Coronavirus Health Crisis in Madrid, Spain: How COVID-19 Has Changed Our Lives in the Last 2 Weeks. Biol Psychiatry. 2020;

6. Arango C. Lessons Learned From the Coronavirus Health Crisis in Madrid, Spain: How COVID-19 Has Changed Our Lives in the Last 2 Weeks. Biol Psychiatry. 2020 Oct 1;88(7):e33–4.

7. Schueller SM, Neary M, O'Loughlin K, Adkins EC. Discovery of and interest in health apps among those with mental health needs: survey and focus group study. J Med Internet Res. 2018;20(6):e10141.

8. Kuhn E, Greene C, Hoffman J, Nguyen T, Wald L, Schmidt J, et al. Preliminary evaluation of PTSD Coach, a smartphone app for post-traumatic stress symptoms. Mil Med. 2014 Jan 1;179(1):12–8.

9. Kuhn E, van der Meer C, Owen JE, Hoffman JE, Cash R, Carrese P, et al. PTSD Coach around the world. mHealth. 2018 May;4:15–15.

10. Sust PP, Solans O, Fajardo JC, Peralta MM, Rodenas P, Gabaldà J, et al. Turning the crisis into an opportunity: Digital health strategies deployed during the COVID-19 outbreak. J Med Internet Res. 2020 May 4;22(5):e19106.

11. De-Sola J, Rubio G, Talledo H, Pistoni L, Van Riesen H, Rodríguez de Fonseca F. Cell Phone Use Habits Among the Spanish Population: Contribution of Applications to Problematic Use. Front Psychiatry. 2019 Dec 17;10:883.

12. Kummer M, Schulte P. When private information settles the bill: Money and privacy in Google's market for smartphone applications. Manage Sci. 2019 Aug 1;65(8):3470–94.

13. Kim H, Fay MP, Feuer EJ, Midthune DN. Permutation tests for joinpoint regression with applications to cancer rates. Stat Med. 2000;19(3):335–51.

14. R Core Team. R: A language and environment for statistical com-puting [Internet]. R Foundation for Statistical Computing, Vienna, Austria. 2017 [cited 2020 May 25]. Available from: https://www.r-project.org

15. Xiong J, Lipsitz O, Nasri F, Lui LMW, Gill H, Phan L, et al. Impact of COVID-19 pandemic on mental health in the general population: A systematic review. J Affect Disord. 2020;

16. García-Álvarez L, de la Fuente-Tomás L, García-Portilla MP, Sáiz PA, Lacasa CM, Dal Santo F, et al. Early psychological impact of the 2019 coronavirus disease (COVID-19) pandemic and lockdown in a large Spanish sample. J Glob Health. 2020;10(2).

17. Kroenke K, Spitzer RL, Williams JBW. The Patient Health Questionnaire-2: validity of a two-item depression screener. Med Care. 2003;1284–92.

18. Spitzer RL, Kroenke K, Williams JBW, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. Arch Intern Med. 2006;166(10):1092–7.

19. American Psychological Association. Patient Health Questionnaire (PHQ-9 & PHQ-2) [Internet]. 2020 [cited 2021 Feb 20]. Available from: https://www.apa.org/pi/about/publications/caregivers/practice-settings/assessment/tools/patient-health

20. Reuland DS, Cherrington A, Watkins GS, Bradford DW, Blanco RA, Gaynes BN. Diagnostic accuracy of Spanish language depression-screening instruments. Ann Fam Med.

2009;7(5):455–62.

21.   García-Campayo J, Zamorano E, Ruiz MA, Pardo A, Pérez-Páramo M, López-Gómez V, et al. Cultural adaptation into Spanish of the generalized anxiety disorder-7 (GAD-7) scale as a screening tool. Health Qual Life Outcomes. 2010;8(1):8.

22.   Kroenke K, Wu J, Yu Z, Bair MJ, Kean J, Stump T, et al. Patient health questionnaire anxiety and depression scale: Initial validation in three clinical trials. Psychosom Med. 2016 Jul 1;78(6):716–27.

23.   Amengual-Moreno M, Calafat-Caules M, Carot A, AR RC, Río-Bergé C, Ventura-Gabarró C. Social determinants of the incidence of Covid-19 in Barcelona: a preliminary ecological study using public data. Rev Esp Salud Publica. 2020;94:94:e202009101.

24.   Baena-Díez JM, Barroso M, Cordeiro-Coelho SI, Díaz JL, Grau M. Impact of COVID-19 outbreak by income: hitting hardest the most deprived. J Public Health (Bangkok). 2020 Aug 7;

25.   Kuhn E, Kanuri N, Garvert D. A randomized controlled trial of the PTSD Coach app with community trauma survivors. J Consult Clin Psychol. 2017;85(3):267–73.

26.   Ruzek JI, Eric Kuhn E, Jaworski BK, Owen JE, Ramsey KM. Mobile mental health interventions following war and disaster. mHealth. 2016; 2: 37. Medline;

27.   Ben-Zur H, Zeidner M. Threat to life and risk-taking behaviors: A review of empirical findings and explanatory models. Personal Soc Psychol Rev. 2009;13(2):109–28.

28.   Boscarino JA, Adams RE, Galea S. Alcohol use in New York after the terrorist attacks: a study of the effects of psychological trauma on drinking behavior. Addict Behav. 2006;31(4):606–21.

29.   Liu S, Yang L, Zhang C, Xiang Y-T, Liu Z, Hu S, et al. Online mental health services in China during the COVID-19 outbreak. The Lancet Psychiatry. 2020;7(4):e17–8.

30.   Wang C, Pan R, Wan X, Tan Y, Xu L, Ho CS, et al. Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. Int J Environ Res Public Health. 2020;17(5):1729.

31.   World Health Organization (WHO). Pandemic fatigue. Reinvigorating the public to prevent COVID-19 [Internet]. 2021 [cited 2021 Jan 5]. Available from: https://apps.who.int/iris/bitstream/handle/10665/335820/WHO-EURO-2020-1160-40906-55390-eng.pdf

32.   Oliver MI, Pearson N, Coe N, Gunnell D. Help-seeking behaviour in men and women with common mental health problems: Cross-sectional study. Br J Psychiatry. 2005 Apr;186(APR.):297–301.

33.   Bayer JK, Peay MY. Predicting intentions to seek help from professional mental health services. Aust N Z J Psychiatry. 1997;31:504–13.

34.   Inkster B, O'Brien R, Selby E, Joshi S, Subramanian V, Kadaba M, et al. Digital health management during and beyond the COVID-19 pandemic: Opportunities, barriers, and recommendations. JMIR Ment Heal. 2020;7(7):e19246.

35.   Torous J, Myrick KJ, Rauseo-Ricupero N, Firth J. Digital mental health and COVID-19: Using technology today to accelerate the curve on access and quality tomorrow. J Med Internet Res. 2020 Mar 26;22(3):e18848.
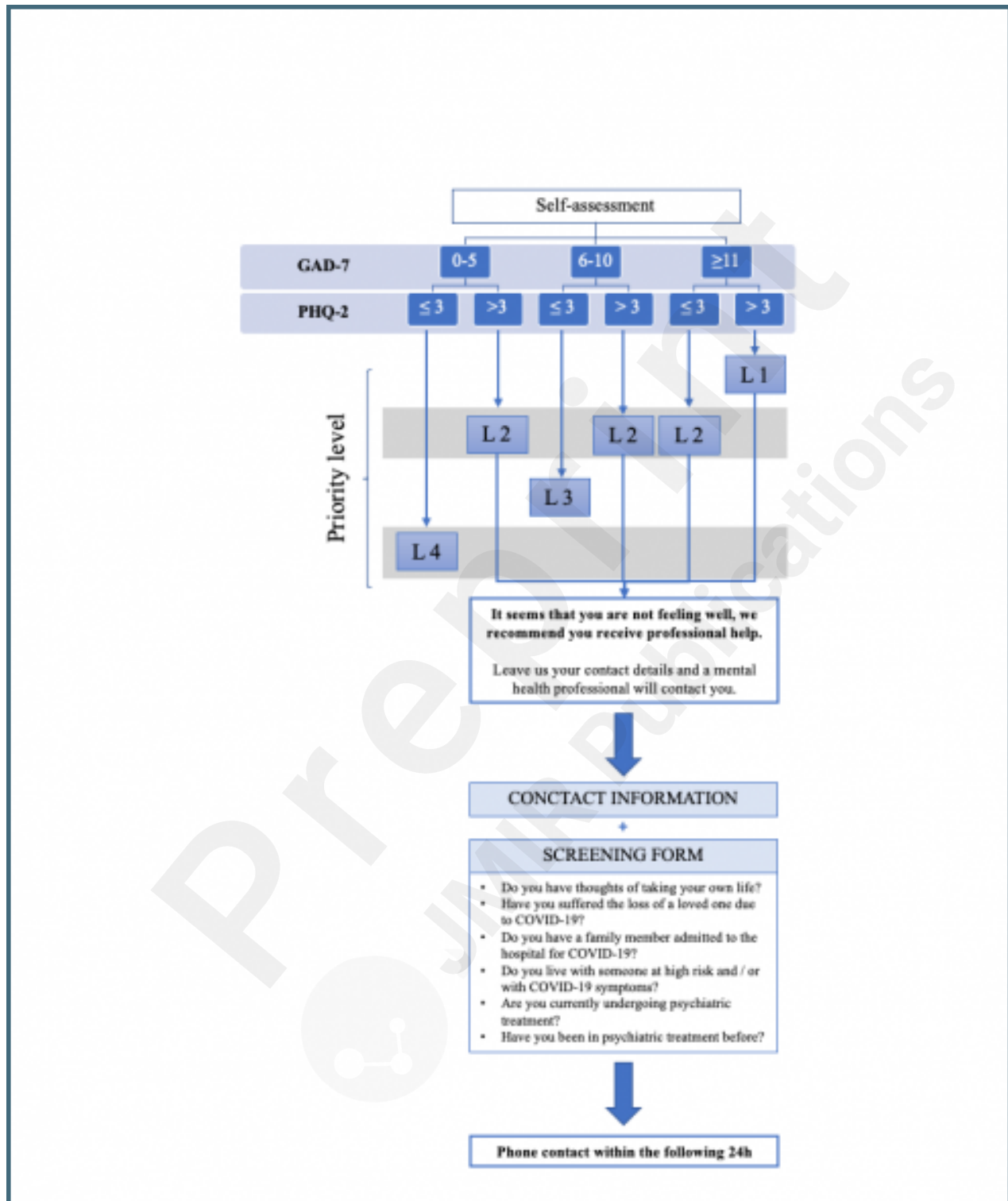
Supplementary Files

Figures

Navigation structure of the gestioemocional.cat Web App.

Prioritization algorithm for proactive contact with healthcare professionals based on the assessment of mental health status.

. Longitudinal analysis of the number of accesses to the webapp (logarithmic scale). Each time point shows the cumulative number of users in the five previous days. Red dotted lines show press releases of key events and government decisions regarding the COVID-19 outbreak. A: 2020-04-17 The Catalan Ministry of Health reports and posts the highest PCR-positive and hospitalization rates. B: 2020-04-28 The Spanish government announces a de-escalation plan, to be deployed in four phases. Catalonia exceeds 10,000 deaths due to COVID-19. C: 2020-05-05 The government announces an upcoming partial lockdown. D: 2020-05-25 Barcelona, the greatest area in Catalonia, enters de-escalation phase 1. E: 2020-06-21 The whole country officially starts the "new normal" state. F: 2020-10-16 The government dictates a temporal lockdown of bars and restaurants. G: 2020-10-25 The government dictates nation-wide curfew from 10 pm to 6 am. H: 2020-10-30 The government dictates a permanent closure of area boundaries and weekend closure of city boundaries. The time window of each period (i.e., first wave, between-waves, and second wave) was defined using a joinpoint regression analysis.
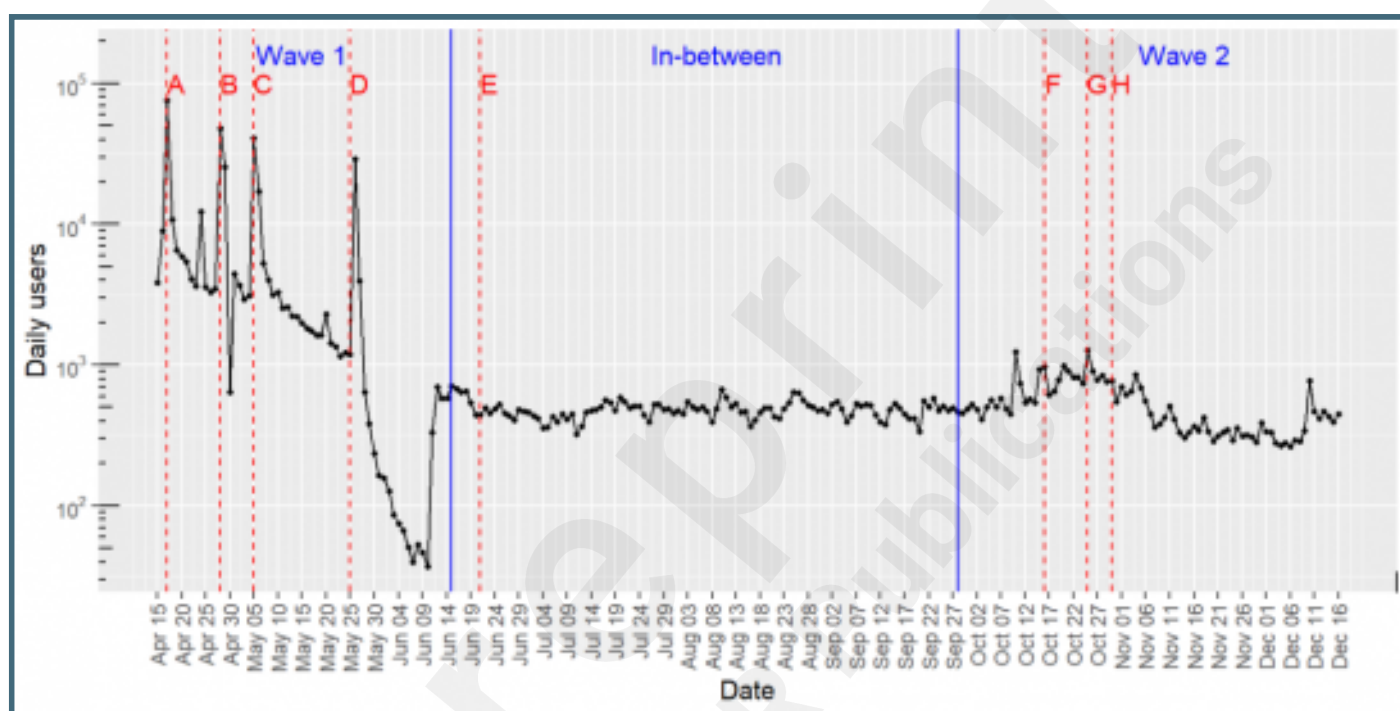
Distribution of the results of the self-assessment test across priority levels (i.e., Risk Group) in each of the investigated period: first wave (n = 124,087), between-waves (n = 8,510), and second wave (n = 9,740). The three periods were defined using a joinpoint regression analysis. The Pearson's Chi-squared test for percentage distribution was significant at p < 0.001 (X^2 = 1349.1; df = 6).