

Feasibility of a Mental Health App Intervention for Emergency Service Workers and Volunteers: A Single- Arm Pilot Study

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Table of Contents

Original Manuscript..... 5

Supplementary Files..... 33

0..... 33

Figures 34

Figure 1..... 35

Figure 2..... 36

CONSORT (or other) checklists..... 37

CONSORT (or other) checklist 0..... 38

Feasibility of a Mental Health App Intervention for Emergency Service Workers and Volunteers: A Single-Arm Pilot Study

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Abstract

Background: Emergency service workers (ESWs) are at greater risk of stressor-related psychopathology than the general population. Barriers to help-seeking are widespread across the sector and appropriate interventions need to be tailored to this population. Build Back Better is a smartphone app-based intervention designed to provide evidence-based prevention strategies for anxiety, depression, and posttraumatic stress disorder (PTSD) for high-risk professionals, such as ESWs.

Objective: This paper presents the development and pilot testing of the app's usability, acceptability, feasibility, and preliminary effectiveness.

Methods: A single group (N = 67), 1-month pilot study was undertaken with ESWs, to assess their use of a smartphone-based mental health (MH) intervention, the Build Back Better app. Demographic data, acceptability and utility questionnaires, general distress (Kessler Psychological Distress) other MH and well-being measures were collected at baseline and 1-month follow-up.

Results: The majority of respondents rated the app quality as very high (79%), felt that the app was easy to use (61%), easily understood (55%), improved their mental fitness (80%), and would recommend the app to others (61%). Encouraging trends toward improvement were found across symptom and wellbeing outcomes. These trends were not statistically significant, which may be attributed to smaller than expected sample size.

Conclusions: The Build Back Better app was found to have satisfactory levels of usability and acceptability. Favorable trends toward better clinical outcomes over time suggest progression to a larger efficacy trial is justified. Participants furthermore highlighted the importance of clarity in both their user journey and presentation of app content to further enhance the in-app user experience. Clinical Trial: New Zealand Clinical Trials Registry (ACTRN12621001006831p)

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Original Manuscript

Title: Feasibility of a Mental Health App Intervention for Emergency Service Workers and Volunteers: A Single-Arm Pilot Study

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Abstract

Background Emergency service workers (ESWs) are at an elevated risk for stressor-related mental health issues, such as anxiety, depression, and posttraumatic stress disorder (PTSD). Barriers to help-seeking are widespread across this sector, necessitating interventions tailored to the unique needs of this population. *Build Back Better* is a smartphone-based intervention designed to provide evidence-based strategies for the prevention of anxiety, depression, and posttraumatic stress disorder (PTSD) among ESWs.

Objective This study aimed to evaluate the usability, acceptability, feasibility, and preliminary effectiveness of the Build Back Better app among ESWs.

Methods A single group (n = 67), 1-month pilot study assessing the impact of the *Build Back Better* app on mental health outcomes, including general distress, anxiety, depression, and traumatic stress coping was undertaken with ESWs. Participants completed baseline and 1-month follow-up assessments using the Kessler Psychological Distress Scale (K10), Patient Health Questionnaire (PHQ-9), Generalized Anxiety Disorder-7-item (GAD-7), World Health Organization Well-Being Index (WHO-5), and the Coping Self-Efficacy Scale for Trauma (CSE-T). The app's usability and acceptability were also evaluated through participant feedback and usage data.

Results Of the 71 participants enrolled, 67 completed the baseline assessment and downloaded the app, with 33 participants providing follow-up data. The mean age of participants was 44.73 years (SD 11.40), and 64% were male. The majority of respondents rated the app quality as very high (79%), felt that the app was easy to use (61%), easily understood (55%), improved their mental fitness (80%), and would recommend the app to others (61%). Encouraging trends toward improvement were found across symptom and wellbeing outcome, however these trends were not significant: general distress ($t_{32} = 0.65$, $p = 0.521$), depression ($t_{32} = 0.75$, $P = 0.459$), anxiety ($t_{32} = 1.08$, $P = 0.290$), or traumatic stress coping ($t_{32} = -0.27$, $P = 0.786$), with effect sizes ≤ 0.2 , likely due to the small sample size.

Conclusions The *Build Back Better* app demonstrated satisfactory levels of usability and acceptability. While the pilot study showed encouraging trends towards improved mental health, further research with a larger sample size is needed to determine its efficacy. Participants furthermore suggested improvements in app navigation and content clarity, emphasizing the need for a more intuitive user experience. Given the positive feedback and improvement in mental health outcomes, a larger-scale efficacy trial is warranted to further assess the app's potential for mental health support in this high-risk population.

Trial Registration New Zealand Clinical Trials Registry (ACTRN12621001006831p)

Keywords: digital mental health; emergency service workers; high risk professions; prevention; psychological distress; smartphone applications; user-engagement

Introduction

Emergency service workers and volunteers (ESWs), are those workers (both paid and volunteer) who attend scenes of emergencies and disaster to minimise risk to community safety and security. These include (but not limited to) police, paramedics, firefighters, rescue and emergency service personnel. They perform an indispensable function in the community; however, the nature of this work can come at a cost to their mental health and wellbeing [1]. These workers are exposed to elevated rates of stress, trauma, and adversity on a regular basis, putting them at increased risk for a range of mental health (MH) conditions including, but not limited to depression, anxiety, drug and alcohol-related disorders, and posttraumatic stress disorder (PTSD) [2-5].

The question of what measures may be able to enhance or protect the mental health in ESWs is garnering growing interest internationally. A recent survey by Kyron and colleagues among 14,868 Australian ambulance, fire and rescue, police, and state emergency services employees, highlights the range of mental health and wellbeing conditions associated with work in the emergency services sector. While 10% of employees screened positive for probable PTSD, 30% had low wellbeing, and 30% had high or very high psychological distress, suggesting that depression and anxiety, as well as PTSD, are likely to be common mental health issues for ESWs [6]. Similar results were found in a systematic review of 27 international studies [7] reporting on 30,878 ambulance personnel, which found estimated prevalence rates of 11% for PTSD, 15% for depression, 15% for anxiety, and 27% for general psychological distress. In a study of 5813 Canadian safety personnel (correctional workers, dispatchers, firefighters, paramedics, and police officers), by Carleton and colleagues (2018) found that 44.5% screened positive for clinically significant symptoms of one or more diagnosable mental disorders; approximately four times higher than rates of diagnosis for the general population. Of concern, these rates were noted to be higher than previously conducted studies in the area, suggesting that mental disorders may be increasing among ESWs [8-10].

Despite the high prevalence of mental health symptoms, significant barriers continue to hinder and delay help-seeking among ESWs, including stigma, perceived unavailability of resources, the need for self-reliance in solving problems, and fear about the intervention or treatment [11]. ESWs' work constraints are also different from many other professions, which can influence seeking help for mental health problems even more. For example, many ESWs are often "on duty" for 24 to 72 hours, thereby having to respond to unpredictable emergencies which supports the importance of tailored interventions, accessible at any time [12, 13]. Their culture is different as well; when ESWs return home, they are expected to "function" in daily living, such as work and family life, which increases the likelihood that any MH symptoms may be ignored. Finally, ESWs are reluctant to approach mainstream mental health services because of fear that awareness by their organization of mental health problems may negative impact certain privileges, such as promotion, deployment to select units, or the right to carry a firearm etcetera. Taken together, these factors point to the importance of considering ESWs' perspectives and needs when devising mental health interventions, and the necessity of developing novel mental health approaches with widespread reach.

Mobile phone-based health initiatives (mHealth) have become an increasingly popular way to provide mental health care and support to individuals [14]. The increased use of technology alongside the widespread

treatment gap, has led researchers to explore the use of digital platforms for mental health engagement. Smartphone applications (apps) are considered a suitable prevention approach, since they have the potential to deliver effective psychological interventions via frequent brief exchanges, offering a unique opportunity for disorder prevention and symptom management [15, 16]. The multiple features of mobile phones furthermore offer great opportunities for the delivery of health promotion interventions in different formats, thereby having the potential to overcome traditional service barriers [17], especially in difficult-to-access populations, such as ESWs. Apps enable flexible user engagement, allowing individuals to access interventions at their convenience, in private and at a time and location of choice, thereby facilitating real-time monitoring of mood and behaviour [18]. Meta-analyses of randomised controlled trials (RCTs) have shown promising results for evidence-based mental health apps in reducing depressive symptoms, stress, anxiety, and substance use [19, 20]. Moreover, mental health applications can successfully employ persuasive strategies, supporting people with mental health issues to adopt healthy lifestyles and improving users-oriented behaviour changes [17, 21]

Prior to efficacy testing, a critical aspect in the development of mobile phone applications is exploring the acceptability and feasibility of the interventions [22]. Engaging the target audience in the process of development is essential for developing optimum treatments in specific settings and is likely to contribute to the wider acceptability and utility of digital mental health interventions [22, 23].

Objectives

The present pilot study aims to explore the use, acceptability, and preferences of ESWs regarding potential uptake of smartphone-based MH intervention designed to provide evidence-based mental health prevention strategies, the *Build Back Better* app. As well as assessing acceptability and feasibility, this study also aims to assess the impact of the Build Back Better app on depression, anxiety, wellbeing, and other symptoms of common mental disorders.

Methods

Study Design and setting

The study was conducted with emergency service workers from five different emergency and rescue services organizations across Australia. Participants were recruited via organizational advertisements, which included QR codes or links to the study website. Participants were recruited to test usability, acceptability, feasibility, and preliminary mental health effects of a smartphone-based MH intervention: the *Build Back Better* app. Data were collected via pre- and post- intervention questionnaires and in-app data collection, with participants using the app remotely. Recruitment started on August 16, 2021, and was finalized December 18, 2021. Data collection of the trial was completed by January 2022.

Ethical Considerations

The study was granted ethical approval by the University of New South Wales Human Research Ethics Committee (HC210399). Informed consent was collected electronically before participation. This approval covers secondary analysis without additional consent. Participants were compensated with a \$40 gift voucher for completing the post-assessment and qualitative interview. Alternatively, participants could opt for a \$40 donation to a charity, if their organization had gift restrictions. The pilot study was registered in The Australian New Zealand Clinical Trials Registry (ACTRN12621001006831p), and the app was notified with the Therapeutic Goods Administration through the Clinical Trial Notification (CTN) scheme (CT-2021-CTN-02958-1). Study data were deidentified to ensure confidentiality and participant privacy.

Participants

Eligibility

Eligible participants were Australian residents, aged 18 years and older, currently working—or previously (i.e., in the last 2 years) — as an ESW (volunteer or paid). Retired ESWs (i.e. ESWs who have worked in the last 2 years) were also deemed eligible to participate due to both the delayed onset of many trauma-related symptoms and the fact that such symptoms may have been implicated in a decision to retire [1]. Other inclusion criteria included: ability to speak and understand English, willingness and ability to provide informed consent, and access to an Android or iOS smartphone. Participants were also required to have a current email address or be willing to obtain one.

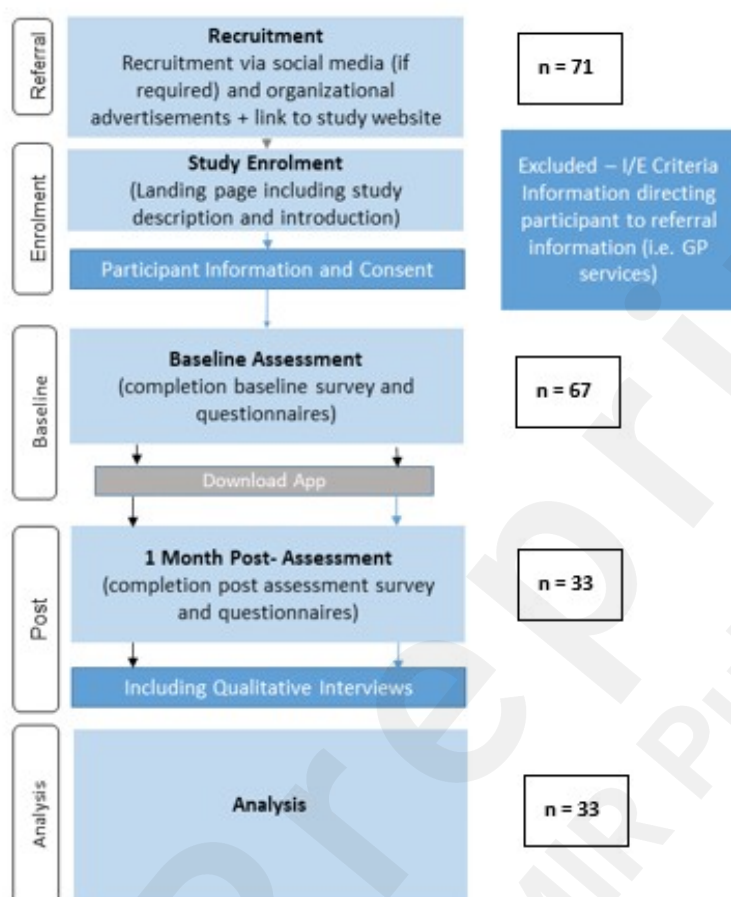
Recruitment

Participants were recruited via organisational advertisements calling for ESWs to test a new mental health app. QR codes or links on the advertisements directed interested individuals to the study website which included more detailed information about the study procedures and inclusion criteria. All interested participants were required to provide informed consent electronically. Baseline assessment occurred immediately after participant consent. Upon completion of the baseline assessment, participants were prompted to download *Build Back Better* from either the App Store (for iPhone users) or the Google Play store (for Android users) and use the app for approximately 30 days. Post-assessment occurred 1-month after completion of the baseline assessment. After the completion of the post-assessment surveys, participants were invited to participate in a qualitative interview to ascertain in-depth information on app use and user-preferences (see also Section: Qualitative Data Collection). See **Table 1** for an overview of the different

measures administered at baseline and 1-month follow-up. All assessments were administered online using Black Dog Institute's Online Research Platform. See **Figure 1** for the CONSORT flow diagram of this single-arm study.

➔ Insert **Figure 1** here. CONSORT flow diagram illustrating the study procedures

Figure 1 CONSORT Flow diagram illustrating the study procedures



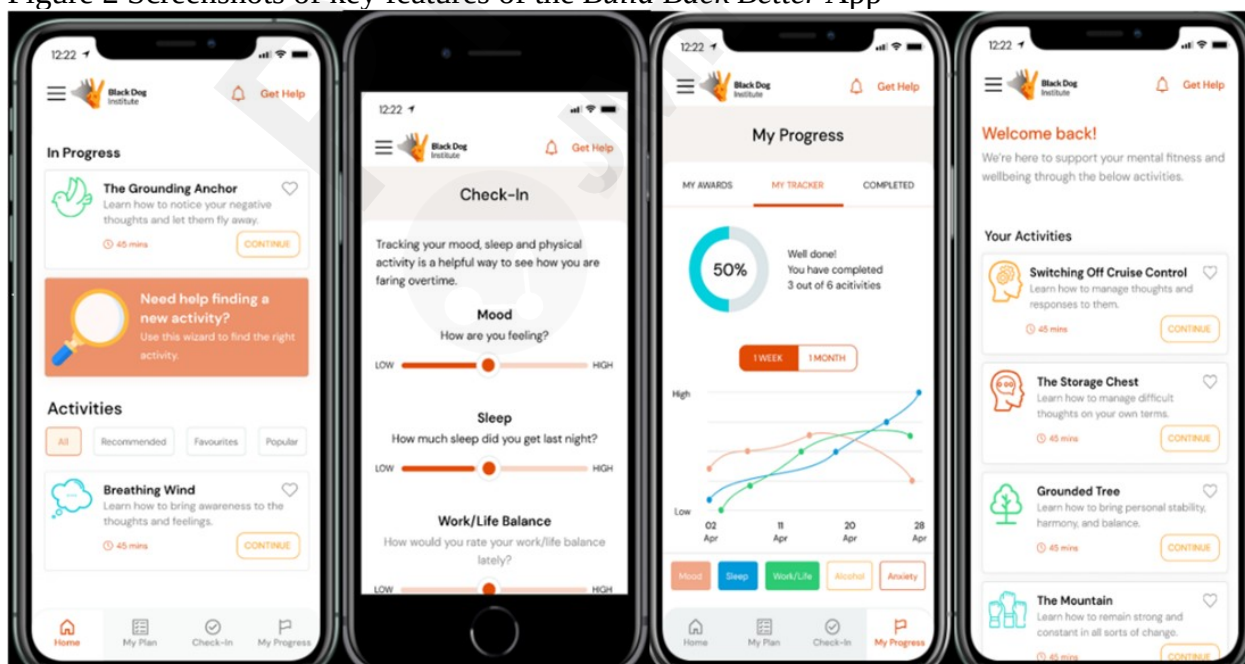
Intervention

Build Back Better was developed by a multidisciplinary team with content adapted from a previously developed app, *HeadGear*, designed to prevent depression and anxiety and improve wellbeing amongst workers in male-dominated industries [18, 22]. An RCT of *HeadGear* with a large sample of workers showed that the app was effective in the prevention of depression and anxiety, as well as improving a range of mental health and work-related outcomes [24] [25]. While many other mental health applications offer generic advice and often fail to offer personalized care, the *Build Back Better* app was carefully developed through extensive collaboration with clinical psychologists, psychiatrists, information technology professionals, user-experience and app- design experts, and, most importantly, emergency service workers themselves. This approach ensures that the app content and design are tailored to the specific needs of emergency service workers and their families. . By integrating trauma-focused content alongside strategies for addressing depression and anxiety, the app tailors its support based on the preferences and needs expressed by emergency service

workers, leading to better, more effective outcomes [26]. Personalised changes to the app visual presentation and design included a more gender-neutral look and feel (achieved through colour scheme, imagery, language, and theme) and streamlined features to promote use in rural populations with unreliable internet access/phone service (i.e., videos/activities that can be accessed without an internet connection) and those with limited mobile phone digital literacy. In addition, changes ensuring that the app's structure would be suitable for those performing shift work were included, by allowing day-to-day use at all times, and whenever desired. For example, whereas previous apps developed by the research team [18, 22] present app content in a linear form to be completed on consecutive days, the *Build Back Better* app content is tailored to the individual needs, via an upfront needs analysis, and through an in-app search function, maximizing user control and autonomy [27]. As it is suggested that this target population typically uses apps in their own time without clinical oversight, they must be intrinsically motivated to engage with the app [26, 28]. Therefore, use flexibility was maximized by allowing the user to complete tasks freely within the app, according to their priorities and preferences. To further target the needs of ESWs, trauma-informed content was developed specifically for the app through consultation with clinical psychologists working primarily with ESWs. This clinical content incorporates thought monitoring/challenging, behavioural activation, problem solving, mindfulness, elements of positive psychology (e.g., gratitude), and techniques to enhance healthy coping behaviours. Other components of the *Build Back Better* app include a tracker for monitoring mood, physical activity, sleep, eating habits and work/life balance, and a variety of breathing and grounding exercises, based on the expressed preferences of ESWs. See **Figure 2** for screenshots of the *Build Back Better* app.

➔ Insert **Figure 2** here. Screenshots of key features *Build Back Better* App

Figure 2 Screenshots of key features of the *Build Back Better* App



Data Collection

At baseline, participants were asked questions regarding demographics, mental ill-health in the prior two years, help-seeking behavior(s) for a mental health problem in the previous month (from any source including health professionals, telephone or online support services, family, partner, or friends) and whether currently taking medication for a mental health issue.

App usability, feasibility and acceptability was measured using questions adapted from the Mobile Application Rating Scale (MARS) (Hides, Kavanagh et al. 2014) at post-assessment including questions pertaining to current smartphone use, potential future use and preferences for design and content. The MARS is a simple, objective, and reliable tool for classifying and assessing the quality of mobile health apps (Stoyanov, Hides et al. 2015). The app quality criteria were clustered within the engagement, functionality, aesthetics, information quality, and subjective quality categories, from which 7 individual MARS items were included. Each MARS item used a 5-point scale (“not at all” to “completely”/“definitely”). In addition, four open-ended questions were administered allowing the user to express their opinion about the app, in their own words. In addition, those agreeing to take part in the qualitative semi-structured interview, were asked a series of open-ended questions pertaining broadly to functionality, engagement, aesthetics, information exchange, and the user’s overall experience with the app to further explore app usability and acceptance. To monitor app-usage, in-app data was automatically collected for the duration of the study (i.e., from baseline to 1-month follow-up) such as: number of times app opened, number of activities accessed, number of activities completed, total time spent in app.

Psychological distress was measured using the Kessler Psychological Distress Scale (K10) [29]. The K10 is a 10-item measure of psychological distress over the past four weeks and is intended to yield a global measure of distress based on questions about anxiety and depressive symptoms. The K10 uses a 5-value response option for each question which can be scored from five (“all of the time”) through one (“none of the time”). The total K10 score is based on the sum of the answers given to the ten questions and will be used to indicate psychological distress across all study time-points. The maximum score is 50 indicating severe distress, the minimum score is 10 indicating no distress.

Depressive symptoms were measured using the Patient Health Questionnaire (PHQ-9) ([30]. The PHQ-9 is a reliable and valid 9-item self-report tool designed to assess depression severity. The items duplicate the nine diagnostic criteria for major depressive disorder covered in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV). The PHQ-9 asks how often participants have been bothered by problems in the past two weeks. Each item is scored on a 4-point Likert scale, ranging from 0 (“not at all”) to 3 (“nearly every day”). Items are summed to provide a total score (ranging from 0-27), which will be used as a marker of depressive symptom severity across all study time-points. Scores ≤ 4 suggest minimal depression which may not require treatment, whereas scores of ≥ 10 are indicative of depression.

Anxiety symptoms were measured using the General Anxiety Disorder-7 item (GAD-7) [31], a reliable and valid 7-item measure of generalized anxiety symptoms [30]. GAD-7 scores can range from 0 to 27, with 5, 10, and 15 representing cutoffs for mild, moderate, and severe levels of anxiety, respectively. A score of 10 or greater on the GAD-7 represents a reasonable cut point for identifying cases of GAD.

Participant wellbeing was measured using the 5-item WHO Wellbeing Index (WHO-5) [32]. The WHO-5 is a short, self-administered measure of well-being over the last two weeks. It consists of five positively worded items that are rated on 6-point Likert scale, ranging from 0 ("at no time") to 5 ("all of the time"). The raw scores were transformed to a score from 0 to 100, with lower scores indicating worse well-being. A score of ≤ 50 indicates poor wellbeing and suggests further investigation into possible symptoms of depression. A score of 28 or below is indicative of depression.

Perceived self-efficacy for coping with challenges and threats was measured using the 9-item Trauma Coping Self-Efficacy Scale (CSE-T) [33]. Participants were asked to rate their capability to handle a series of posttraumatic situations (e.g., "Deal with my emotions [anger, sadness, depression, anxiety] since the traumatic event," "Manage distressing dreams or images about the traumatic experience"), on a 7-point scale ranging from 1 ("not at all capable") to 7 ("totally capable"). Total CSE-T scores (ranging between 1 and 63) were created by summing the item ratings, across all time points, to analyze whether CSE-T increased as participants continued to use the application (i.e., reflecting improvement in self-efficacy perceptions).

➔ Insert **Table 1** here. *Overview of Study Measures and Data Collection Timepoints*

Table 1. Overview of Study Measures and Data Collection Timepoints

Instrument	Domain	Time-points			data
		Baseline	Post-Assessment ¹	In-app collection ²	
Demographic Inventory (DEMOG)	Demographics	✓			
Kessler Psychological Distress Scale (K10)	Psychological distress	✓	✓		
Patient Health Questionnaire-9 item (PHQ-9)	Depression	✓	✓		
General Anxiety Disorder-7 item (GAD-7)	Anxiety	✓	✓		
5-item WHO Wellbeing Index (WHO-5)	Wellbeing	✓	✓		
Trauma Coping Self-Efficacy (CSE-T)	Trauma coping	✓	✓		
App Engagement (survey & qualitative interviews)	App Feasibility & Acceptability		✓		
Objective app engagement outcomes	App Feasibility & Acceptability			✓	¹ Post-assessment

administered 1 month after baseline assessment

²In-app data collection throughout entire duration of study (i.e., from baseline to 1-month follow-up).

Qualitative Data Collection

After the completion of the post-assessment surveys, participants were invited to participate in a qualitative interview to ascertain in-depth information on app use and user-preferences. Interviews (approximately 1-hour) occurred within 2 weeks of post-assessment and were conducted virtually (i.e., using telephone or videoconference).

Participation in post-assessment surveys and the qualitative interviews was entirely voluntary and did not affect the use of the app. Users could engage with the app as they wish, regardless of their involvement in the post-assessment surveys and qualitative interviews. Participants were, however, offered a \$40 gift voucher as time reimbursement upon completion of the post-assessments and the qualitative interview; if this was against the gift policy of their organisation, they could select a \$40 donation to a charity of their choice.

Sample size

Based on earlier comparable (pilot) studies using eHealth interventions [22, 34, 35], it was estimated that a sample size of $n = 63$ was required to detect a small within-group effect difference ($d = 0.3$) with 80% power and a 0.05 significance level. With the expectation of 30% of participants to be found to be unsuitable or lost to follow-up, drop-outs, and noncompliance, at least 90 participants would need to be enrolled.

Data analysis

Analyses were both quantitative and qualitative. Study investigators examined descriptive characteristics of the study sample and overall feasibility and acceptability of the smartphone app within the pilot study. Potential efficacy of the app in reducing psychological distress was assessed by evaluating changes in clinical outcomes after one month of use in terms of both statistically significant changes as well as effect size estimates. Changes in participants' wellbeing and mental health levels from baseline to post-test were examined using paired sample t-tests. Qualitative data collected through semi-structured interviews were examined to understand user needs, experience, satisfaction, and expectations of the app. Study investigators extracted themes based on participant responses to understand participants' acceptability of the study design and overall experience with the smartphone app.

Results

Participants characteristics

A total of 71 participants enrolled in the study, of which 67 both completed the baseline assessment and downloaded the app. The baseline characteristics of the sample ($n = 67$) are presented in **Table 2**. The mean age of the participants was 44.73 years (SD 11.40; range 29–66 years) with the majority being male (64%). Participants included firefighters, disaster response, surf lifesaving, police and correctional services across four Australian states (New South Wales (NSW) 12; South Australia (SA) 5; Tasmania (TAS) 17; Western Australia (WA) 33. The sample was largely drawn from major cities (>60%) and approximately half were volunteer ESWs (48%). Over 80% reported an episode of poor mental health lasting at least one month within the last 4 weeks, with 44% having sought some form of mental health support in the previous month (e.g., from a GP, mental health professional, telephone or online support services, family, partner, or friends), and 16% currently using medication for a mental health issue.

Although the majority of the sample (62%) reported experiencing no current distress (i.e., a score under 20 on the K10) on the K10, more than a quarter (27%) reported either moderate or severe distress (i.e., a score of 25 or higher on the K10) at baseline (see **Table 2**). Around half of the participants (52.2%) reported minimal anxiety symptoms (i.e., a score of 4 or under), whereas 45% scored between 15-24 on the GAD-7, indicative of mild to moderate anxiety symptoms. 3% of the participants reported severe anxiety symptoms (i.e., a score greater than 15 on the GAD-7). Prevalence of depression symptoms was reported in 24% (i.e., a score of ≥ 10 on the PHQ-9), minimal to mild depression severity was reported in 76% of the participants (i.e., a score of < 10 on the PHQ-9).

Of the 67 app users who completed the baseline assessment, 51% failed to complete the follow-up questionnaire, resulting in complete follow-up data on 33 users. The only significant difference between post-completers and non-completers was gender, with males being less likely to complete the post-assessment. Non-completers reported worse mental health on all measures at baseline, although none of these differences reached statistical significance.

➔ *Insert **Table 2** here. Sociodemographic and Clinical Characteristics of Study Participants*

Table 2. Sociodemographic and Clinical Characteristics of Study Participants

Demographics	N	%
Age (Mean, [SD]; range)	44.73 [11.40]; 29 -66 years)	
Male	43	64.2
Highest level of Education		
University	13	19.4
Postgraduate	9	13.4
Non-university diploma/college	14	20.9
Trade or other certificate	17	25.4
Year 12 certificate	11	16.4
Year 10 certificate	2	3.0
Other	1	1.5
State		
NSW	12	17.9
SA	5	7.5
TAS	17	25.4
WA	33	49.3
Agency		
Airservices Australia	2	3.0
DBCA	3	4.5
DFES	30	44.8
DPFEM	16	23.9
RFS	4	6.0
SAFECOM	5	7.5
SLSA	7	10.4
Emergency Service Worker - Volunteer (%)	32	47.8
Location		
Metropolitan	44	65.7
Rural	11	16.4
Remote	12	17.9
General Distress (K10)		
No Distress	41	61.2

Mild Distress	8	11.9
Moderate Distress	9	13.4
Severe Distress	9	13.4

NSW: New South Wales; SA: South Australia; TAS: Tasmania; WA: Western Australia; Airservices: Aviation Rescue Fire Fighting Service - Airservices Australia (NSW); DBCA: Department of Biodiversity, Conservation and Attractions (WA); DFES: Department of Fire and Emergency Services (WA); DPFEM: Department of Police, Fire & Emergency Management (TAS); RFS: New South Wales Rural Fire Service (NSW); SAFECOM: South Australian Fire and Emergency Services Commission (SA); SLISA: Surf Life Saving Australia (NSW); K10: Kessler Psychological Distress Scale

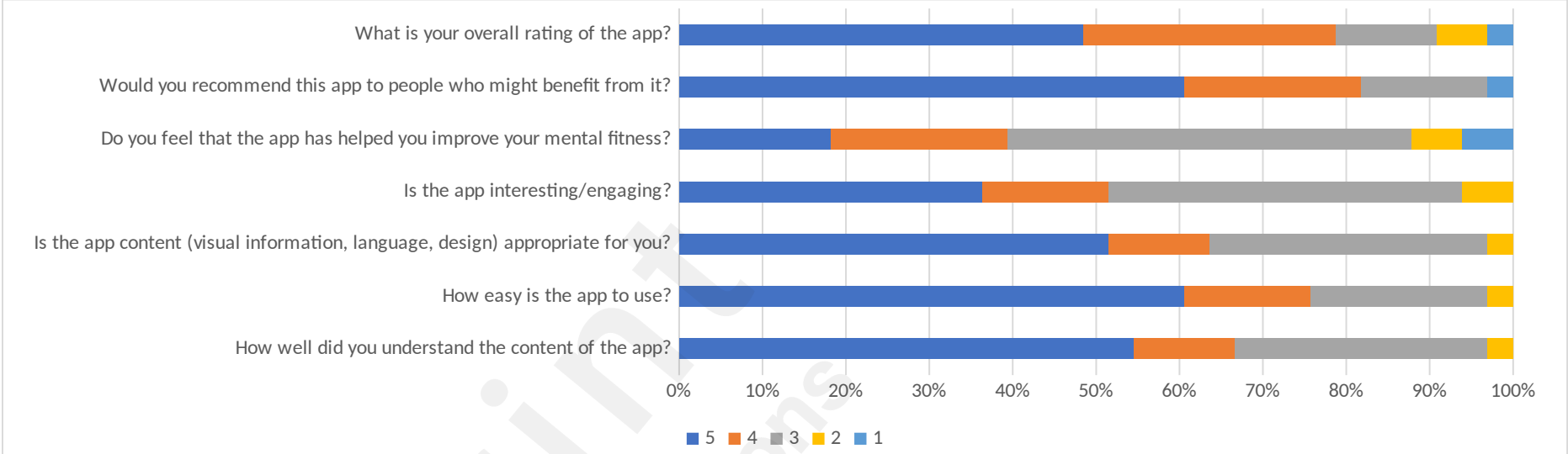
Intervention delivery

Frequency of app usage ranged from once to 22 days ($M = 5.5$ $SD = 5.62$), with usage averaging 25 minutes per session. In-app activities related to trauma; recognizing poor mental health; identifying thought patterns, breathing and mindfulness exercises were the most accessed by users. The daily-check in feature (allowing users to rate their mood/behaviors, and displaying a weekly/monthly graph of their past mood check-ins) was the most popular app feature, being accessed by 43% of participants during the trial period. On average, after opening an activity within the app, 67% of participants completed the full activity content.

Table 3 presents the results for the different acceptability variables. At 1-month follow-up most of the participants (88%) felt that the *Build Back Better* app had at least “somewhat” improved their mental fitness. The majority of participants (79%) rated the overall quality of the app as “very high” or “high”, with a mean score of 4 out of 5. Although over half the participants (55%) claimed that they “completely” understood the app content, 30% indicated the content of the app was “somewhat well” understood. The majority of participants (61%) reported that using the app was very easy (with a mean rating of 4 out of 5), and that they would “definitely” be willing to recommend the app to others. Around half (52%) indicated that the app content (visual information, language, design) was appropriate, whereas a third (33%) indicated the app content was “somewhat” appropriate for them. In terms of app interest and engagement, the participant response was somewhat mixed. 36% of the participants indicated the app was “completely or highly” engaging, whereas 42% of participants rated the app as “somewhat interesting”.

➔ Insert **Table 3**. Participant ratings of Acceptability Variables using a 5-Star Rating Scale

Table 3. Participant ratings of Acceptability Variables using a 5-Star Rating Scale



The specific meanings of the 5-star rating scale labels may vary depending on the item, but in general, -5- points represent excellent or outstanding performance, while -1- points to a poor experience/performance.

Qualitative Data

Open feedback on the app of the N = 33 participants who completed their 1-month follow-up assessment, was generally positive and encouraging: *"It is a great app, a very useful tool"; "Really good work, thank you"; "Well done and I hope it helps many people along the way"*.

Users commented on the presentation of app content and features, overall, they appreciated the mixture of audio/visual/text within the different in-app activities and liked having a variety of activities and interactive components: *'For me it was especially helpful the components with video and audio. I do not like the components with reading as I am trying to minimise my screen time; "It's very interactive which is a great feature to get focus back on track"*.

In terms of the usefulness of specific therapeutic elements within the app, the relaxation practices such as breathing, or meditation were particularly well received. User indicated that these activities assisted them with stress reduction, and anxiety relief and experienced these activities to be beneficial for overall well-being and joy: *"This a great tool for anyone who is suffering any kind of anxiety and doesn't feel they can approach anyone with their problems"*.

With respect to the thematic analysis, we further classified feedback into three categories: (1) qualities/features users liked; (2) features requested/missed by users; and (3) weaknesses of the app identified by users. These three categories helped us further understand how each component of the app helped (or could be improved) to meet user' needs and promote adherence and acceptability.

Several app users (7/33, 21%) indicated they liked the daily check-in feature; it was suggested that this feature was very helpful for self-management of symptoms: *"I liked the daily check-in and to see how my two selected categories were tracked; mood and sleep. It was interesting to see the correlation between the two"; "I like how the app asked how you're currently feeling, and then displayed content relevant to your feelings that you could do within the app"*.

Around a quarter of users (8/33, 24%) provided suggestions to further improve the app; referring to specific app features; participants emphasized the importance of using 'real-life' characters (i.e., characters with lived experience) throughout the app, and more audio and visual elements to stimulate engagement with the app. Accurate presentation of time-estimates for each of the activities was also recommended. The main weakness of the app identified by users (8/33, 24%) related to difficulties navigating the app: *"Too many steps to find results"; "Not very much direction in how to go through the app"; "Was a little scattered to navigate"*. Others (5/33, 15%) highlighted problems with user-engagement: *"Sometimes getting back into a repeat activity was tedious"; "Maybe a little too simple, I tended to forget about using it"; "Could be more interactive"; "The repetitive nature of all the activities. It got a bit boring and started feeling less impactful"*.

Qualitative interviews

Eight out of the 33 participants (24%) who completed both the baseline and follow-up assessment agreed to participate in a semi-structured interview. During the qualitative interviews participants were asked to reflect on their experiences with the app and provide more detailed feedback on certain features of the app and its overall design and functionality. Participants felt that the app was very easy to use and provided relevant information for ESWs who are feeling overwhelmed and need some help

managing stress or anxiety: *"I thought the app content was well balanced and covered a whole range of different issues and problems that people like me might helpful"; "For everyone who has a stressful job or stressful home life or school life or just life in general I think the app is really relevant, it's really suitable for pretty much everybody across the board in our communities"; "Of great use for first responders and community members who don't have access to the mental health resources of the agencies"*. Participants also commented on the quality and credibility of the app, referring to the content as being of high standard, easy to use, and very educational. Participants furthermore felt that the app increased their awareness of mental health issues not only within themselves, but also regarding work colleagues or employees: *"I highly recommend using the app for its insight into mood tracking. It showed me the relationship between anxiety and sleeping and the effect that it has a mental health when you don't know unless you track it"; "It makes it easier to start that conversation when thinking about suicide, gives you some ideas how to start that conversation": "I'm not feeling so great, Tom, can I chat with you"*. Participants suggested some minor design and content changes: *"There were too many layers. There were too many pages, sometimes that confused me"* and recommended including additional reminders and adjunct components to help users stay engaged with the app: *"Maybe come up with a reminder, on your phone saying don't forget to finish this. You know that you started yesterday or the day before just something like that"*. Further suggestions for improvement by ESWs app users, were therefore largely focused on elements of user interface and user experience, such as a more intuitive home screen and changes to the background colour within the app to reduce confusion around navigation and increase clarity in the presentation of the different activities.

Symptom Change

Table 4 presents the means of the outcomes at both baseline and 1-month follow-up. Overall, at 1-month follow-up, there was a non-significant trend for improvement in general distress ($t_{32} = 0.65$; $P = .521$), depressive symptoms ($t_{32} = 0.75$; $P = .459$) and anxiety symptoms ($t_{32} = 1.08$; $P = .290$) symptoms. This same non-significant trend was present for participants ability to manage traumatic stress ($t_{32} = -0.27$; $P = .786$). Effect size estimates from baseline to 1-month follow-up were $ES \leq 0.2$ for all outcomes.

➔ **Insert Table 4.** *Changes in General Distress, Depression, Anxiety, Wellbeing and Traumatic Stress Coping outcome scores: Mean Difference, Effect Sizes, and Standardized Mean Differences from Baseline to 1-Month Follow-Up*

Table 4. Changes in General Distress, Depression, Anxiety, Wellbeing and Traumatic Stress Coping outcome scores: Mean Difference, Effect Sizes, and Standardized Mean Differences from Baseline to 1-Month Follow-Up

	Baseline Mean (SD)	Post- Assessment ¹ Mean (SD)	t (df)	P	Effect Size (95% CI)	Standardised Mean Difference
K10 (General distress)	18.67 (6.63)	18.18 (5.78)	0.65 (32)	.521	0.08 (-0.41- 0.56)	0.48
PHQ- 9 (Depression)	5.52 (4.14)	5.12 (3.98)	0.75 (32)	.459	0.10 (-0.39-0.58)	0.39
GAD-7 (Anxiety)	5.21 (4.38)	4.49 (4.20)	1.08 (32)	.290	0.20 (-0.25 – 0.58)	0.87
WHO-5 (Wellbeing)	56.97 (21.89)	56.12 (24.67)	0.28 (32)	.783	-0.06 (-0.55-0.42)	-1.55
CSE-T (Traumatic stress coping)	47.82 (11.07)	48.12 (11.60)	-.27 (32)	.786	-0.12 (-0.60-0.37)	-1.33

¹Post- assessment administered 1 month after baseline assessment

K10: Kessler Psychological Distress Scale; PHQ-9: Patient Health Questionnaire-9 items; GAD-7: Generalized Anxiety Disorder-7 items; WHO-5: 5-item World Health Organisation Well-Being Index; CSE-T: Coping Self-Efficacy Scale

Discussion

The study evaluated the usability, feasibility, acceptability, and preliminary effectiveness of *Build Back Better*, an app-based mental health intervention aimed at enhancing emotional well-being and positive mental health among emergency service workers and volunteers (ESWs).

The results from the post-assessment surveys, in-app feedback and qualitative interviews indicated that the *Build Back Better* app was found to have satisfactory levels of usability and acceptability. Participants indicated that the app content was relevant for ESWs, and felt it was beneficial in increasing their capacity to manage stress and anxiety, and in improving their general wellbeing. Users also appreciated the variety of features, functionality, and content within the app. The overall rating of the app was high to very high, with the majority of respondents indicating the app was easy to use, appropriate, and recommendable to others. These findings suggest that the app and its components, are likely to meet ESW users' expectations and requirements. However, qualitative analyses provided a more nuanced understanding of the perceived acceptability and usability of the app. Despite positive feedback on the user experience of the app, navigation concerns were raised which require design changes to enhance user experience and flow within the app. In addition, although most respondents understood the app content mostly or completely, a sizable proportion reported they only "somewhat" understood the content. Coupled with these navigation issues, both self-report feedback and objective app data highlighted issues pertaining to engagement and functionality. Not only was the mean total number of activities accessed within the app low, questionnaire data also suggested half of respondents found the app at best "somewhat" engaging. The 51% dropout rate for post survey completion, may also be indicative of a lack of engagement with the app. Even though it is well-established that interventions delivered via mental health apps are susceptible to low levels of engagement and poor adherence by their users [36-38], this can have implications for the effectiveness of the intervention delivered [39-41].

A secondary goal of this study was to determine the preliminary effectiveness of the Build Back Better app in reducing general distress and supporting (mental) wellbeing of ESWs. Although encouraging trends toward improvement in most symptom and wellbeing outcomes were found, these failed to meet significance. This raises vital questions which need to be addressed prior to larger testing. Considering the overall low symptom levels at baseline, floor effects are a possible implication of this lack of significance. However, as mentioned above, high rates of trial attrition left the trial underpowered, which would have also contributed the risk of Type 2 error. Furthermore, a related factor which requires attention, is low program adherence. Despite the short length of the trial and wide variety of available exercises within the app, engagement was low, with the app being used on average 5 to 6 times for the duration of the one-month trial. Surprisingly, adherence was considerably lower than that observed in previous trials of similar apps [18, 24, 34, 35]. This raises questions about both the app content and the free-form structure of the app. Compared to previous trials, in which the app content was delivered in a linear fashion (introducing one new activity at a time) in this app users had greater choice and were able to access recommended content on demand. Generally, such an individualized approach using personally tailored content, is viewed as a positive means to enhance engagement in digital interventions [42, 43] but in this study it may have left users feeling

overwhelmed and undirected, as from the qualitative data findings some participants reported to feel overwhelmed and/or confused by the lack of direction in how to navigate the app content. Previous research has shown that providing users with more choices and actions leads to increased cognitive strain and this may negatively affect acceptability [40, 44, 45]. Further research should investigate which activities users prefer to do without those activities becoming burdensome or overwhelming, while also creating an app that allows independence and control.

Limitations

There are several limitations of the current study, which should also be acknowledged. ESWs are an at-risk population due to high rates of trauma exposure and related illness [46]. Although the self-reported ability of participants to manage traumatic stress was captured for the duration of the trial, trauma exposure or levels of traumatic distress were not examined in the present sample, nor were there restrictions on eligibility related to these factors. Overall, the sample reported very few symptoms of mental ill health. Interestingly, despite low baseline levels of anxiety, depression, and psychological distress, most participants also scored in the lower percentile of wellbeing scores. Regardless, not only did this potentially impact capacity for symptom change, but it also limited comparison of outcomes based on severity. Such a program is likely to have differing effect on individuals experiencing differing levels of psychological wellbeing at baseline, possibly because there are considerable between-individual differences in the response to these interventions [47, 48]. The *Build Back Better* app itself was designed as a mental health promotion and selective prevention app, directed to at-risk groups or individuals with physical, psychological, or social risk factors associated with mental illness development, but the current study lacked power to adequately test this.

Another limitation of the current study was the high attrition rate, with nearly half of the participants failing to complete their follow-up assessments after 30 days. Although high attrition is common in unguided trials [49-51], nonrespondents in this study may have been affected by digital access issues. Of the study sample, 34.3% lived in regional or remote areas, these rural residents are still less likely than those living in suburban areas to having home broadband and could have faced challenges to access the internet and complete their follow-up surveys. While the *Build Back Better* app was designed to allow the user to run the app, in different conditions and locations, lack of internet connectivity could have prevented users from completing the online follow-up surveys via Black Dog Institute's Online Research Platform.

Future directions

Further investigation is needed to determine the potential protective benefits of the *Build Back Better* app under more controlled conditions, in the light of current knowledge on between-individual differences in how individuals respond to interventions. In addition to a larger, appropriately powered controlled trial, future evaluation should consider baseline cut-offs for symptom severity, which may influence the effectiveness of the app. The current study utilised a heterogeneous sample of ESWs, which may have impacted on finding. While this diversity was seen as a strength of the study and the

app was designed to cater to a range of ESWs, there is the potential that the content may have led to being received differently across professions. This suggests that more tailored version of the app, designed specifically for different professions/roles, could improve engagement and content relevance.

We recognize that the lower participation rate in the follow-up questionnaires and qualitative interviews is a limitation of this study. Although the interviews were structured with thoughtful, targeted questions designed to elicit rich, in-depth responses, the low response rate limits the representativeness and diversity of the perspectives gathered. Similarly, the high dropout rate from the follow-up assessments reduces the robustness of our conclusions and generalizability of our findings. Further analysis comparing post-completers and non-completers revealed that the only significant difference between these groups was gender, with males being less likely to complete the post-assessment. Dropout was not strongly associated with baseline symptom severity or wellbeing, however, additional research with a larger sample size would help clarify these patterns and improve the reliability of the findings.

The high attrition rate furthermore highlights the need for future studies to address potential barriers to engagement, such as digital access issues. Identifying and mitigating these barriers - through improved app design or more effective follow-up communication strategies - could provide more reliable data on the effectiveness of mHealth interventions in high-risk populations. For example, testing different engagement strategies, such as varying the frequency of reminders or employing multiple forms of communication (e.g., SMS, phone calls) could help improve follow-up rates. The protocol for this trial involved two email reminders for follow up assessment. In future evaluations of mental health apps consideration is needed regarding other reminder options. SMS-reminders and phone calls might be a more reliable form of contact for this group considering their location and the nature of many ESWs work, moreover varying frequency of email reminders, and varying content could help engage participants [52]. Nevertheless, once recruited, participants seemed motivated to start using the app, and the 94% (67/71) baseline completion rate was strong.

Finally, feedback from users in this pilot study, revealed several areas for improvements in the app to increase usability and engagement. Participants in this study identified issues particularly around app navigation and user interface, i.e., clearer design, short interactions with the app, easy access, but the app-users also provided suggestions for improving user-engagement, for example via incorporating reminders to engage with the app, and involving those with lived experience in the activities within the app. This feedback is consistent with observations from reviews of efficacy studies on smartphone interventions, in which apps incorporating more elements aimed at promoting user engagement have shown larger effect sizes on several mental health outcomes [41]. Proposed design changes therefore include: (1) improved navigation via refined home screen emphasising the presentation of activities in modules; (2) more visually engaging home screen; and (3) increased accessibility and understanding of the in-app search function via clearer instructions and use of different design elements. Additionally, future marketing and promotion efforts should emphasize involving those with lived experience to strengthen the app's relevance and appeal. Finally, this study furthermore highlighted the need for more nuanced app usage data to further explore use patterns.

Conclusions

The findings of this pilot study support the usability and acceptability of the Build Back Better app among ESWs, complemented by valuable user input which will inform modification of the app design to further enhance the in-app user experience. The app was found to have satisfactory levels of engagement, usability, feasibility, and acceptability. However, evidence of change in mental health outcomes could not be gained from this small pilot study. Comparison of the Build Back Better app with a control condition in a larger trial, will help to address the limitations of the present study and further elucidate (clinical) mental health outcome findings. To further advance the field in digital mental health options, it is furthermore important for future research to explore which engagement metrics (log-ins, activities completed, time spent in app, etc.) could have an impact on improving mental health outcomes.

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Data Availability

The datasets generated or analysed during this study are available from the corresponding author upon reasonable request for non-commercial purposes.

Conflicts of Interest

Authors D.M.; D.W. and M.D. were involved in the development of the Build Back Better app. There is no other conflict of interest to declare. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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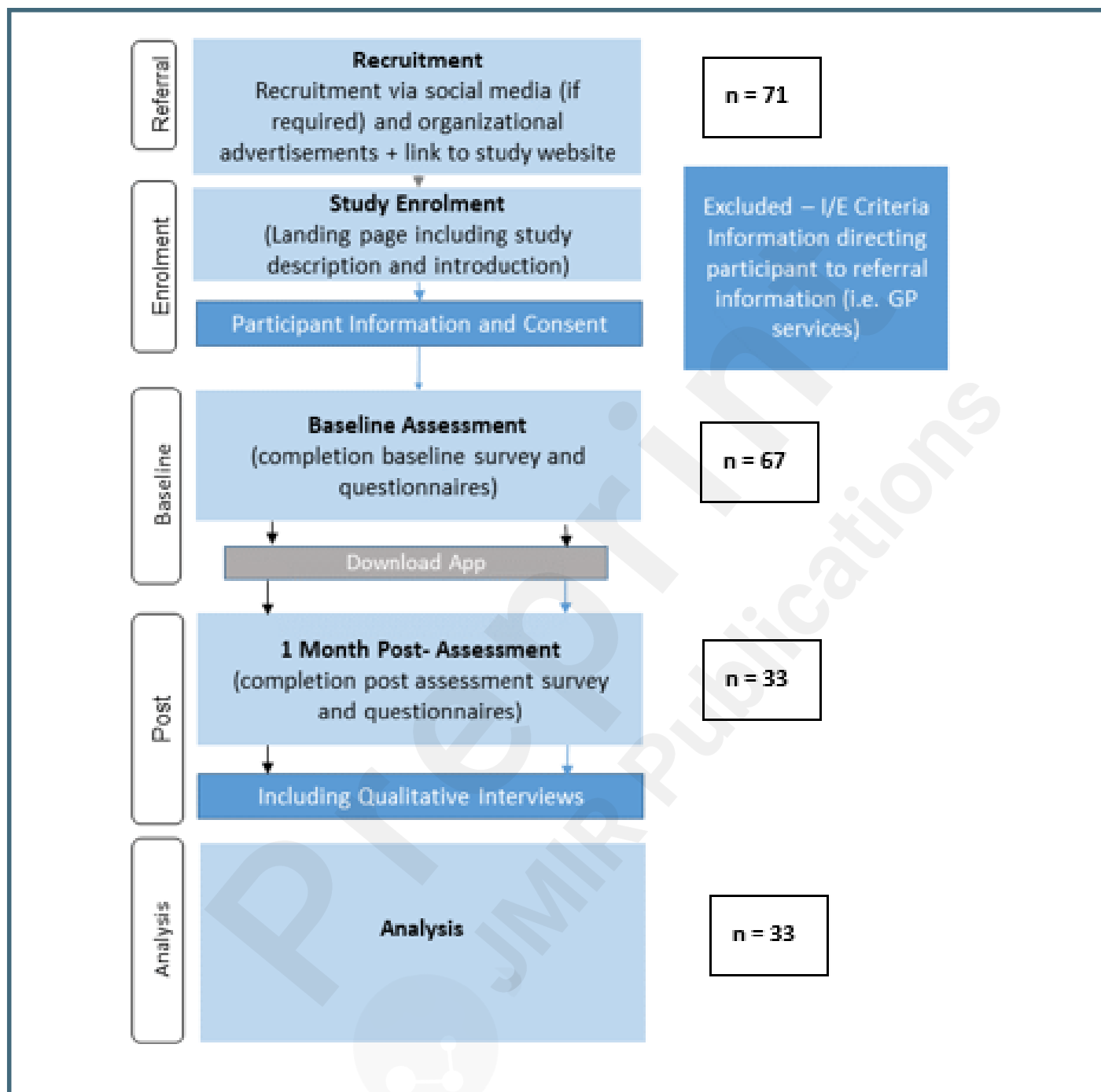
Supplementary Files

Table 3. Participant ratings of Acceptability Variables using a 5-Star Rating Scale.

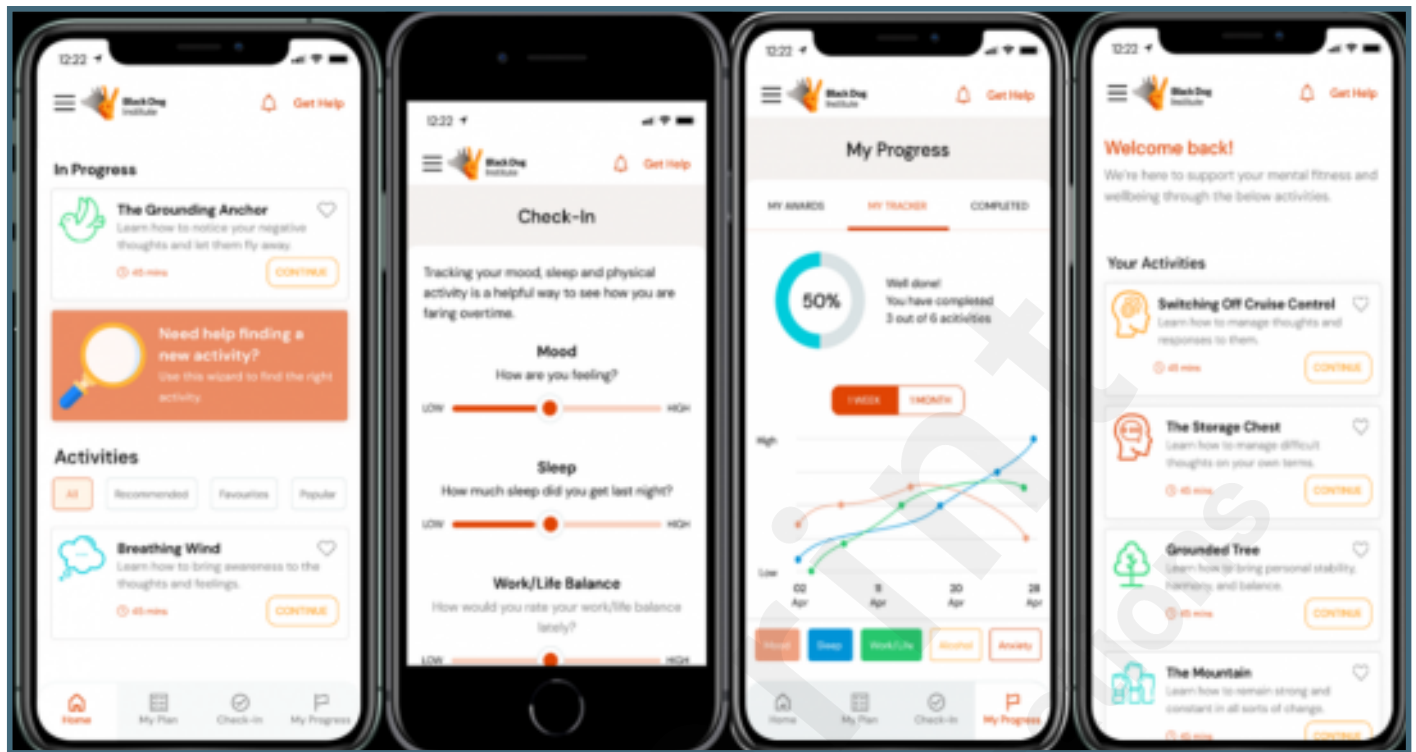
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Figures

CONSORT Flow diagram illustrating the study procedures.



Screenshots of key features of the Build Back Better App.



CONSORT (or other) checklists

CONSORT (Consolidated Standards of Reporting Trials) extension Pilot and Feasibility Trials Checklist.
URL: <http://asset.jmir.pub/assets/dcc6538212034ef9b4bb3118c5d9e508.pdf>

