A Resilience-Building App to Support the Mental Health of Health Care Workers in the COVID-19 Era: Design Process, Distribution, and Evaluation

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Abstract

Background: The COVID-19 pandemic has resulted in increased strain on health care systems and negative psychological effects on health care workers. This is anticipated to result in long term negative mental health effects on the population, with health care workers (HCWs) representing a particularly vulnerable group. The scope of the COVID-19 pandemic necessitates the development of a scalable mental health platform to provide services to large numbers of at risk or affected individuals. The Mount Sinai Health System in New York City was at the epicenter of the pandemic in the United States.

Objective: To address the current and anticipated psychological impact the pandemic has had on the HCWs in the health system, a Center for Stress, Resilience, and Personal Growth (CSRPG) was created. The mission of the Center is twofold; it aims to offer (1) resilience workshops and (2) mental health resources and institutional support to all employees. Our aim was to build a mobile application to support the newly founded Center in its mission.

Methods: We built the app as a standalone intervention platform that hosts a suite of tools which users can interact with on a daily basis. With consideration for the Center's aims, we determined the overall vision, initiatives, and goals for the Wellness Hub app, followed by specific milestone tasks and deliverables for development. We defined the app's primary features based on the mental health assessment and needs of HCWs. Feature definition was informed by the results of a resilience survey widely distributed to Mount Sinai HCWs, and by the resources offered at CSRPG, including workshop content.

Results: from the baseline assessment show that more than half of users demonstrate a need for support in at least one psychological area. As of three months after the phase 2 launch, approximately 55% of users re-entered the app after their first opening to explore additional features, with an average of 4 app openings per person.

Conclusions: To address the mental health needs of HCWs during the COVID-19 pandemic, the Wellness Hub app was built and deployed throughout the Mount Sinai Health System. To our knowledge, this is the first resilience app of its kind. The Wellness Hub app is a promising proof of concept, with room to grow, for those who wish to build a secure mobile health app to support their employees, communities, or others in managing and improving mental and physical well-being. It is a novel tool offering mental health support broadly.

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Keywords: mHealth, resilience, mental health, COVID-19, HCWs, digital health, health app, mental health platform

ABSTRACT

Background: The COVID-19 pandemic has resulted in increased strain on health care systems and negative psychological effects on health care workers. This is anticipated to result in long term negative mental health effects on the population, with health care workers (HCWs) representing a particularly vulnerable group. The scope of the COVID-19 pandemic necessitates the development of a scalable mental health platform to provide services to large numbers of at risk or affected individuals. The Mount Sinai Health System in New York City was at the epicenter of the pandemic in the United States.

Objectives: To address the current and anticipated psychological impact the pandemic has had on the HCWs in the health system, a Center for Stress, Resilience, and Personal Growth (CSRPG) was created. The mission of the Center is to support the resilience and mental health of employees through educational offerings, outreach and clinical care. Our aim was to build a mobile application to support the newly founded Center in its mission.

Methods: We built the app as a standalone digital platform that hosts a suite of tools which users can interact with on a daily basis. With consideration for the Center's aims, we determined the overall vision, initiatives, and goals for the Wellness Hub app, followed by specific milestone tasks and deliverables for development. We defined the app's primary features based on the mental health assessment and needs of HCWs. Feature definition was informed by the results of a resilience survey widely distributed to Mount Sinai HCWs, and by the resources offered at CSRPG, including workshop content.

Results: We launched our app over the course of two phases, the first phase being a "soft" launch and the second being a broader launch to all of Mount Sinai. Of the 231 health care workers who downloaded the app, 173 completed our baseline assessment of all mental health screeners in the app. Results from the baseline assessment show that more than half of users demonstrate a need for support in at least one psychological area. As of three months after the phase 2 launch, approximately 55% of users re-entered the app after their first opening to explore additional features, with an average of 4 app openings per person.

Conclusion: To address the mental health needs of HCWs during the COVID-19 pandemic, the Wellness Hub app was built and deployed throughout the Mount Sinai Health System. To our knowledge, this is the first resilience app of its kind. The Wellness Hub app is a promising proof of concept, with room to grow, for those who wish to build a secure mobile health app to support their employees, communities, or others in managing and improving mental and physical well-being. It is a novel tool offering mental health support broadly.

INTRODUCTION

The Coronavirus disease (COVID-19) has resulted in over 41 million infections with a worldwide case fatality ratio of approximately 2.6% as of early November 2020 [1], [2]. Disease spread has been facilitated by a prolonged incubation period and variable symptomatology and severity. As a result, there is a tremendous burden on the healthcare system, with health care workers (HCWs) experiencing increased stress and demand, and increased risk of COVID infection, particularly for patient-facing staff [3]. With consideration for the existing issues of burnout and stress within the healthcare population, the additional impact of COVID-19 on HCWs, who represent a vulnerable group during this pandemic, is a growing concern [4]–[6]. Results from a survey of 2,579 frontline HCWs at Mount Sinai Hospital during Spring 2020 showed that 39% of respondents screened positive for COVID-19 related post-traumatic stress disorder, generalized anxiety disorder, or depression. This finding displays the growing need for additional mental health support amongst HCWs as a result of the pandemic [7].

In recent years, mobile health applications (MHAs), or “apps”, on smartphones have become ubiquitous tools for personal health management and behavior tracking [8], [9]. MHAs can provide individuals with continuous feedback on health status/progress, push notification reminders, and other useful engagement features. These remote, digital capabilities pose a major advantage for smartphones because they provide users with a mechanism to engage with, study, and interpret their health behaviors more regularly and comprehensively than in an average sequence of in-person doctors’ appointments or study visits [10], [11]. Informed by the literature that has considered the techniques that drive behavior change through MHAs as well as their effectiveness [12]–[15], implementation of MHAs for personal health and behavior management can be fine-tuned and leveraged to become a powerful tool in behavior modification and overall lifestyle improvement.

Mobile health applications have been rigorously implemented during the COVID-19 pandemic in order to support contact tracing, symptom tracking, and behavioral management for individuals across the globe. These apps have been deployed to support healthcare systems, governments, and communities to reduce the spread of COVID-19 and its negative long-term effects on the stress and wellbeing of individuals [16]–[18].

The growing knowledge and popularity around MHAs, in combination with the imperative to support frontline workers [19][7], allowed us to launch a mental health-focused smartphone app for health care workers in New York’s Mount Sinai Health System. It offers tools and support for users to bolster emotional well-being [20]. In its current state the app is anonymous, and the data collected in this phase will offer insight into how to optimize the features and content.

METHODS

The Wellness Hub™ app is designed as a tool for general mental health maintenance and resilience and connects users to the mental health services available through the Center for Stress, Resilience, and Personal Growth (CSRPG) and Mount Sinai at large [21]. A team of psychiatrists and psychologists affiliated with CSRPG provided all the content for the app and partnered with the Digital Discovery Program at the Hasso Plattner Institute for Digital Health at Mount Sinai to lead the software development. With consideration for the Center’s aims, we determined the overall vision, initiatives, and goals for the Wellness Hub app, followed by specific milestone tasks and deliverables for development. Content and design framework were shared between the development team and CSRPG. The first version of the app was released after 2.5 months of iterative development.

The app is a standalone platform that hosts a suite of tools which users can interact with daily. While initially only available within Mount Sinai, we envisage the app being applicable and deployable in the future to other outside settings where there is a need to offer resilience building tools to healthcare workers. Content (e.g., lists of local supportive resources) could be tailored to specific healthcare systems.

Resilience Content

Resilience-focused content and user tasks for the app were adapted from resilience training workshops provided to Mount Sinai Health System staff starting in July 2020, in direct response to the impact of the pandemic on staff well-being. The Center's resilience workshops draw upon the work of Southwick and Charney, who outlined 10 factors contributing to personal resilience from laboratory research and interviews with trauma survivors, including Prisoners of War (POWs) during the Vietnam War [22].

The Center's staff developed a peer co-led resilience training curriculum and first piloted a series of eleven 45-minute workshop meetings [21]. Virtual training of over 70 peer leaders was conducted over the summer of 2020, with an initial focus on nurses and physician assistants. As of November 2020, 46 unique staff members have participated in the workshops, with time constraints often cited as reasons for non-attendance. Based on these practical considerations, we condensed the intervention to five meetings in the Fall of 2020 focusing on the following: 1) realistic optimism, 2) facing fears and active coping, 3) social support and utilizing resilient role models, 4) self-care, and 5) faith, meaning and spirituality. Video content has been developed around these five topics hosted in the app, on Mount Sinai's YouTube channel and on the Center's website - to facilitate engagement of staff who do not have the time to participate in person [23].

Application Framework

We defined the app's primary features based on the mental health assessment and needs of HCWs. Feature definition was informed by the results of a resilience survey widely distributed to Mount Sinai HCWs [7], and by the resources offered at CSRPG, including workshop content.

Most prominently, app users answer standardized mental health surveys with subsequent score-based feedback that incorporates various exercises for building resilience. Progress is visualized over time based on individual survey scores, showing green (good) or yellow (cautionary, screen-in) feedback depending on the score, allowing users to track their mental health in a regular, quantitative, and accessible way. A user will receive randomized feedback text based on their score (good vs. cautionary). If a user scores in a way that suggests a need for mental health care (cautionary), a feedback screen appears suggesting that they seek additional mental health/wellness resources and lists available resources and tools directly on the screen for easy access. App users can write private digital journal entries and access videos for relaxation, including some created specifically for Mount Sinai employees. Users also have the ability to tailor their resources and videos to suit their mindset and interests by favoriting specific ones for ease of access. The app also offers quick links to Mount Sinai wellness-related resources (e.g., spiritual care and behavioral health clinics). The app is intended to be used in conjunction with CSRPG's resilience workshops and therefore includes key information and activities related to resilience development. We selected features based on their usability as it relates to mental health management and their compatibility with behavior change theory [12],[24]. Our primary aim was to build features that support feedback and self-monitoring in a simple and straight-forward manner through surveys and journaling and in this way support behavior change. Resources in the app – videos and referral resources – serve as reinforcement and

added support if desired.

Mental Health Surveys

The app contains mental health surveys presented on the main screen. Users are first introduced to the surveys in a "baseline" fashion, where all questions are offered at one time, in one baseline survey. After completion, users will see each survey individualized on the home screen and can take each survey as many times as they would like. The surveys offered to users are validated measures commonly used in research and clinical practice, though they are available to answer consistently in the app as opposed to on a validated schedule. This is because the surveys are meant to serve as a feedback mechanism for users, where they can regularly assess their well-being and mental health, and receive consistent feedback based on their results. The surveys were chosen based on prior knowledge about disorders that occur in the context of trauma as well as data derived from a previous survey distributed across Mount Sinai Hospital healthcare workers [7]. All surveys are presented to users in plain language, as opposed to their clinical name, with scores calculated as indicated in the original validated scoring instructions.

1. Ecological mood assessment ("My Daily Feelings"). We included a daily feelings meter with emoticons indicating a 1-7 scale from sadness to happiness, for participants to rate their daily mood. This measure is similar to that utilized in prior research with smartphone apps [25].
2. PHQ-8 and GAD-2 ("My Mood"). The PHQ-8 and GAD-2 screen for depression and overall anxiety, respectively, over the past two weeks [26], [27]. The PHQ-8 is identical to the PHQ-9, except that the item pertaining to suicidality is omitted [28]. PHQ-8 and GAD-2 items are presented on a 0-3 scale, with higher scores indicating more severe depression and anxiety, respectively. A PHQ-8 score of 10 or higher was used to indicate probable depression while a score of 3 or higher on the GAD-2 suggested clinically significant anxiety problems.
3. PCL-5 ("My Stress Reactions"). We utilized the PCL-5, a newly published brief 4-item version of the longer 20-item PTSD Checklist for DSM-5, anchored to the COVID-19 experience, to evaluate post-traumatic stress reactions [29], [30]. Items are presented on a 0 (not at all) - 4 (extremely) scale. Based on initial work with this brief measure, a score of 8 or higher was used as a cut-point for probable PTSD [29].
4. CD-RISC2 ("My Coping Resources"). We utilized the 2-item version of the Connor Davidson Resilience Scale (CD-RISC2), a previously validated short form of the CD-RISC [31], [32]. The scale ranges from 0 (not true at all) to 4 (true nearly all the time), with higher scores indicating greater resilience. Based on a review of the available normative data, a score of 5 or lower was used to indicate current problems with resilience for purposes of providing feedback [31].
5. WHO-5 ("My Well-being"). The WHO-5 is a 5-item globally utilized measure of overall well-being [33]. Items are presented on a 5 (all the time) to 0 (at no time scale) Higher scores indicate greater well-being. Scores are summed and multiplied by four to yield a 0-100 index; scores at or below 50 are suggestive of depression.
6. AUDIT-C ("My Alcohol Use"). The AUDIT-C is a widely utilized 3-item screening measure for alcohol misuse [34]. Items are presented on a 0-4 scale; scores of three or higher were taken to be suggestive of problems with alcohol misuse.
7. Spiritual Struggle Items ("My Spirituality"). Based on prior research, two items were included in the app to measure problems with spirituality based on prior research: 1) "do you struggle with loss of meaning and joy in your life" and 2) "do you currently have what you would describe as spiritual or religious struggles" [35]. These items were presented on a 0 (not at all) to 3 (a great deal) Likert scale. Endorsement of 1 or higher on either item triggered feedback regarding addressing loss of meaning or spiritual problems.

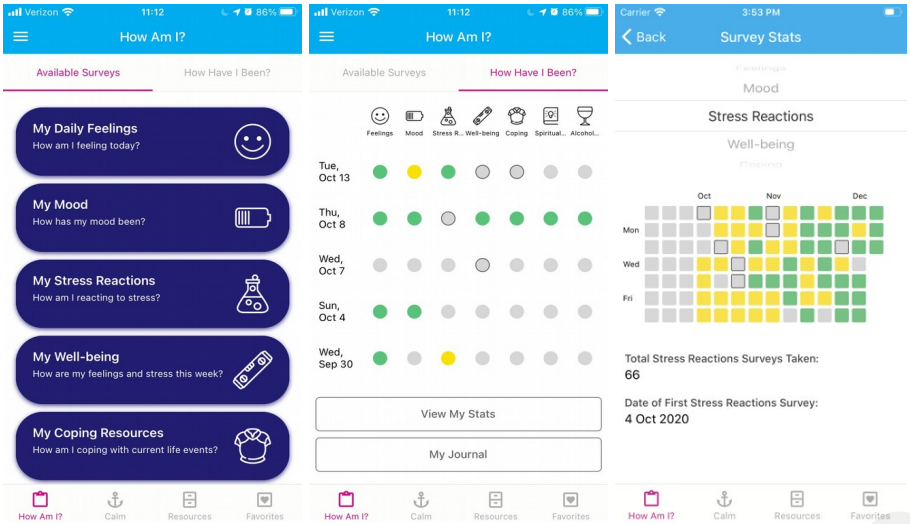

Figure 1. Available surveys (left), weekly progress screen (center) and survey-specific progress screen (right)

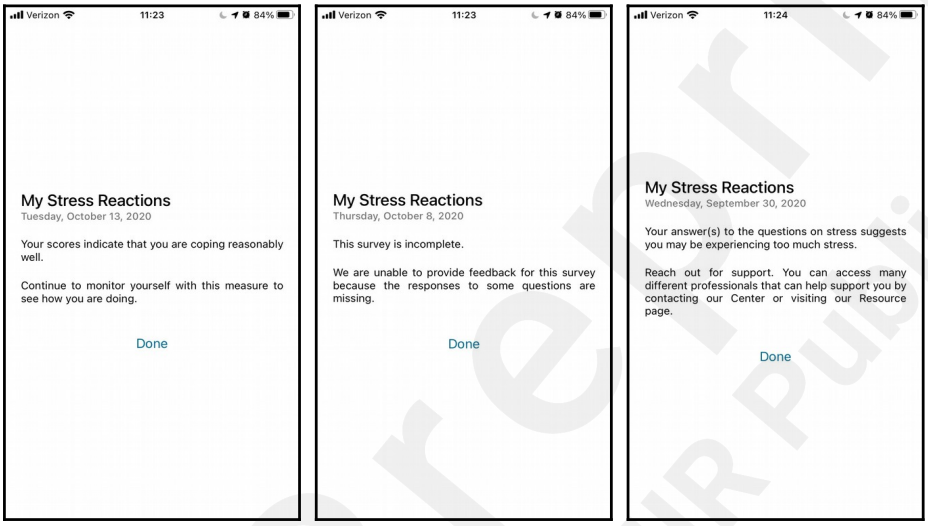

Figure 2. Randomized feedback based on survey score (good, incomplete, or cautionary), respectively

My Resources/My Journal

We offer a library of resources to our Wellness Hub users. Whether based on survey feedback, general curiosity, or additional mental health needs, the app provides access to the Mount Sinai mental health support network and offers resources and tools external to Mount Sinai.

For individuals looking for direct interaction with a mental health expert or support network, the app provides contact information for CSRPG, chaplaincy, and other behavioral practices and offices at Mount Sinai. We offer a page focused on promoting resilience and building a resilience plan. This page also offers additional CSRPG workshop content and videos.

The “My Resources” tool includes a journal function, which allows users to write down any relevant thoughts or experiences that they feel it is important to log. These entries serve as a way self-monitor their feelings and thoughts and can be in the form of text, image, or voice recording. They can also be tagged as a regular journal entry or a resilience act. This tagging feature allows users to apply what they learn in the CSRPG workshops, along with the Resilience page in “My Resources” in order to discern for themselves what experiences are helping them to build their resilience.

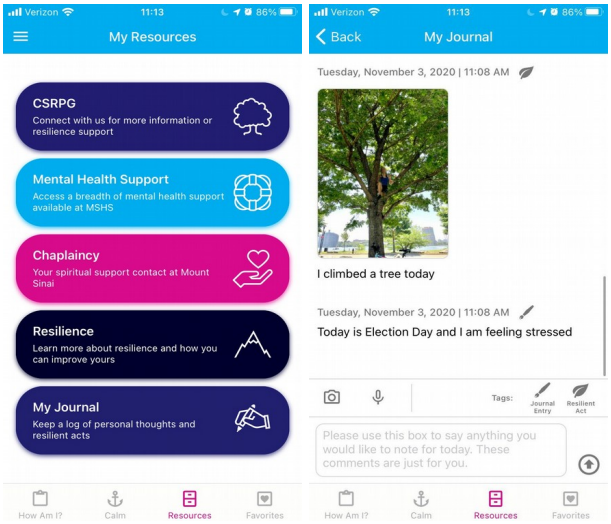

Figure 3. Resource page, with My Journal feature showing tagged photo and text entries.

Another feature provides HCWs with easily accessible relaxation content. The “My Calm” tool offers users a library of relaxation videos, some from the public web and some specifically designed for Mount Sinai employees [36]. These videos range in topic and duration so a user can select something that works for them in the moment. For example, an app user may choose a short, 2-minute video if they are on break during the workday, but may prefer to engage with a longer, more involved yoga video in the evening or to start the day.

General app features

Wellness Hub also includes general app and health app related features. Our data management page allows users to download their data and/or delete all data from the app. Because the app may hold sensitive or personal information related to a user’s feelings or mental health, we maintain an anonymous backend server, meaning we do not collect identifiable data from any of our users. Our only way of identifying a specific user is if they provide us with the unique identifier (“UUID”) that lives in the “My Profile” section of the app.

A notification-setting tool allows users to set the time of day they want to receive notifications about checking in with the app to engage with the available features. Users can also turn off notifications completely.

Additionally, and in accordance with standard practice, we also include information about the app, its developers, and additional copyright or reference information for content hosted in the app.

Data Privacy and Security

Data privacy and security are important considering the content of the app and its potentially stigmatizing and/or personal content, and we ensure that all anonymous data is stored with limited access within the Mount Sinai secure network. Further, all questions in the app are optional, including demographics.

Wellness Hub app data is hosted in a HIPAA-compliant ecosystem. For quality control, robust data transfer, and data persistence, the Wellness Hub app stores the data in an encrypted environment. The environment is fully encrypted, and the metadata are stored in secure NO-SQL instances for quality control.

The data transferred from the app to the cloud is performed through an HTTPS protocol with end-to-end encryption. Authentication protection at the beginning of the data ingestion is performed, and all data requests external to the server are blocked. No personally identifiable information (PII) ever is transferred from the app to the backend. The server manager cannot identify the data's owner, effectively making the ingested data anonymous.
The cloud system is only accessible through a secure shell (ssh) with a public/private key, and IP address restrictions are in place to prevent cyber-attacks. The database is restricted only to the app data, and does not host any data from outside the app.

The app processes the survey scores locally and initializes the data transfer. Scores are given either a valid value or invalid value, depending on whether the user completes a full survey or not. The app also implements Single Sign-On authentication, either Apple or Google, depending on which operating system the app is running. Consistent with our approach to privacy, the app has a non-utilization timer that expires if the app is not used for 2 minutes, and the timer forces a logout when it expires.

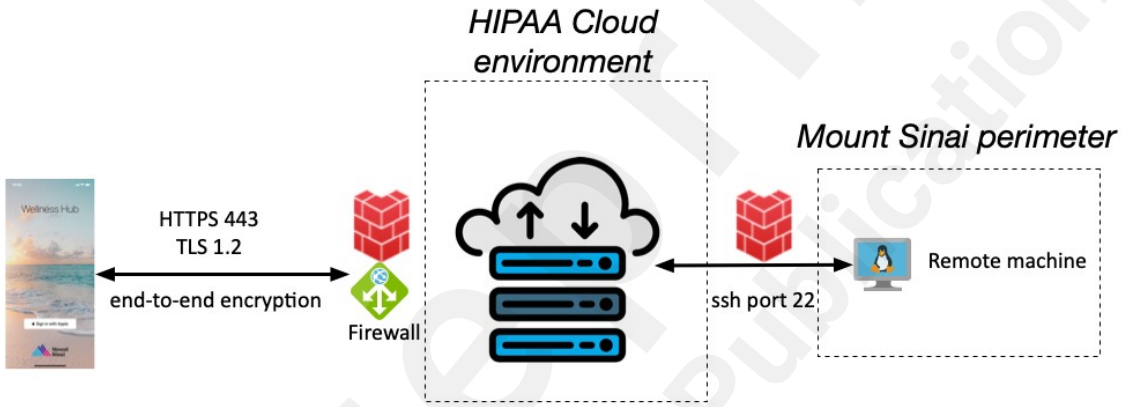

Figure 4. Data ingestion diagram

Personalization

The "Favorites" tool in Wellness Hub allows users to tailor the content of the app based on what they find most helpful to them. All resources and videos from the "My Resources" and "My Calm" pages can be selected as favorites and will subsequently appear as a personalized library in this view. Here, preferred resources can be easily accessible.

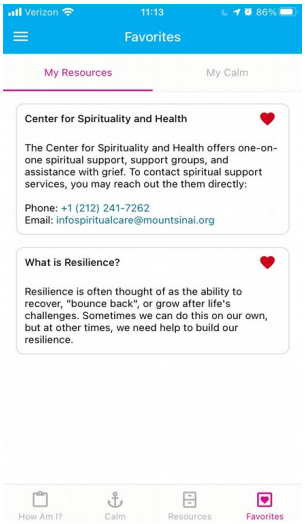

Figure 5. Example of the “My Favorites” page with resources/contact pages “hearted” and easily accessible

Beyond tailoring resources, we also allow users to further personalize their experience through design. In addition to the standard Mount Sinai colors, we include a feature allowing users to choose the color scheme they prefer for their app - with numerous options meant to offer a calming effect to the user. This serves as a simple way to allow personalization of the app, in the same way that they can personalize their favorite content and track their journal entries and survey responses.

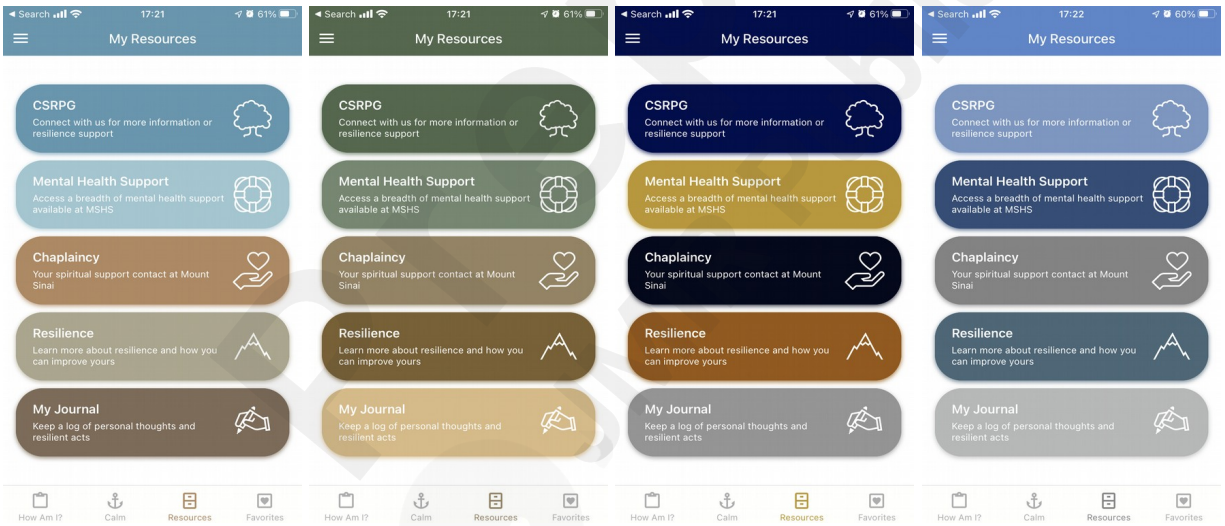

Figure 6. Tailoring the app by color scheme

Demographics

For future use, we have included a basic and optional “About Me” anonymous demographics survey in the standard Profile app section in order to improve the personalization of resources based on age, role at MSHS, and other demographic or COVID-related features. This section can also help us better understand the breakdown of our user population and develop new or amend existing features to better address and target outreach to an underserved user population.

Distribution

This app is available for both iOS and Android devices and is currently only available to employees of the Mount Sinai Health System. Due to this employment restriction in distribution, we developed

this as a custom app that is only available for download using a unique redemption code or link. The code/link can only be used one time, thus limiting the possibility of users distributing the app outside of the health system. In order to verify the current employment status of the user, we created a page on the Mount Sinai intranet in which users must first log in, thus validating their employment, and subsequently select whether they want to download the app for iOS or Android. Next, they enter the email address to which they want to receive installation instructions. The intranet page automatically pulls a unique redemption code from a list on the backend and sends the interested employee download instructions including the unique code. The code is then marked as "used" and unable to be supplied to another person.

The Wellness Hub app was launched between June and September 2020, as a Phase 1 pilot in which we manually distributed redemption codes to interested MSHS employees while further developing the app in anticipation of the Phase 2 launch in October, to correspond with Mental Health Awareness Month. At the time of Phase 2 launch in early October, CSRPG introduced the app to the MSHS community through regular presentations, in-hospital messaging, and email notifications.

Key Performance Indicators

Prior to app development, we established key performance indicators (KPIs) to measure the success of the product and level of engagement of our app users. Our KPIs included: total number of healthcare workers downloading the app, total number of baseline surveys submitted, users submitting additional surveys post-baseline, and general app engagement metrics (e.g., number of app openings).

RESULTS

This paper outlines the design and launch process for the Wellness Hub app. Development time for the platform was variable between phase 1 and phase 2. From initial ideation to current version, we estimate a total of approximately 2.5 months for development and launch. This timeframe is reflective of one software engineer, one product manager, and one designer working on the app. Since the app was developed in-house at Mount Sinai, the platform's primary cost is for database management, which is a regular ongoing service fee. As of March 2021, there were new downloads each month and no reports of bugs or software crashes, suggesting a successful technical launch of the Wellness Hub app.

We analyzed several key performance indicators (KPIs) to determine the success of the app early after launch. These early results serve to showcase the initial launch of the app. Between July 27th and October 13 during our phase 1 pilot launch, which included manual app distribution and word-of-mouth recruitment, 74 users downloaded the app. We received informal feedback from many of these early users, which allowed us to refine the app and include additional features and adapt existing ones to support our user population. This led to the inclusion of relaxation videos and the improvement of our survey feedback content and progress visualizations.

Our broader, phase 2 launch was on October 14, 2020 and included greater recruitment and easily accessible app distribution methods. Within three months of phase 2, we received 157 additional app downloads, totaling our reach and app use to 231 users over the course of 4.5 months.

Of the 231 health care workers who downloaded the app, 173 completed our baseline assessment of all mental health screeners available in the app. As of three months after the phase 2 launch, approximately 55% of users re-entered the app after their first opening to explore additional features, with an average of 4 app openings per person.

While the platform is meant primarily to provide individualized feedback to users, and not analyze a cohort of users together, we have compiled a brief overview of baseline results.

Survey Type	Total Completed	Yellow Score (Screen-in) (%)	Green Score (Doing OK) (%)	Total Incomplete (%)
Daily Feelings	173	105 (61)	65 (38)	3 (1.0)
WHO-5	173	97 (56)	71 (41)	5 (3.0)
AUDIT-C	159	79 (50)	75 (47)	5 (3.0)
GAD-2	102	38 (37)	64 (63)	0 (0.0)
PHQ-8	160	45 (28)	105 (66)	10 (6.0)
PCL-5	159	53 (33)	98 (62)	8 (5.0)
CD-RISC-2	159	41 (26)	113 (71)	5 (3.0)
Spiritual Struggle	159	113 (71)	40 (5.0)	6 (4.0)

Figure 7. Survey-specific completion at baseline and screen-in distribution.

Slightly more than half of baseline survey responses showed “screen-in” cautionary scores on the WHO-5 (56%), AUDIT-C (50%), and Spiritual Struggle (71%). This demonstrates a clear need for additional HCW support related to overall well-being and spiritual struggles.

On average, users took 2.06 surveys (screeners) after completing the baseline assessment, with a standard deviation of 6.5. Of all the surveys available on the app, the daily feeling (“My daily feelings”), PHQ-8 (“My mood”), and PCL-5 (“My stress reactions”) surveys have been taken the most with 410, 368, and 318 total completions, respectively. Considering the everyday availability of these surveys for users on the platform, they are not taken on the validated schedule for which the surveys are primarily intended.

As our study of app usage proceeds, we will review resilience-related indicators beyond the baseline assessments taken by users. We intend to review additional KPIs that align with longer-term use of the platform.

STRENGTHS & LIMITATIONS

The strength of the application is that the Center was able to quickly deploy a tool based on existing resilience literature in order to address a mental health need within the frontline HCW community amidst the initial wave of the COVID-19 pandemic.

The main limitation of the app is that, as it is not a research study in its current version, there is no strict protocol given to users for how they must interact with the application. As a result, there is significant variability in app usage and our ability to track user experiences relative to their demographics. Future versions of the application may include a research intervention that will empirically test the use and effectiveness of the application as a supplement to CSRPG workshops.

Additionally, we consider selection bias; users may already have a bias or inclination toward resilience-building, or recognition of their need for wellness tools, thus leading them to search for an

app-based tool. We may be missing an important HCW population that is both lacking in resources and would not know how to find or use this tool effectively. We have to consider an outreach strategy that will promote greater access or must consider making these tools available in multiple formats and venues. Lastly, the app is available to a specific cohort with specific access - healthcare workers in the Mount Sinai Health System. In its current state, it is meant to serve partly as a supplement to CSRPG workshops held at Mount Sinai. This may impact external validation of the app's efficacy in building resilience outside of this specific cohort.

DISCUSSION

Mobile health applications are an increasingly used tool for people to maintain their physical and mental wellness [8]. MHAs focused on engaging features, linked to behavior change theory, are crucial in helping to empower people to take control of their own health [37].

There are many publicly available resilience-building platforms similar to Wellness Hub, such as COVID Coach and Calm. COVID Coach, developed by the US Department of Veterans Affairs, offers education about coping, self-care tools, progress visualization, and national mental health resources [38]. Calm is a meditation app that offers video and audio programs related to meditation and mindfulness [39]. The Wellness Hub app stands out due to its targeted nature, in that it provides specific and accessible health system resources to its users, and also offers validated mental health surveys along with progress visualization. With healthcare workers feeling the brunt of the pandemic stress, it makes sense to offer them resources that are close to home and relevant to their work.

To address the mental health needs of HCWs during the COVID-19 pandemic, the Wellness Hub app was built and deployed throughout the Mount Sinai Health System. To our knowledge, this is the first resilience app targeted to HCWs, and applied within the context of a global trauma. It includes validated surveys/questionnaires based on prior knowledge of disorders that occur in the context of trauma, a journal tool to allow users to log their feelings and activities related to resilience, and numerous Mount Sinai-specific resources and videos targeted to those seeking additional support and tools to build resilience. The app's initial results, showing that more than half of baseline assessments result in "screen-in" scores, are consistent with previous findings at Mount Sinai in the same cohort via a hospital-wide early pandemic survey [7].

The limited level of app use and engagement thus far may be related to the constrained recruitment strategies to date, considering the lack of in-person advertising, enrollment and distribution due to the pandemic. Additionally, the slower uptake is consistent with our expectations of an initial app release, especially considering the involved download process and our active and occupied target audience of frontline HCWs and others in the health system.

We intend to continue developing this app by improving features based on feedback from our users, including the translation of the platform into Spanish and the integration of Mount Sinai employee and healthcare services such as appointment scheduling. We will move beyond assessment by adding specific resilience-promoting interventions, action items, and tools. Potential future improvements include "badges" that users can obtain in order to encourage them through their resilience journey and inclusions of materials from the CSRPG workshop curriculum in specific "learning" sections and as thought prompts in an expanded version of our journal tool. As the Center for Stress, Resilience, and Personal Growth continues to grow and COVID-19's effects continue to be felt across the healthcare system, we intend to use our KPIs, user feedback, and guidance from the Center workshops to determine the future direction of the app and its content.

The Wellness Hub app is a promising proof of concept for those who wish to build a secure mobile health app to support their employees, communities, or others in managing and improving mental and physical well-being. It offers a novel tool to offer mental health support broadly.

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CONFLICTS OF INTEREST

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests. Dr. Dennis Charney is named co-inventor on an issued patient in the United States, and several issued patients outside the U.S. filed by the Icahn School of Medicine at Mount Sinai (ISMMS), for the use of ketamine as a therapy for PTSD. This intellectual property has not been licensed. In addition, Dr. Charney is named co-inventor on several issued U.S. patents, and several pending U.S. patent applications, filed by ISMMS for the use of ketamine as a therapy for treatment-resistant depression and suicidal ideation. ISMMS has entered into a licensing agreement with Janssen Pharmaceuticals, Inc. and it has and will receive payments from Janssen under the license agreement related to these patents. As a co-inventor, Dr. Charney is entitled to a portion of the payments received by the ISMMS. Since SPRAVATO (esketamine) has received regulatory approval for TRD, ISMMS and Dr. Charney as its employee and a co-inventor, will be entitled to additional payments, under the license agreement. Dr. Charney is named co-inventor on a patent application filed by the ISMMS for the use of intranasally administered neuropeptide Y for the treatment of mood and anxiety disorders. This intellectual property has not been licensed. Dr. Charney is a named co-inventor on several patents filed by ISMMS for a cognitive training intervention to treat depression and related psychiatric disorders. ISMMS has entered into a licensing agreement with Click Therapeutics, Inc., and has and will receive payments related to the use of this cognitive training intervention for the treatment of psychiatric disorders. In accordance with the ISMMS Faculty Handbook, Dr. Charney has received a portion of these payments and is entitled to a portion of any additional payments that the medical school might receive from this license with Click Therapeutics. Dr. Katz is a paid national trauma consultant with Advanced Recovery Systems and a consultant to the RANE Network. Drs. DePierro, Sharma, Marin, Bottinger, Nadkarni, and Danieletto and Ms. Golden, Ms. Katz, Mr. Lindell and Mr. Somarriba have no competing financial or personal relationships that could have appeared to influence work reported in this paper, nor do any additional authors listed on this paper.

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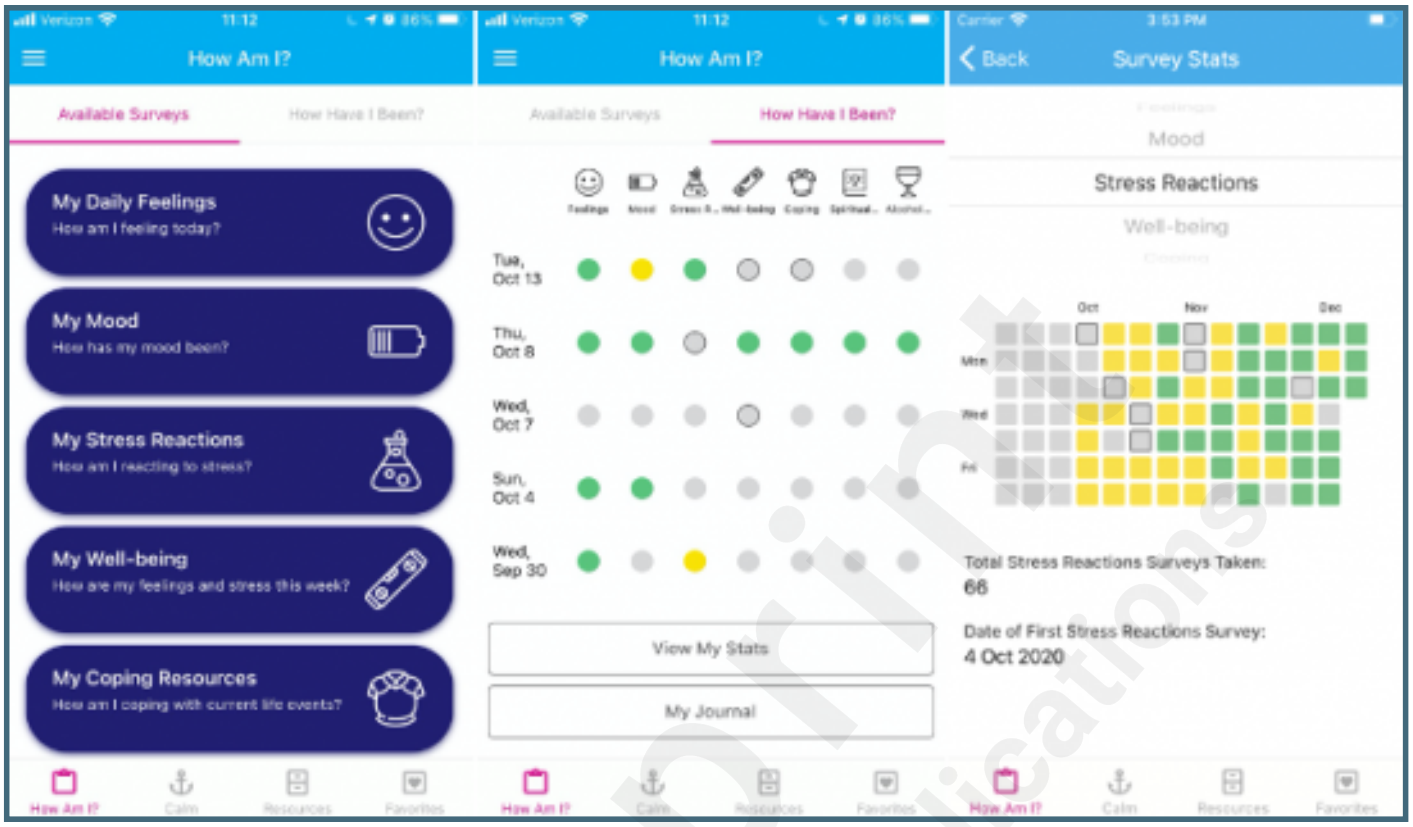
Supplementary Files

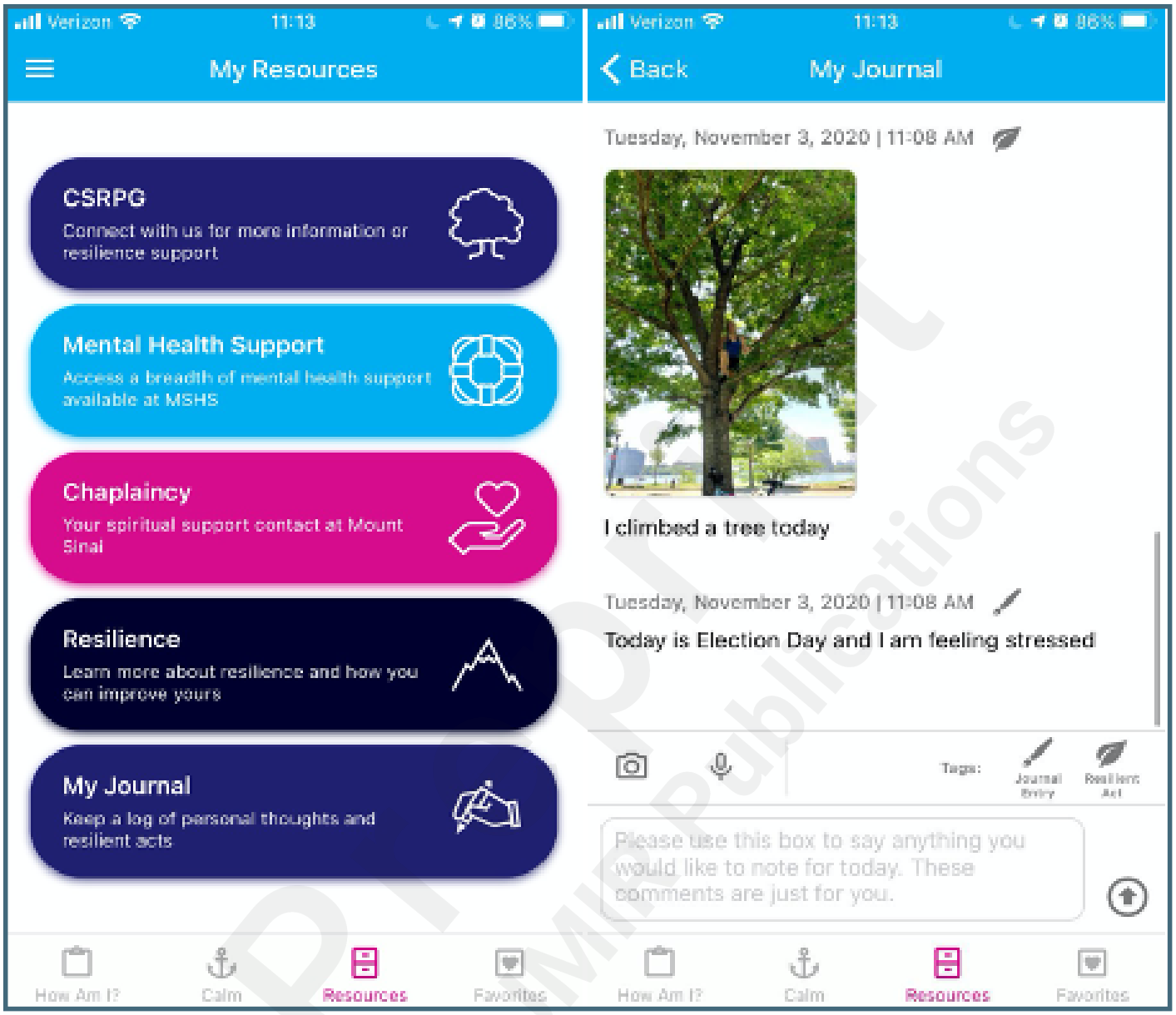
Figures

Available surveys (left), weekly progress screen (center) and survey-specific progress screen (right).

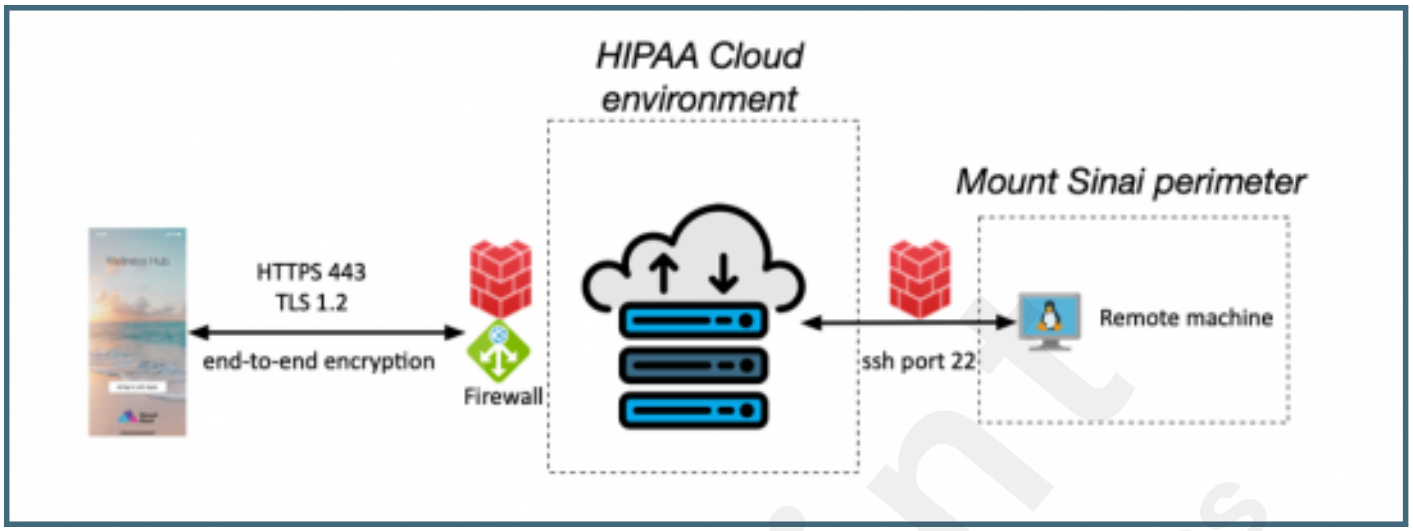


Randomized feedback based on survey score (good, incomplete, or cautionary), respectively.

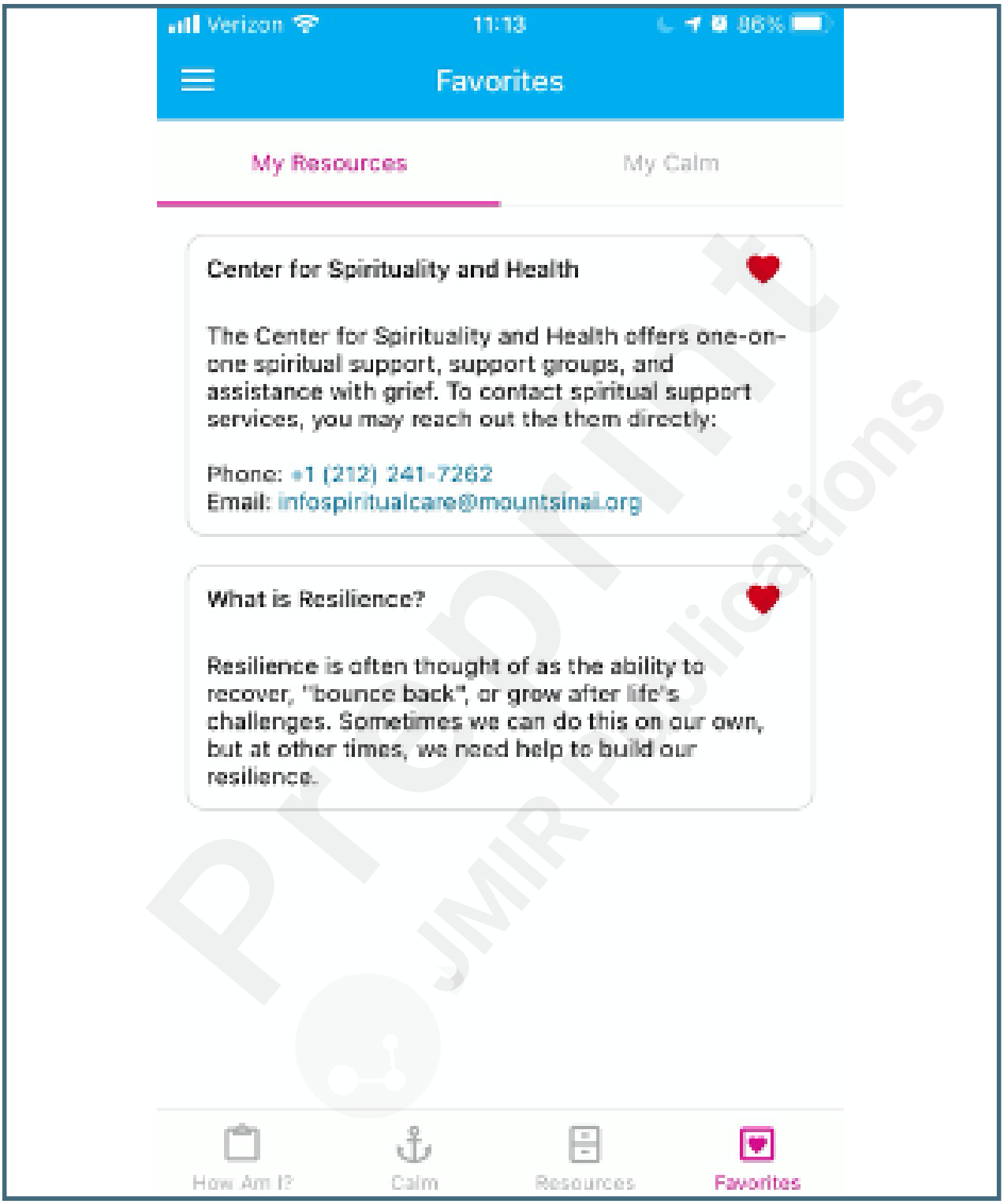
Resource page, with My Journal feature showing tagged photo and text entries.



Data ingestion diagram.



Example of the “My Favorites” page with resources/contact pages “hearted” and easily accessible.



Tailoring the app by color scheme.

Survey-specific completion at baseline and screen-in distribution.

Survey Type	Total Completed	Yellow Score (Screen-in) (%)	Green Score (Doing OK) (%)	Total Incomplete (%)
Daily Feelings	173	105 (61)	65 (38)	3 (1.0)
WHO-5	173	97 (56)	71 (41)	5 (3.0)
AUDIT-C	159	79 (50)	75 (47)	5 (3.0)
GAD-2	102	38 (37)	64 (63)	0 (0.0)
PHQ-8	160	45 (28)	105 (66)	10 (6.0)
PCL-5	159	53 (33)	98 (62)	8 (5.0)
CD-RISC-2	159	41 (26)	113 (71)	5 (3.0)
Spiritual Struggle	159	113 (71)	40 (25)	6 (4.0)