

MeT4VeT: Development and Assessment of a Mental Health Toolkit for Military Veterans

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King's Centre for Military Health Research, King's College London

Previously the Gulf War Illness Research Unit, the King's Centre for Military Health Research (KCMHR) was launched in 2004 as a joint initiative between the Institute of Psychiatry, Psychology and Neuroscience and the Department of War Studies, King's College London. KCMHR draws upon the experience of a multi-disciplinary team and is led by Professor Sir Simon Wessely and Professor Nicola T. Fear. The centre undertakes a wide range of research investigating military life using quantitative and qualitative methods. Its flagship study is an ongoing epidemiological multiphase investigation of the health and wellbeing of approximately 20,000 UK Armed Forces personnel. The study, funded by the Ministry of Defence (MOD), has been running since 2003. Data from our studies have been used to analyse various military issues, and many hundreds of academic papers have been published in peer reviewed, scientific journals. Our findings are regularly reported in the press and have also been used to inform military, health service and charitable policy makers. KCMHR also maintains excellent links with other academic centres across the globe.

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Foreword

Mental health awareness is thankfully no longer a taboo subject in UK society, hidden behind personal and social stigma or misguided concepts of weakness and inability to cope. Positive strides are being made almost everywhere it seems in terms of appreciating the prevalence of mental health vulnerabilities, of understanding and accepting the impact it has on individuals and those closest to them, and barriers are slowly being broken down in terms of help-seeking too. Our previous FiMT research has also identified a variety of barriers to help-seeking in the ex-Service community where previous military cultural tropes and expectations can be amplified in unique ways. Ours and other study evidence shows the decision to ask for help is mainly affected by the perceived need for treatment and so it is important to Forces in Mind Trust to understand the complex dynamics at play and to identify practical solutions that can help.

The Mental Health Toolkit for Veterans Project (MeT4VeT) toolkit developed by King's Centre for Military Health Research is one such example of how dedicated research into stigma and barriers to seeking care can then be translated into a practical step that could sit alongside other care and therapy support pathways. We know that ex-Service

personnel access services that are tailored to their needs, and where there is an understanding of the culture of the Armed Forces. So, we are pleased to see the approach taken in developing this accessible and usable App and believe this feasibility trial could encourage future users to independently identify their need for support and, importantly, where they can access it.

Forces in Mind Trust's mission is that all ex-Service persons and their families make a successful and sustainable transition to civilian life, a journey that begins whilst still in service but one which often continues to need support long after an individual has left the Armed Forces. Our Health Programme policy goal is that all veterans and their families are able to access good quality health and social care services when and where they need them. The development of this App is therefore an important step forward in the management of mental health in the ex-Service community and one which has the potential to play a significant role in enabling the successful and sustainable transition we seek.

Tom McBarnet

Chief Executive (Acting), Forces in Mind Trust

Executive Summary

Background

There are approximately 2 million UK Armed Forces veterans and each year, 14,000 leave the service. It is estimated that 6% of UK military veterans are likely to have Post-Traumatic Stress Disorder (PTSD), and around 22% report symptoms of a common mental disorder although not all will have developed difficulties due to their military experience. Previous work led by King's Centre for Military Health Research (KCMHR) highlighted three core barriers which prevented military veterans from seeking help for their mental health. These barriers included not identifying their problems as a mental health difficulty, only recognising the need for help when they had reached a crisis point and difficulty in navigating the care pathway and finding the right support. The aim of this project was to develop a toolkit to help those leaving the UK Armed Forces overcome these barriers. Through collaboration with veterans and stakeholders, a mobile phone application was developed: the Mental Health Toolkit for Veterans (MeT4VeT). The app was designed to assist military veterans in defining if their problems were mental health difficulties, recognising the need for help before their difficulty reached a crisis point and engaging with support either through self-help tools on the app or by helping them to access formal treatment if required.

The MeT4VeT app has five main elements: *People, Tasks, Tools, Tracking and Notifications*.

When opening the app, the *Dashboard* screen is presented indicating how many days the app has been used. The *People* section contains videos of veterans explaining their story and mental health difficulties they are facing. Participants are asked to identify the thoughts, feelings, and behaviours they relate to which are captured in the *Tasks* section for the participant to work on. Each task will have a tool related to it such as grounding or thought reframing which can be viewed in the *Tools* section, and everything is tracked in the *Tracking* section.

Objective

A feasibility trial was conducted to assess the acceptability and usability of the MeT4VeT app. Feedback from veterans and app data was collected to provide an initial assessment of the practicality of testing the app, to assess the acceptability and usability of the app and to provide initial feedback on the app.

Method

The feasibility trial used randomisation to assign participants to either the full-app group who had access to all features of the MeT4VeT app or a control group, who had an app with only signposting information.

Participants who had served for at least two years in the UK Armed Forces and left within the past two years were recruited into the study

through discharge medical interviews at several military medical centres, third sector organisations who provide support (e.g. housing) to veterans and social media. As the Stigma and Barriers to Care project only identified barriers to care for male veterans and the toolkit was tailored to these specific barriers, this project only recruited males as these barriers cannot be assumed to be synonymous for female veterans. All veterans recruited reported mental health distress on the General Health Questionnaire (GHQ-12), indicating they were likely to have either a diagnosable mental health disorder or a sub-threshold disorder which would have caused them distress. Demographic information was collected, and mental health measures were completed at baseline, one month and three months after they started using the app.

To determine the practicality of testing the app, we assessed the technical ability to deliver the app, determined participant recruitment numbers and drop-out and the sample size needed for a randomised controlled trial (RCT). To assess usability, app usage data was collected across the whole study period. App acceptability and usability were also measured after one month using the mHealth App Usability Questionnaire (MAUQ). To assess the app's acceptability and usability qualitatively and provide feedback on the app, semi-structured interviews were conducted after one month with a sub-sample of the full-app group regarding their app usage.

Results

Fifty male veterans were recruited and randomly assigned to two groups: 24 in the full-app group

and 26 in the control group. Participants were predominately white (94%), married, cohabiting or in a long-term relationship (82%) and in the Army (64%), Royal Navy (26%) and the Royal Air Force (10%). The majority had been regulars (90%) and were of non-commissioned officer (NCO) rank (78%).

App usage data indicated that after the questionnaires and *Dashboard* sections, the *People* section was accessed the most and was also used for the longest amount of time. App acceptability and usability scores were good for both groups (scored at least 4.8 out of 7 on the MAUQ), with the full-app group having higher scores for the sub domain of usefulness.

Interview feedback from 12 participants revealed themes of positive feedback for MeT4VeT, challenges faced and suggestions for improvement. Positive feedback from participants included finding the *People* and *Tools* sections especially helpful, appreciating the utility of a mental health toolkit in an app format and being able to identify their own thoughts, feelings, and behaviours through the app. App related challenges experienced included difficulty understanding the *Tracking* section and technical difficulties such as not being able to complete questionnaires, notifications not appearing and videos not playing. Suggestions for app improvement related to adding more content, expanding on the *People* and *Tasks* sections, and improving navigation around the app.

Discussion

For the practicality of testing the app, there were difficulties with publishing the app to the Apple App Store. Further, due to COVID-19,

recruitment had to be done through social media which made it difficult to recruit and retain participants.

For the acceptability and usability of the app, the trial revealed it was well received by participants based on the MAUQ scores and interviews. The app enabled participants to record and track their thoughts, feelings and behaviours relating to their mental health within the app.

Feedback on the app included appreciating the videos of veterans in the *People* section and finding the *Tools* section helpful. However, participants recommended an expansion of the content and greater clarity around how each section worked. Participants also suggested improving navigation around the app to enhance engagement and the addition of personalisation within the app. Although there were improvements in some domains of users' mental health, reliably assessing the impact of the app on mental health status was outside the scope of the trial; this could be further explored in future research. The results of the trial suggest there is room to improve the app and trial it in other military populations including widening recruitment to include female veterans and those who left services longer ago.

Recommendations

For the future development of MeT4VeT we recommend adding more content such as additional stories to the *People* section addressing different mental health problems and adding more *Tasks* to appeal to a wider population of veterans. The *Dashboard* and *Tracking* sections can be re-developed to make them clearer and easier to understand. Navigation around the app can be further improved

through the linking of pages together. Personalisation options can be added, as well as accessibility features to make the app available to those with different needs, such as veterans with impaired sight. Collaboration with veteran partnerships and transition teams within the Ministry of Defence would allow for the app to reach a larger number of veterans. Further research is needed with longitudinal designs to understand the long-term significance of using an app for veterans' mental health.

Conclusions

The acceptability and usability of the MeT4VeT app were generally supported. The app was reported to have helped veterans to recognise their own thoughts, feelings, and behaviours; helped with the development of concrete goals; aided in relaxation; helped veterans to develop the ability to self-monitor mental health; and provided a source of comfort and guidance when they felt they did not have other sources of mental health support. Feedback from participants did not indicate a need for substantial modifications of the app and suggestions were provided for adding content and improving clarity in some areas. This should be the focus of future development of the app to ensure veterans continue to engage with it. MeT4VeT showed some promise as a useful, accessible way for veterans to monitor and manage their mental health. A robust recruitment and retention strategy should be determined before conducting a RCT to fully understand the effectiveness of the app. Following this, the app can be expanded to other populations such as females and veterans of other age groups.

Chapter One:

Introduction

Background

In the UK Armed Forces, there are approximately 2 million veterans (1) and 14,000 individuals that leave each year (2), most transitioning out successfully. Some veterans will face difficulties with their mental health although from this minority, not all difficulties will have resulted from their experiences in the line of duty (3). Recent research suggests that approximately 6% of UK military veterans are likely to have Post-traumatic Stress Disorder (PTSD), and around 22% report symptoms suggestive of a common mental disorder such as anxiety or depression (3). Mental health difficulties in veterans are associated with worse practical outcomes in terms of income and employment, with unwell veterans who delay seeking professional help among the worst affected (4, 5). Therefore, seeking help at the earliest opportunity is vital to improving the long-term outcomes of veterans. However, military veterans appear reluctant to seek formal mental health support, with more than half of those who report experiencing mental health difficulties not engaging with healthcare professionals (6). Many veterans also prefer to manage their mental health independently (7) and so equipping veterans with the skills to manage their symptoms is also important and in addition, ensuring they recognise the limits of this and seek help when appropriate.

The previous Stigma and Barriers to Care Project (8), conducted by the King's Centre for Military Health Research (KCMHR) and funded by the Forces in Mind Trust, investigated barriers to help-seeking in veterans. The study identified

three core barriers that prevented veterans from seeking help. First, veterans struggled to understand that their problems were due to a mental health difficulty. Secondly, they did not tend to recognise the need for help before reaching a crisis point. Lastly, once veterans did seek help, they found it difficult to navigate the care pathway and the plethora of services for veterans, both NHS and third sector. It was challenging for veterans to identify the most suitable service regarding eligibility and access.

The Mental Health Toolkit for Veterans Project (MeT4VeT) aimed to develop a toolkit to help veterans overcome these barriers. The main aims of the feasibility trial were to provide initial assessment of the practicality of testing the app, assess the acceptability and usability of the app and to provide initial feedback on the app.

Scoping review

The research team conducted a scoping review of existing toolkits (Appendix 1). None of the existing toolkits identified in the review, and presented to the stakeholder group, fully met the criteria (ability to help veterans overcome the identified barriers) set out above and, therefore, did not align with the project's aims to help veterans overcome relevant previously identified barriers to accessing care (8). In addition, many of the resources available to veterans had little or no evidence base, with very few tested in a RCT. Therefore, following the development of the MeT4VeT toolkit, the project's final phase consisted of a feasibility trial (see Appendix 2 for more information).



In line with the Medical Research Council Complex Intervention Framework (9), the feasibility stage of developing an intervention is focused on three areas to assess the practical aspects of testing an intervention, including:

1. Testing procedures (technical app delivery; measurement processes).
2. Estimating recruitment and retention (number of eligible/interested participants; drop-out rates).
3. Determining sample size (testing main outcome measures to determine the appropriate sample size for a later RCT).

In addition to this, the feasibility trial will provide feedback from participants on their reactions to the app, including:

- ♦ Actual use of the app.
- ♦ Satisfaction with the app.
- ♦ How appropriate they believe the app to be.
- ♦ The intent for continued use.

In summary, the project aimed to develop a mental health toolkit to help military veterans overcome key barriers to help seeking for mental health difficulties. These included being able to:

1. Define and identify their experiences as a mental health problem.
2. Recognise when to seek help before they reach a crisis point.
3. Seek support, either formal treatment or self-help resources.

The project also aimed to test the acceptability and usability of this toolkit in a feasibility trial.

Chapter Two: App Development

Toolkit name

At project inception, the project name was MINDfitness, however this was changed to MeT4VeT to avoid any confusion with the HeadFIT initiative (<https://headfit.org>).

Toolkit format

The research team purposefully were open minded about the eventual format of the MeT4VeT toolkit at the beginning of the project; part of the development process was evaluating what format would be most useful. Various formats were considered, including a website, an information pack for service leavers and e-resources such as online programmes. Through the scoping review (Appendix 1) and later discussions with veterans (Appendix 3) and stakeholders (Appendix 4), a mobile phone application was deemed the most appropriate based on the ease of access and distribution, and the anonymity an app can offer, a point frequently highlighted by veterans in the development interviews (Table 1 and Table 2, Appendix 5).

The decision to use a smartphone app was based on many factors including that they can be downloaded at low to no cost by many people, 24/7 availability, not requiring face-to-face contact, and can be used by anyone (10).

Project aims

As this project was a feasibility trial, the aims were as follows:

- 1 To provide initial assessment of the practicality of testing the app;
- 2 To assess the acceptability and usability of the app;
- 3 To provide initial feedback on the app.

Overview of app development process

The first phase of the project consisted of a scoping review of existing toolkits, and these were evaluated on their ability to help veterans overcome the barriers identified in the Stigma and Barriers to Care project (8) as described above (Figure 1). This was followed by stakeholder events and veteran interviews (Figure 2, Appendix 6) which were repeated at several points to ensure stakeholders and veterans were involved in all stages of the app development process.

Figure 1. Overview of app development process.



MeT4VeT app

Overview and theoretical basis

The intended use of the app was to help users define when their experiences indicated a mental health problem, recognise when to seek help before reaching a crisis point, and to inform users regarding the self-management of symptoms or ways of seeking formal support. The app was not intended to be a replacement for treatment or to be used alongside treatment, therefore the decision was made to exclude participants who were already in treatment, such as talking therapy. The elements of the app have been chosen for inclusion as they represent the intersection between:

1. Core components of Cognitive Behavioural Therapy; this was the theoretical framework underwriting the app.
2. Behaviour change constructs.
3. Means to overcome each of the barriers outlined in earlier research.

Cognitive Behavioural Therapy (CBT)

CBT has been shown to be an effective therapy for a range of mental disorders and is recommended by the NICE guidelines in the treatment for depression and anxiety. As a therapeutic model, it has been used as the foundation for a number of self-help support tools (11). Moreover, CBT based apps have been shown to be effective for common mental disorders (11).

The core principle of CBT is that a person's thoughts, emotions, physical sensations, and behaviours interact. As it is difficult to change emotions voluntarily, CBT encourages change of thoughts and behaviours by the self-monitoring of thoughts, feelings and behaviours (as incorporated within the *People* section), behavioural activation (as included within the *Tasks* section) and the use of techniques such as mindful breathing and cognitive reframing (within the *Tools* section) (11).

Behaviour change constructs

In addition to being underwritten by an evidence-based framework (12), apps should incorporate key behaviour change constructs (13). Though further evidence is needed, the existing research base

suggests support for a number of behaviour change constructs including:

- ♦ Self-monitoring of behaviour (found in both the *People* and *Tracking* sections).
- ♦ Goal setting (found in the *Tracking* section).
- ♦ Feedback on behaviour (found in the *Tracking* section).

App summary

The app consists of five core elements:

1. *People* - developed as an aid to the provision of psychoeducation on how mental health difficulties might look in real life and to help participants identify symptoms of mental health difficulties in themselves.
2. *Tasks* - employing behavioural activation principles to encourage users to set a series of tasks to help them achieve larger goals in different areas of their life e.g., work, family, physical health.
3. *Tools* - to provide participants with a range of resources that they can use independently to help them manage symptoms of mental ill-health that they may be experiencing.
4. *Tracking* - to allow users to monitor their own mental health and to see their progress across the elements of the app.
5. *Notifications* - a schedule of daily notifications to encourage participants to continue to engage with the app.

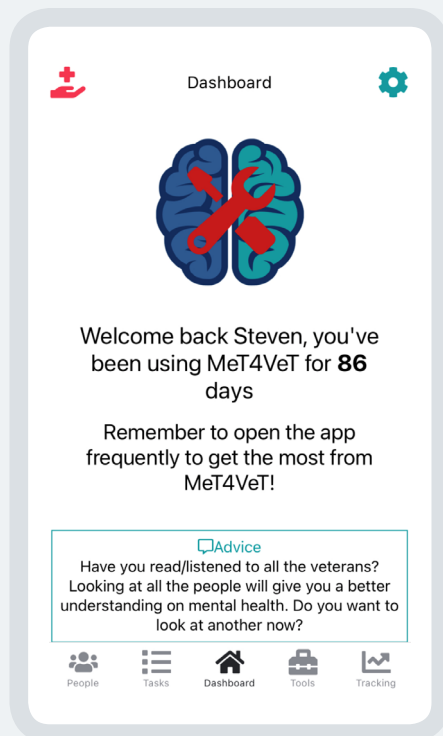
User journey

Upon downloading the app, users are encouraged to work their way through the app in a linear order (Figure 3, Appendix 6). First, the *People* section and then *Tasks*, *Tools* and finally *Tracking*. Once they are using the app regularly, they should focus on completing tasks and tracking their mental health. The tracking will determine what they focus on next, for example it will suggest focusing on tasks or a using a particular tool based on the symptoms they have reported. The signposting information is always available, and users will be prompted to look at the signposting information if they input worsening mental health two weeks in a row.

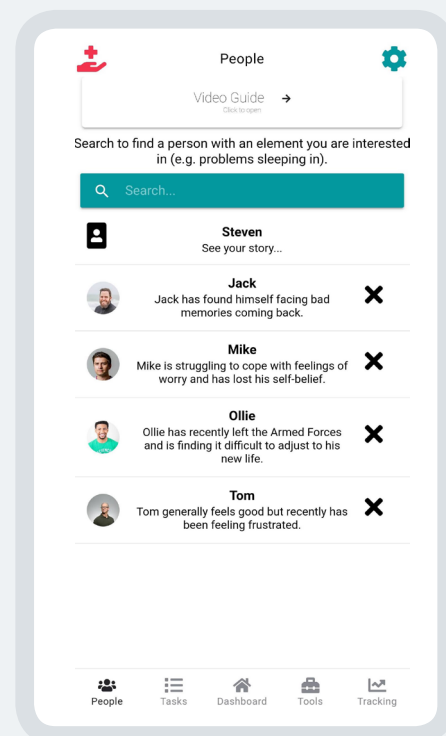
App sections

Dashboard

The *Dashboard* is the first section that will be seen when opening the app. It contains information about how long the person has been using the app, their name and gives some general advice for using the app.



health and is having some difficulties in their life and struggling with certain emotions but would not necessarily meet the diagnostic threshold. The inclusion of this story was informed through discussions with stakeholders, and it was considered important to include someone experiencing these emotions.

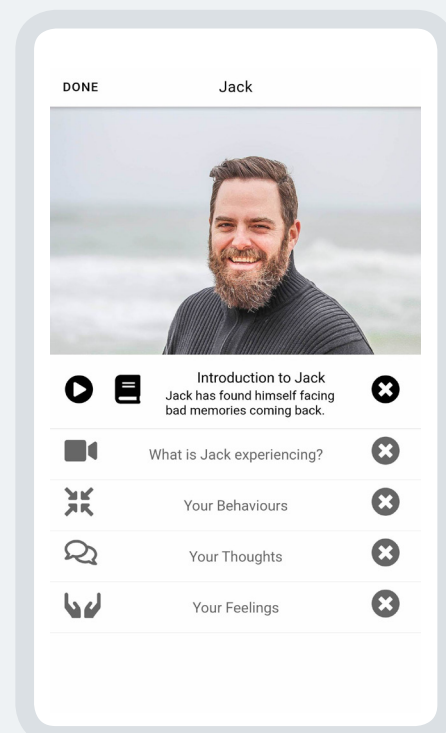


People

The *People* section contains videos of four veterans who each speak for approximately five minutes detailing their current mental health difficulties and how it impacts their life. The stories are not based on a true story in the sense of one individual but are an amalgamation of various stories composed using the research team's clinical expertise. The stories were designed to incorporate a wide range of thoughts, feelings and behaviours which are common to each disorder from four veterans:

1. Generalised anxiety disorder
2. Depression
3. PTSD
4. Distress but sub-threshold for mental disorder

Veteran four is intended to represent an individual who does not have the best mental

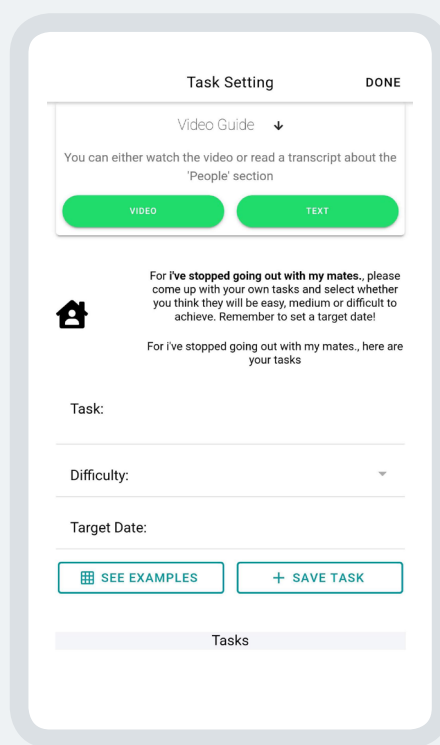


The app asks the user to listen to four individuals speaking about their experience of mental health. From those stories, the app highlights different quotes from the stories which encapsulate thoughts, feelings and behaviours and asks users to differentiate between them. They are then asked which thoughts, feelings, and behaviours they relate to in order to encourage users to reflect on their own wellbeing and experience. These thoughts, feelings and behaviours are stored in the 'my story' section and these become the focus for the user as they proceed further onto the other sections of the app (Figure 3, Appendix 6).

An example of a story can be seen in Figure 4 (Appendix 6).

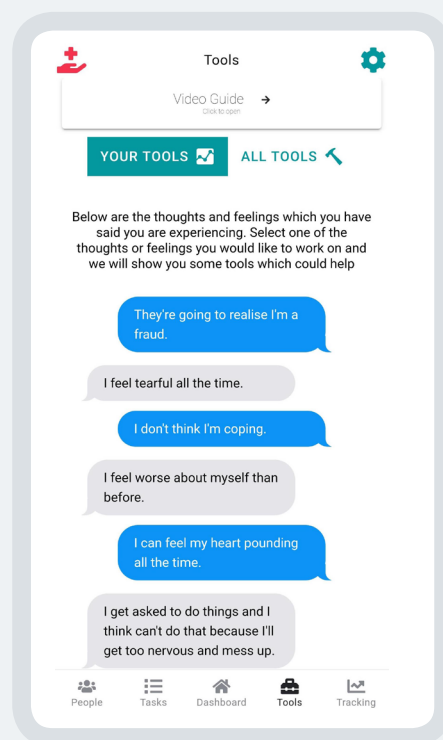
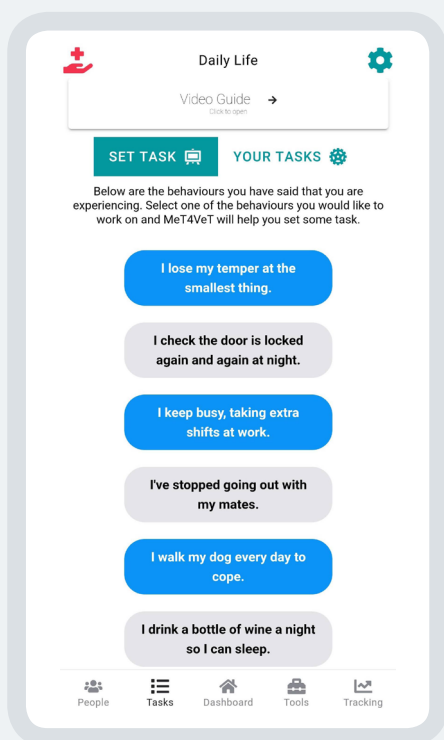
Tasks

In the user's story, they will have a list of behaviours. These can be behaviours that are having a negative impact on their life (e.g. avoidance behaviours) but also behaviours that make them feel better (e.g. walking the dog). Users are urged to set tasks to work on to reduce their negative behaviours and build on the positive ones by engaging in those more frequently. For example, if a behaviour is "I don't socialise anymore" then it would assist users in creating a stepwise approach to overcome this.

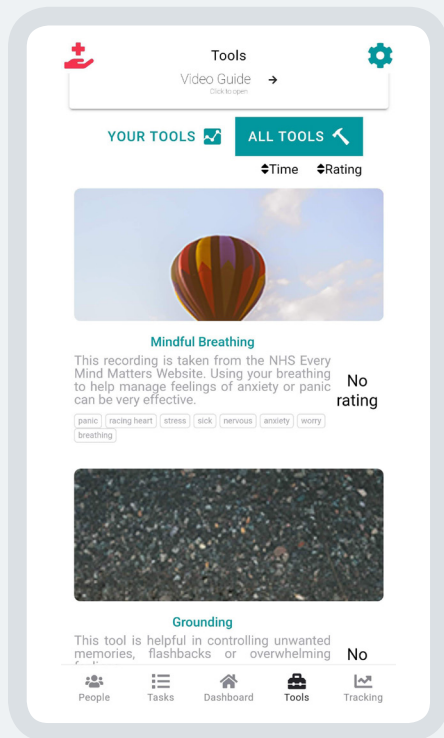


Tools

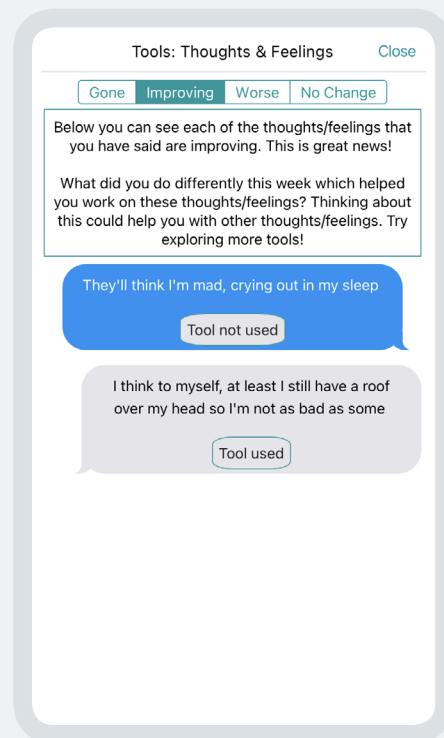
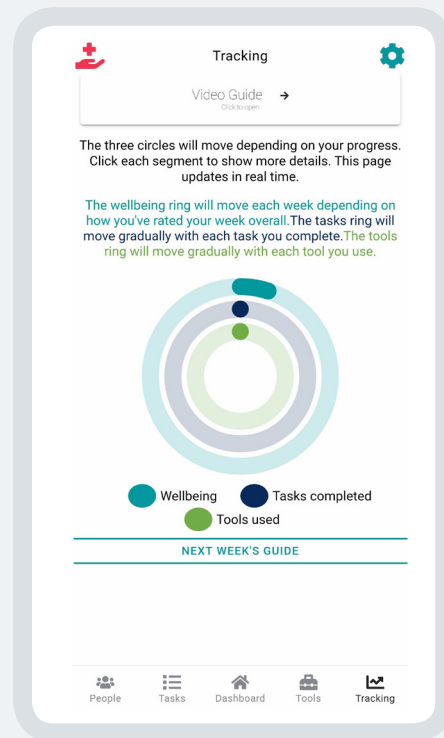
The *Tools* section is used to work on the user's thoughts and feelings. These tools were kindly shared with us by Public Health England and are from the Every Mind Matters resource (14) and include tools such as reframing negative thoughts and breathing exercises. Once in this section,



users are asked to select which thought or feeling they want help with and to select this 'bubble' (Appendix 7). The app will then suggest a relevant tool. For example, if the user is struggling with intrusive thoughts "I can't get the images out of my head" then it will suggest safe place imagery or grounding exercises. Users can also rate which tools they like and if they do not like a tool, it will not be suggested in the future.



'smiley face' and backwards for every time they select a negative one. If the user improves consistently each week and selects a positive 'smiley face' for each week, they will eventually see a fully coloured circle indicating their overall wellbeing as significantly improved.



Tracking

At the end of each week, the user is asked to rate how they are feeling by selecting a simple 'smiley face'. This idea came directly from stakeholders and veterans who deemed its simplicity to be beneficial. The app will also ask users to check in with their story and ask them to select which thoughts, feelings and behaviours are improving, are no longer an issue (gone), which have got worse, and which have not changed.

The three rings on the front screen of the *Tracking* section are structured as follows:

1. The outer ring is for 'wellbeing' overall, and this will gradually fill the ring and turn it a darker shade of teal when the user selects a positive

2. The middle ring is for tasks completed and this will fill the ring as more tasks are completed. This will enable users to keep an overall track on how many tasks they are completing and visibly see that they are taking proactive steps towards the management of their mental health.
3. The inner ring is for tools and will fill the ring every time a user uses a tool. This will enable users to keep an overall track on how many tools they are using and visibly see that they are taking proactive steps towards the management of their mental health.

The front screen aims to provide an overview of their progress, but the user can also select each ring enabling a more detailed understanding of their process:

1. On selecting the wellbeing ring (outer), the user can see how they've tracked their **overall wellbeing**, broken down by each week. This may enable users to recognise certain triggers for low mood or stress, for example if one week stands out as being rated particularly poorly then they may link it to a certain event that occurred. This will help users define their difficulties as a mental health problem and identify perpetuating factors.
2. On selecting the tasks ring (middle), the user will see their **behaviours** in four categories: gone, improving, no change and worse. This reflects how the user has rated each behaviour as changing over time. For each behaviour, it will show whether a task has been completed or not. The idea is that users will see that for behaviours

that are not improving, they have not set a task to improve on and so it will encourage them to proactively attempt to change this behaviour using tasks. If however, they are doing tasks, but the behaviour remains the same then the app will suggest through a pop-up message to look at the signposting section for more support. This is to help users recognise when they may need more support than the app can offer and to seek formal support before it reaches crisis point.

3. Similarly, when users select the tool ring (inner), the user will see their **thoughts and feelings** in the same categories of gone, improving, no change and worse. They will see how many tools they've used for each thought or feeling. If no improvement has been made in two weeks but they have been using the tools then as with above, the app will suggest seeking further support. Again, this is to aid in the recognition of the need for help before it escalates.

Signposting

A list of statutory and third sector organisations that focus on veterans' mental health is available in the signposting section with links to their website and contact information (see Appendix 7).

Notifications

Various push notifications are sent to the user, encouraging them to engage in the app by looking at new stories, set tasks, use tools, and track their progress. These are limited to once a day to avoid over-burdening the user.

Chapter Three:

Method

Design

The feasibility trial used a randomised design to assign participants to either the full-app group or control group. The full-app group received the MeT4VeT app with full functionality and the control group received an app with signposting information only.

Study population

The inclusion criteria for the study were as follows:

- Male veterans that had served at least two years within the UK Armed Forces.
- Left the UK Armed Forces within the last two years.
- Indicated to be experiencing a degree of mental health distress as measured by the General Health Questionnaire (GHQ-12) with a score of two or above.
- Not currently undertaking mental health treatment.
- Owned a smartphone.

The exclusion criteria for the study were as follows:

- Served in the Armed Forces for less than two years.
- Left the Armed Forces more than two years ago or not in the last two years of service.
- Scored less than two on the GHQ-12 at screening.
- Do not own a smartphone capable of downloading the app.
- Not willing to participate in three in-app surveys and potentially to use an app for one month with usage data collected and a telephone interview.
- Currently engaged in active mental health treatment.

Participant recruitment

Study participants were recruited through three military medical centres between October 2020 and February 2021. All individuals receive a discharge medical when they are transitioning out of the military; this includes a mental health screening. At the participating centres, medical officers introduced the project to those who were deemed to have some medical health difficulties but were not being referred to the Department of Community Mental Health (DCMH) for treatment. If the participant was interested in taking part, their details would be passed on to KCMHR.

As this initial recruitment method was unsuccessful, recruitment via social media and advertisement through veteran third sector organisations was utilised between February and November 2021. For social media advertisement, paid advertising posts were created for Facebook and Instagram and project details were shared on Twitter. The posts included a link to the participant information sheet on the questionnaire platform Qualtrics.

Similarly, posters and flyers were sent to third sector organisations that provided support such as housing or financial advice to veterans. These posters and flyers were displayed in support centres where possible (many were closed due to COVID-19 restrictions), and they were sent electronically in newsletters and email distribution lists. In some organisations, 'gate keepers' were used to introduce the study to eligible individuals whom they were working with, and these participants were given a flyer. The flyers included a link and a QR code

to the participant information sheet on Qualtrics. Eligible participants were sent further information about the study and asked to complete a consent form. After receiving the consent forms, instructions for downloading the relevant app were sent to the participants via e-mail.

Compensation

Both groups of participants received compensation of a £10 Amazon voucher for completing each questionnaire at baseline, after one month of app usage and after three months follow-up (Figure 5, Appendix 6). The participants in the full-app group received another £10 Amazon voucher for completing a telephone interview.

Materials

Apps

The full-app group received the MeT4VeT app with full functionality including the five core elements detailed in chapter two: *People, Tasks, Tools, Tracking* and *Notifications*. The app featured a signposting section with details of organisations relevant to veterans if they needed to seek further help. The comparison control group received an app containing only this signposting information. Both apps were available on Android through the Google Play Store and on Apple through the TestFlight app. The apps could only be activated by using a QR code or token code which was sent to participants by the research team.

Questionnaires

The participants completed questionnaires as detailed in Table 3. The mHealth App Usability Questionnaire (MAUQ) (15) was used to measure the app acceptability and usability. This measures overall usability and three other domains: ease of use and satisfaction, interface and functionality, and usefulness. The mean total score and the mean of each three domains is scored out of seven, with

higher scores indicating greater app usability. Mental health measures were used to determine the feasibility and sample size required for a future RCT (Table 4, Appendix 5). The measures included the General Health Questionnaire (GHQ-12) (16), PTSD Checklist (PCL-C) (17), Warwick Edinburgh Mental Well-being Scale (WEMWBS) (18) and the World Health Organization Quality of Life Assessment (WHOQOL-BREF) (19). For the GHQ-12 and PCL-C, higher scores indicate poorer well-being on those measures and for the WEMWBS and WHOQOL-BREF, higher scores indicate better well-being and quality of life respectively.

Interviews

After one month of app usage, participants from the full-app group were invited to participate in a recorded telephone interview regarding their opinions of MeT4VeT. Semi-structured interviews were conducted using an interview guide developed by the research team which focused on each section of the app and its use and accessibility (Table 5, Appendix 5). Prompts and follow-up questions were used, and the participants were able to guide the direction of the interview. Interviews lasted approximately 15 to 40 minutes. Interviews were recorded and transcribed by a professional transcription service paying due regard to confidentiality.

App usage data

App usage data was collected passively from Google Analytics (CA, USA) and included information such as the number of times the app was opened, duration of each app use and number of times specific sections of the app were used. Participants' devices were automatically included in this data, but it was possible for participants to disable app tracking for MeT4VeT from their device.

Analysis

Practicality of testing app

To determine the practicality of testing the app, we assessed the technical ability to deliver the app. We also determined the number of participants recruited into the study and how many of those dropped out. Lastly, we determined the sample size needed for a RCT based on the likely change in GHQ-12 scores at follow-up (three months).

Acceptability and usability

App usage data was used to assess the usability of the app. The acceptability and usability of the app were also assessed using the MAUQ and qualitatively through interviews.

Initial feedback of the app

Initial feedback of the app was determined through the semi-structured interviews with the full-app group participants.

App usage data

App usage data from Google Analytics was analysed to understand how the participants used MeT4VeT, including the number of times each section was accessed and how long they were accessed for. This data is reported using the median and interquartile range. The app acceptability and usability were reported for both groups using the mean and standard deviation from the MAUQ.

Table 3. Questionnaires across all timepoints.

Measure	Baseline	Baseline + 1 month	Baseline + 3 months
Demographics <ul style="list-style-type: none"> ♦ Age ♦ Gender ♦ Ethnicity ♦ Relationship status ♦ Military service branch ♦ Military rank ♦ Regular/reservist status ♦ Service joining date ♦ Reason for leaving 	*		
App acceptability & usability <ul style="list-style-type: none"> ♦ mHealth App Usability Questionnaire (MAUQ) 		*	
Mental health <ul style="list-style-type: none"> ♦ General Health Questionnaire (GHQ-12) ♦ PTSD Checklist (PCL-C) ♦ Warwick Edinburgh Mental Well-being Scale (WEMWBS) ♦ World Health Organization Quality of Life Assessment (WHOQOL-BREF) 	*	*	*

Interviews

Interview transcripts were stored and analysed using NVivo 1.6 (QSR International Pty Ltd, 2022). The transcripts were analysed using a type of thematic analysis known as framework analysis (20). This involved a five-step process of: familiarisation with the data, identifying a thematic framework through the use of codes, mapping the study data against these codes, charting to summarise the codes, and interpreting themes from the codes.

Mental health measures

To compare the differences in mental health measures (Table 4, Appendix 5) between the

full-app group and control group at each timepoint (baseline, baseline + one month, baseline + three months) independent sample t-tests were used. Independent sample t-tests were also performed to compare the differences in mental health measures across timepoints (pre-intervention to post intervention and post-intervention to follow-up) for both the full-app group and control group.

Ethics

The feasibility trial was granted full ethical approval by the UK Ministry of Defence Research Ethics Committee (1074/MODREC/20) and the Research Governance Office at King's College London (DPRF-19/20-16015).



Chapter Four: Results

Participants

The mean age of the participants was 42 years, and they were predominantly white (94%), married, cohabiting or in a long-term relationship (82%) (Table 6). The majority of the participants were in the Army (64%), followed by Royal Navy (26%) and the Royal Air Force (10%). Participants were

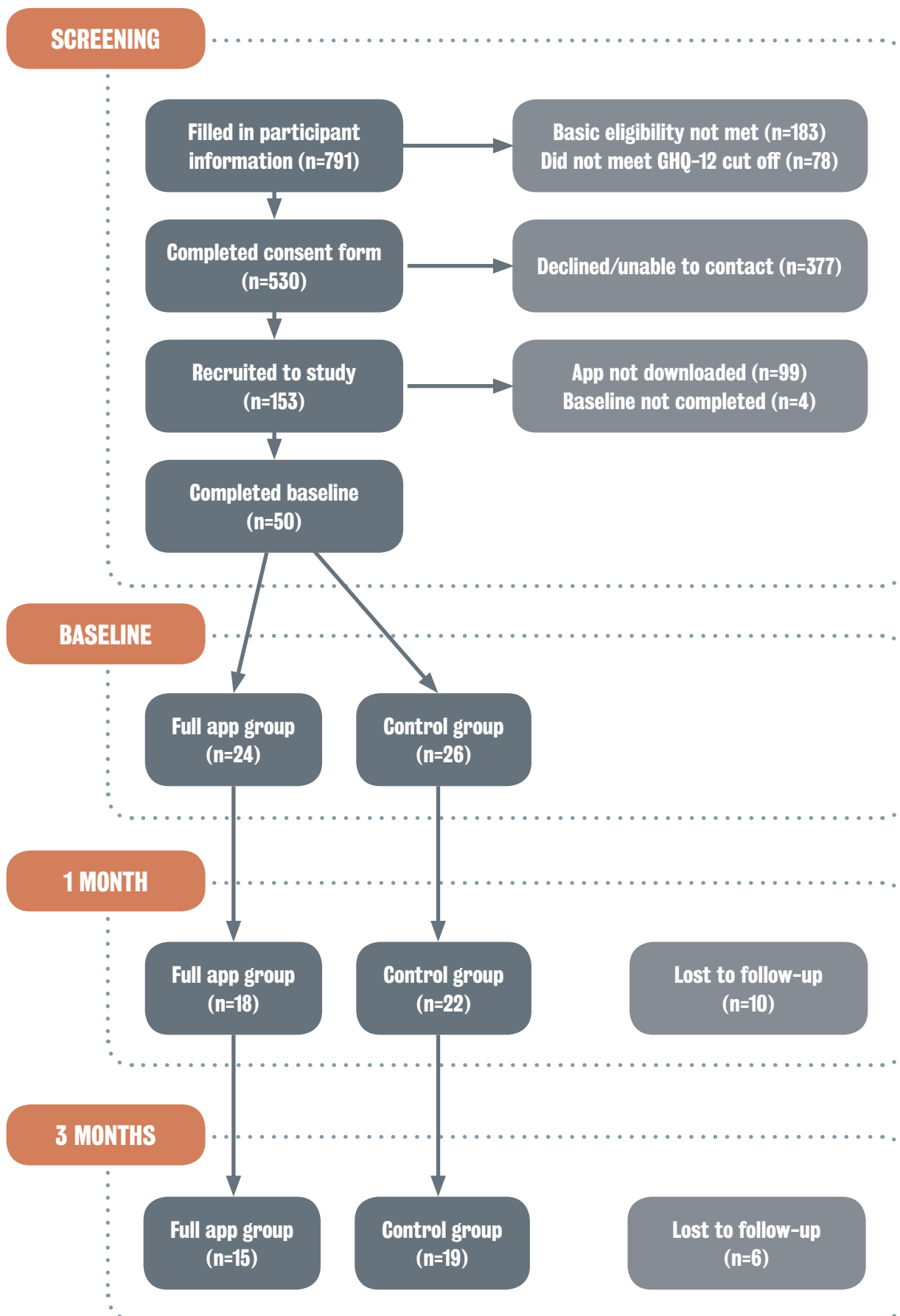
predominantly NCOs (78%) and were regular serving personnel (90%). For the reported reasons for leaving the military, the most common was completing the terms of service (34%). Most participants used an Android device (54%). The participant recruitment flow diagram is shown in Figure 6.

Table 6. Participant characteristics, military background, and device information.

	Full-app group n (%)*	Control group n (%)*
Total Number	24	26
Age In Years		
<40	10 (42)	8 (31)
40-49	8 (33)	11 (42)
50+	6 (25)	7 (27)
Relationship Status		
In a relationship	20 (83)	21 (81)
Not in a relationship	4 (17)	5 (19)
Service Branch		
Army	14 (58)	18 (69)
Royal Navy/Royal Air Force	10 (42)	8 (31)
Military Rank		
Officer	4 (17)	6 (23)
Non-officer	20 (83)	20 (77)
Reason for Leaving Military		
Completed term of service	9 (38)	8 (31)
Impact of service life on family	4 (17)	4 (15)
Other	11 (46)	14 (54)
Device Operating System		
Android	14 (58)	13 (50)
iOS (Apple)	10 (42)	13 (50)

* Where cells had less than four people, categories were combined.

Figure 6. Participant recruitment flow diagram.



Quantitative findings

Practicality of testing app

In terms of providing the app to participants, there were problems with Apple accepting the app on their App Store and MeT4VeT had to be installed via another app (TestFlight) which may have led to loss of engagement.

We experienced some issues with recruiting participants. One barrier to recruitment was the COVID-19 pandemic, which meant that military discharge meetings were held remotely because of social distancing guidelines, and it was therefore more difficult to recruit participants than it would have been face-to-face. We also had some challenges with recruiting via social media. There were a large number of people who completed the participant information and consent forms in a short space of time, some of which provided incorrect information (e.g. telephone numbers with incorrect formatting; the same names/telephone numbers from multiple people). Therefore, we believed these may not have been genuine responses and likely contributed to a large number of people that could not be recruited to the study (n=377). To overcome this, we implemented 'captcha' anti-robot checks, form validation so that an e-mail address had to be in the correct format and telephone numbers that needed to be UK-based, which helped to reduce the problem. It was hoped that the provision of monetary

incentives at the end of each data collection period would encourage participants to continue with the study; however, we did have some difficulties retaining participants and lost several to follow-up. Out of 153 participants recruited to the study, 99 did not download the app. Of those that completed the baseline measures (n=50), 34 (68%) remained at follow-up.

Acceptability and usability

The app usage data across the whole study period for both groups is summarised in Table 7. For the full-app group, the app was initialised by the participants a median of 20 times and over a median period of 3 weeks. The median usage duration was 29 seconds (slightly lower than another mental health app for veterans that had an average session duration of 47 seconds (21)). The control group was initialised by the participants a median of 10 times and over a median period of 1 week. The median duration was 31 seconds. For the full-app group, the participants used all areas of the app (Table 8). The first screen that the participants accessed after completing the questionnaires and on subsequent openings of the app was the *Dashboard* which was accessed the most, followed by the *People* screen. All the measures were completed on the Questionnaires screen, which was used the most, followed by the *People* section.

Table 7. App usage for both groups across the whole study period.

	Full-app Median (IQR)	Control Median (IQR)
Initialisations	20 (8-27)	10 (4-19)
Session count	66 (34-168)	43 (16-56)
Session duration	29 (17-49)	31 (22-43)
Server interactions	8 (4-26)	5 (4-8)
Weeks active	3 (1-5)	1 (1-3)

Table 8. App usage for each section of the MeT4VeT app in the full-app group.

App screen	Ever accessed n (%)	Number of times accessed per person Median (IQR)	Average time on screen per person (seconds) Median (IQR)
Questionnaires	24 (100)	5 (3-7)	1268 (725-2104)
Dashboard	23 (96)	22 (12-34)	173 (109-303)
People	23 (96)	16 (9-41)	239 (92-583)
Tasks	23 (96)	12 (6-39)	149 (90-631)
Tools	21 (88)	9 (4-27)	119 (43-282)
Tracking	24 (100)	11 (4-26)	126 (56-311)
Signposting	17 (71)	2 (0-7)	32 (0-62)
Settings	18 (75)	7 (2-17)	60 (16-81)

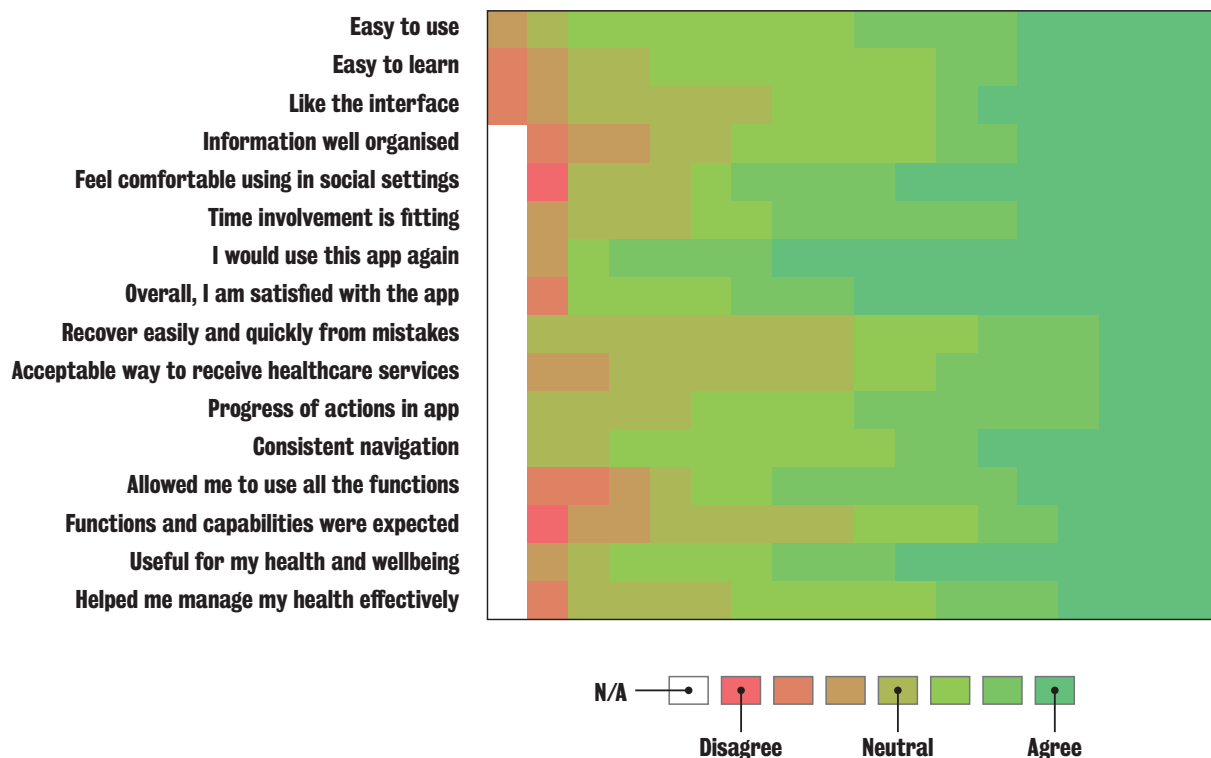
Participants in both groups completed the MAUQ after one month of app usage (Table 9). The MAUQ is measured on a scale from 1 to 7, with higher values indicating better app usability. Both groups had high overall usability for the full-app and the signposting app. The sub domains

of ease of use and satisfaction and interface and functionality were higher in the control group and the full-app was perceived to have a higher amount of usefulness. The scoring for each question is displayed in a heat map for the full-app group (Figure 7).

Table 9. mHealth App Usability Questionnaire (MAUQ) results for both groups after one month of app usage.

	Full-app (n = 18) Mean (SD)	Control (n = 22) Mean (SD)
Total score	5.27 (1.50)	5.62 (1.20)
Ease of use and satisfaction	5.51 (1.52)	5.90 (1.12)
Interface and functionality	4.94 (1.55)	5.51 (1.43)
Usefulness	5.28 (1.78)	4.82 (1.60)

Figure 7. App acceptability and usability scores for the MeT4VeT full-app group. Each square represents one participant's response for each question on the MAUQ, scored on a scale from 1 (disagree) to 7 (agree).



Mental health measures

The GHQ-12 scores for both groups decreased significantly after one month of app usage (Figure 8, Appendix 6). The GHQ-12 scores further decreased for the full-app group after three months follow-up and increased for the control group, although these differences were not significant. The PCL-C scores for both groups decreased after one month of app usage, although this was only significant for the full-app group (Figure 9, Appendix 6). The PCL-C scores further decreased for the full-app group after three months follow-up and increased for the control group, although these differences were not significant.

The WEMWBS scores for both groups increased after one month of app usage although the differences were not significant (Figure 10, Appendix 6). After three months follow-up, the

WEMWBS scores increased for the full-app group and slightly increased for the control group, but these differences were also not significant.

The WHOQOL-BREF scores increased for the full-app group after one month and three months follow-up across all domains except physical health which increased after one month and then stayed the same at three months (Figure 11, Appendix 6). However, these differences were not significant. For the control group, the WHOQOL-BREF environment scores decreased after one month and three months follow-up, the physical health and social relationships scores increased after one month and then decreased after three months follow-up and the psychological scores decreased after one month and then increased after three months follow-up. These differences were not significant.

Power calculation

A power calculation was performed to determine the sample size needed for a future RCT. This was based on the GHQ-12 scores at follow-up (three months). To detect a difference in the GHQ-12 means of three points between groups at three months follow-up, with 80% power and a significance level of 5%, each group would need to have 39 participants. Considering an acceptance rate of 20% into the study after recruitment based on our feasibility trial and a total drop-out rate of 35% at follow-up based on a systematic review of mental health interventions delivered by smartphone (22), at least 560 participants will need to be recruited.

Qualitative findings

The main themes from the transcripts were grouped into positive feedback, challenges faced, suggestions for improvement and other themes. For positive feedback, the themes related to usability, content and information and appearance (Table 10, Appendix 5). For challenges faced, the themes related to usability and content (Table 11, Appendix 5). Themes related to suggestions for improvement were for usability, and content (Table 12, Appendix 5). Other themes that were identified included app usage and military (Table 13, Appendix 5). All themes and sub themes are presented in Figure 12 and further expanded upon with quotes from the interview transcripts below.

Figure 12. Themes and sub themes identified from interviews with full-app group.

Positive Feedback	Challenges Faced	Suggestions for Improvement	Other Themes
<p>Usability</p> <ul style="list-style-type: none"> ♦ App format ♦ Ease of use ♦ Continue to use the app <p>Content</p> <ul style="list-style-type: none"> ♦ People ♦ Tasks ♦ Tools ♦ Tracking ♦ Tutorials ♦ Identifying thoughts, feelings & behaviours ♦ Military Relevance <p>Information & Appearance</p> <ul style="list-style-type: none"> ♦ Logo & font ♦ Tone & language 	<p>Usability</p> <ul style="list-style-type: none"> ♦ App format ♦ Technical difficulties <p>Content</p> <ul style="list-style-type: none"> ♦ Tasks ♦ Tools ♦ Tracking 	<p>Usability</p> <ul style="list-style-type: none"> ♦ Navigation ♦ Personalisation ♦ Recruitment <p>Content</p> <ul style="list-style-type: none"> ♦ Add content ♦ Dashboard ♦ People ♦ Signposting ♦ Tasks ♦ Tools ♦ Tracking 	<p>App usage</p> <ul style="list-style-type: none"> ♦ App usage frequency ♦ Notifications <p>Military</p> <ul style="list-style-type: none"> ♦ Transitioning

Unique identification codes have been provided alongside the interview quotes to protect the participants' anonymity (P1 to P12). Where an ellipsis has been used '...', this indicates that some text has been removed. For example, conversational filters or where the removal of words in a long passage were not deemed to change the meaning of what was said. Text in square brackets within a quote '[Text]' indicates text that has been inserted by the author for clarification.

Positive feedback

Usability - App format

The participants commented on the usability of the app and most felt that an app format was the best for a mental health toolkit. They appreciated the ease of access to mental health information and the support it gave them when they were reluctant to seek professional help:

"I think it is because everybody has a phone nowadays and it's always handy because even at work if I'm getting a bit stressed or something I'll just go onto it. I'll go hold on a minute I'm a bit stressed, I've got the App there, open it up, right let's have a little breathing exercise. I just calm down, have a coffee." (P1)

"I think the in-person stuff with qualified professionals that's always going to be the gold standard but that's not always necessarily practical and reasonable, which I think this is the next best option. I also think an App is a lot easier and lot more accessible for people with busy lives or people who might not necessarily be comfortable seeking more explicit in-person help. So I think it's really good for what it does." (P12)

Usability - Ease of use

The majority of the participants said they would continue to use the app. The app was considered easy to use and the participants did not find it overly complicated and understood what each part of the app did:

"It's laid out really well and each of the different categories along the bottom if you like they were obviously very, it's very obvious what it is each of the different sub-categories do." (P4)

"I'd say it was quite easy. I'd say maybe 8 out of 10. The only problem was there were lots of little bits and pieces that you had to go into and go out of and you had to sometimes go chasing for, chasing certain parts of the App. But other than that it was very good, it's easy to use, it was simple. I didn't need any real instruction to use it." (P12)

App content - People

Most of the participants reported finding each section of the app (*People, Tasks, Tools, Tracking*) useful and provided positive feedback. The *People* and *Tools* sections received the most positive feedback. For the *People* section, the participants appreciated the videos of the veterans' stories and found they could relate to them. The people and their stories were seen as realistic and relatable. The stories encouraged reflection on the participants' own feelings and behaviours, helped them to identify their feelings/behaviours, and helped them understand why they felt the way they did:

"[When asked to elaborate on comment about finding the people section helpful] I suppose just reading through and seeing other people's, I don't know whether they're real or what but seeing all their thoughts on people's feelings and how they felt through, the way they're explaining them and putting them in words if you know what I mean." (P8)

"It was just useful to see other people's point of views and see that other people are probably thinking similar things to what I'm thinking." (P5)

App content - Tasks

The tasks helped the participants to think about what they wanted to achieve and helped them to stay focused on it. Most appreciated how setting tasks would hold them accountable and provided a clear step by step way to achieving their goals:

"I like the way they were broken into the four areas, relationships, looking after me, career, finance because it makes it quite like step by step. I know if I'd had this back in 2019 when I was in a really bad place, I think that would have been really, really beneficial because it's there in stepping stones going forward." (P11)

"I think the one particularly relating to goal setting because it helped me think about what I need to do for the next step, what the process forward from where I'm currently at is. I think that element was most useful and again the ideas it put in my head what had to be done next." (P12)

App content - Tools

Most of the participants appreciated the inclusion of the tools, in particular the mindful breathing, progressive muscle relaxation and thought reframing. Participants reported that the tools helped them to relax when they were feeling stressed or anxious:

"But your App has learnt me to do the breathing and the relaxation thing. If I feel a bit of anxiety or something is not right, then I actually use that video and that seems to settle me down." (P9)

"...so I've got to be really relaxed and since I've had this App, I've not had any occurrence with my medication because I'm already relaxed, and I'm cleared. Before I would be taking my medication that would be giving me a little reaction and then that would stress me out more. But this way I've got, it's like a goal each day right listen to that, chill, take my medication, have a little lie down and listen to the muscle relaxant as I'm lying there." (P1)

App content - Tracking

Several of the participants appreciated the visual elements of the *Tracking* section. They reported that it was easy to identify what they had achieved within the app and appreciated having the information available in one section:

"...it's a good visual effect to show where you are and what you've done...To me it seemed easy. Every picture paints a thousand words. All the information is there from you." (P6)

"I think the tracking section is good. I think it might have been better if I was doing more tasks but it's handy to know how long you've been on there and what you are doing on there." (P5)

App content - Identifying thoughts, feelings & behaviours

Most participants reported that the app helped them to identify their own thoughts, feelings, and behaviours. There was an appreciation that use of the app was a continual learning process and in particular the *People* section helped them to identify their own thoughts, feelings, and behaviours by reflecting what others were experiencing:

"Well sometimes you are just feeling down and annoyed or whatever and you can't really put your finger on why, so you read about them people and you watch the video, and you think, yes that's probably why I'm feeling the way I am." (P5)

"...it's trying to figure out why I think like I think or why I do what I do and why some days are OK, and some days are not. It's all about learning I guess." (P3)

App content - Military relevance

A large majority of participants appreciated the military focus of the app and how it could be useful for veterans. One participant believed it would be useful for those that had experienced extreme events and could also be applicable in other careers where there may be a high risk for psychological trauma:

"I would see it being really, really useful for those that have maybe done or have just finished their first or second operational tour but particularly their first one where there has been significant enough activity for them to start seeing extreme events. So not necessarily an easy tour in the Falklands or something but it could be anything. It could be something like an RAF firefighter that doesn't necessarily go on deployment but might well be asked to do first responders at accidents and stuff like that. I think it's almost that first deep event where there's a psychological impact when someone hasn't had to deal with that before." (P2)



Another participant appreciated the app's focus on veterans due to a feeling of abandonment once they had left the military:

"Well personally just thank you guys because obviously it's nice to see that someone is having an interest in us. Like I said when I signed my paper, they just said bye. They've never been in contact with me, they didn't ask how I am. I mean I didn't even have a medical and it's quite heart-warming that there is like yourselves doing the App especially so that a person can maybe put their thoughts down on how they're feeling that day because not everyone can talk to someone. And there is so much mistrust at the moment in the veteran side...that sometimes an App is even if it just gets something off their chest themselves and said actually that helped and I didn't have phone someone because I wasn't as bad as I thought it was and the App has actually made me think and see through things. If this App saves a veteran, then it's done its job because at the moment there's nothing out there." (P9)

Information & appearance - Logo & font

The appearance of the app appealed to a large majority of participants, with most finding the font clear and easy to understand. Some participants appreciated the use of a brain in the logo due to its association with mental health and the use of the red, green, and blue colours:

"I thought it was quite clever in effects it's obviously a picture of the mind. A lot of mental health is in the mind so yes it says exactly what it is. It's brain health. Mind health. So yes, this to me it says what it's going to do. It's there to help the mind. And obviously you've used the triand colour for Army, Navy, Air Force." (P6)

"The logo is good. The font is readable, it's not big bold capitals it's an easy reading page. There's a nice white background so it keeps your focus and then you've got the writing. So it's not like it's on a blue with the black and you are like that, well what am I trying to read here. It was white and you can actually see everything." (P1)

Information & appearance - Tone & language

The tone and language used within the app was reported to be suitable for most participants and most found the language used was easy to understand and clear. They appreciated the simple tone of the language and did not feel anything needed to be changed to make it more military-specific.

"It works for me...I know that some of them guys joined up who couldn't even read and write, and I know we're still getting a few of them people nowadays from some of the third world countries, some of the commonwealth countries and what have you. So, without being in their shoes and knowing what their skill level is I can't comment. What I know is I could understand it, I could read it, I could understand and follow the instructions." (P6)

"It's clear and easy. Make it clear, make it simple. We used to say in the military simple stupid and that's what a military person will, he will understand simple stupid." (P9)

Challenges faced

Usability

It was suggested by a small minority of participants that there are limitations to what an app can offer veterans as a mental health toolkit. Issues that veterans face were discussed such as triggers, a lack of meaning and a loss of social life which they felt an app would not be able to solve:

"...I think the main issues that my general and personal impression that veterans face is it's limited as to what an App can do...There are some broader things that it can't necessarily fix, so for example the lack of meaning, the loss of your social life, that sort of thing. That's not something the App can do, it can give you tools for. So, it does as well as it can. It's good in it's area." (P12)

However, a few participants acknowledged that an app may be a useful start for those that are reluctant to seek help, particularly amongst the younger population:

“Maybe for the younger generation...might be more inclined to turn to an App first time first up whereas I think I’m just probably slightly more older school in that respect.” (P2)

There were technical difficulties experienced by several participants when using the app, such as not being able to complete the questionnaires, notifications not appearing and videos not playing. One participant reported that it was difficult navigating around the app and recognised a need to make it as easy as possible to use:

“Certainly, when first going on I struggled to navigate around, and I ended up closing the App more often than managing to go back into a previous menu. Now whether that’s smartphone specific or app specific I don’t entirely know but obviously the smoother more idiot proof you can make it I suppose is what I’m trying to say the better.” (P7)

“I had trouble getting videos to work for me. So even on the people section I generally ended up just reading it because I couldn’t get the videos to work. But it may be a problem with me maybe.” (P8)

Content

Some of the challenges faced when using MeT4VeT related to the app content and the individual sections of the app. Several participants reported that the *Tasks* section was difficult to engage with. One participant reported that it was difficult to know what type of tasks to set for themselves and did not realise that there were example tasks provided for them within the app:

“I didn’t really get on with the tasks setting section because it wants you to set your own tasks and I didn’t really think, I don’t know what tasks to set myself. Do you know what I mean? I think it would be better if it had suggested tasks if that makes sense?” (P5)

Another participant was aware of the example tasks but realised that they may not be applicable to everyone and that it depends on their own situation:

“Most of them didn’t really work for me but like I said everyone has different triggers and situations I suppose. What they experience will be different so their reaction and their understanding of the event will be different I suppose. But generally speaking, so the ones that were relevant worked or I believe work and therefore the other ones should work for other people if they are applicable to them, I suppose.” (P2)

A couple of participants could not see the relevance in particular *Tools* such as the safe place imagery or grounding and felt that they did not personally work for them but appreciated they may be useful for others:

“I just don’t think I got into it. I think I didn’t see the relevance of it, but I can see how it could be important to other people. But personally, it didn’t seem to work for me. It might be worth trying it again.” (P4)

There was some confusion regarding the *Tracking* section by the majority of participants and the participants did not understand what it was trying to show. Several participants also did not realise that they could tap on the rings to receive more information:

“I mean the tracking element if there was anything that I had to say didn’t give a great deal of value...I’d look at the tracking and go, so what really because it doesn’t really mean a great deal to me.” (P7)

Suggestions for improvement

Usability

Regarding suggestions to improve the usability of the app, the participants felt that navigating around the app could be made simpler and more intuitive by having the different sections link together:

“I think perhaps things linked together so whenever you look at your behaviours and your thoughts and your feelings in the people section perhaps that could link into something you could do to set as a task instead of having to go to tasks.” (P8)

There were suggestions by several participants to make the app more personalised by adding more details to the user account section such as a picture or cap badge. One person thought it would be helpful to be able to include your own set of rules or values and standards.

"...all companies that I've worked with have all got their values and standards so say if you are in the workplace and make an inappropriate comment that's going against your values and standards. But if you had your own personal stuff that would be a good value thing to have, I think." (P3)

A small minority of participants gave suggestions for how to recruit people to use the app, specifically within the military community. One participant felt that advertising it as a mental health app may be off-putting for some:

"I think that's probably the point where you get your as soon as you start talking mental health you might turn off 50% of the audience of people that would actually benefit from the App. So I think it is very much about how you sell it. If it was an App to help with the stress of transitioning, then everyone is going to have stress with transitioning, and I think that would be how you would sell it." (P7)

Two participants felt that the younger population would benefit greatly from access to mental health information, but they may be particularly difficult to reach due to a perception of being able to deal with issues themselves:

"I think that's another thing a lot of particularly younger people are probably more in denial about what they're feeling...it's that denial thing of, oh well I'm a rough tough squaddie or marine or whatever and I should be able to deal with this because I'm in the Army and I've got this rank. But that doesn't mean that if they've never experienced it before then they're going to not necessarily know how to deal with it and could be even more unlikely to actually seek redress because the higher up the ranks you go probably the bigger the perceived impact on your career." (P2)

One participant felt it would be better to make the app more military specific to attract people to the app and not to try and cater to everyone:

"I don't think it would be a good idea to make it like a tri service so RAF, Navy and Army I don't think that would be a good idea at all to try and make it all singing, all dancing. So you either concentrate or you have maybe I don't know three different ones with the Navy, Army, and Airforce. But again I'm ex-Army so I think purely for the Army you'd need to design it to look more military like." (P3)

Content

Adding content was suggested as a way to improve the app, such as adding more veterans' stories to the *People* section as it was something that the participants found useful. Several of the participants recognised that the app may get to a point of saturation where they have used everything they could within the app, and it would need to be updated to keep them engaged:

"I think once you've completed a lot of the tools, they can become a bit repetitive. I also find that it's really good, but you get the benefits early on. So for example the exercise about do I feel better about this that was useful initially but if I did that say every week or every month there wouldn't be much change to see. So yes, it is useful, but it probably needs to evolve over time to keep someone like me engaged I dare say." (P12)

There was also a suggestion by a couple of participants for adding a way to connect with other veterans, such as through meetups and connecting with others who may have similar issues such as alcohol addiction:

"...so mental health and drug and alcohol addiction is a bit of a main one and I worry really for veterans so maybe having an article or a page on that where they can go onto that page and speak to like-minded people to what they do to stay sober." (P10)

For specific parts of the app, it was suggested to improve the *Dashboard* section by including

information from other areas of the app such as the *Tracking* section:

"I think the dashboard could have a bit more to it. Maybe you can amalgamate the tracking in the dashboard because then you can have your three rings as right this is where you are at. That's like your landing page, this is where you are, this is what are you doing, this is where you've been." (P11)

It was felt by several participants that the *People* section could be expanded upon by including different veterans' stories such as those from an older population and that are at different stages of their military career. The veterans' stories in the *People* section were considered by most to be accurate and to be real veterans but one person felt they were actors and suggested they wanted the app to either include a *"drawing of somebody rather than an actual person"* or to include *"real individuals telling their real stories"* (P3).

For the *Tasks* section it was felt there could be more guidance for setting tasks, such as including more example tasks or re-using previous tasks that were created. One participant had a suggestion of being able to track their progress on the tasks by adding *"a little note in there saying on this day I'm nearly there...it gives you that moral boost"* (P9).

In the *Tools* section, a small minority of participants suggested to include more information about the specific issues that the tools help with to make it easier to choose one. One participant would like to see the inclusion of military related tools to make it easier for them to understand:

"I don't know they all come off the likes of the NHS and stuff. There must be some sort of military mental health Apps... you know when they talk about mindful breathing and grounding and stuff it's hard for us to understand really." (P8)

Other identified themes

App usage – Frequency

Participants commented on how often they used the app. Seven participants mentioned using the app at least once a week, two participants used it every day and one participant used it once a month. Some participants mentioned they used the app more at the beginning when using the *People* section and completing tasks, but then used it less frequently:

"I obviously used it more when I first downloaded it and got into it reading through the stories and that, so it's probably for the first week/10 days I probably used it every day but since then a couple of times a week." (P7)

One participant mentioned their usage depended on how their day had gone and that speaking with other veterans prompted them to use it:

"I did a fundraiser for Combat Stress about three weeks ago and I got together with fellow veterans, and we did some fundraising. I found myself going back in more to the App because obviously we spoke a lot about, everyone spoke about their different experiences and things like that, and it sort of awakens your mind again and you start to think about the past again. So that brought me back into it." (P9)

App usage – Notifications

Seven participants said that they had the notifications turned off for the app and four participants had them turned on. Several people mentioned receiving too many notifications in general on their phone which made them want to turn off the notifications for MeT4VeT:

"...when you come to all the different WhatsApp groups and everything you've got, and everything is buzzing at you every 10 seconds so I've quite a lot of notifications turned off." (P8)

Several participants felt that notifications would be useful to update them for tasks to complete within the app and that once per day would be acceptable, but others felt that would be too much unless more information is added:

“Well, it probably depends on how much the App has got, how much you add to the final version. It wouldn’t be something I would need currently with the amount of information that’s on there, personally I wouldn’t need to be on it every day. So, receiving an action every day might be too much for me.” (P7)

Military – Transitioning

A number of comments were made by participants about their experiences of transitioning away from the military. Several participants mentioned a lack of support, particularly regarding mental health:

“If somebody is leaving service there is a number of interviews you get when you leave service and mental health isn’t one of them. So you’ll get maybe an interview on housing, you’ll get an interview on job search, but nobody tells you or talks about this huge change of civilian life from military life to civilian life. Nobody forearms you. I always say when I left the gates of the camp didn’t close, they slammed shut. You are totally cut off.” (P3)

“I would say today one of the biggest issues with transitioning out of the Army now is if I give you an example on my last day in the RAF it was two minutes. It was sign here, bye. That’s it.” (P9)

There was a recognition by one participant that help is available but a lack of guidance around who they should speak to for a specific issue which can lead people to not seek help:

“There is a wealth of organisations out there, there’s a wealth of places you can go. But nobody collates that stuff for you and tells you who you can go to for what reason or who might help you in this reason and I think purely because of that most people just think well I’ll just soldier on and I’ll be alright, I’ll be alright.” (P7)

One participant highlighted that how much support you receive may depend upon how or where you transition from the military:

“I think it depends on how you leave or where you leave from...when I initially left I had about eight weeks of treatment for that transition period until after I’d left. So that was useful for me, but I know there’s a lot of people out there that left and then still to this day struggle and they never got any diagnosis when they were in, so they don’t get the support or they’re battling for support, which is just proper crap.” (P11)

Chapter Five:

Discussion

The MeT4VeT app was developed to help military veterans identify mental health difficulties they may be facing after transitioning from the Armed Forces, recognise when they may need to seek help and enable them to monitor and manage their mental health. This study was designed to be a feasibility trial assessing the usability and effectiveness of the MeT4VeT app. The main aims of this study were to assess the practicality of testing the app, assess the acceptability and usability of the app, and provide feedback on the app itself. We collected app usage data to assess usability and qualitative data to gather feedback on the app and assess the acceptability and usability. We also collected quantitative data at three time-points to assess changes in wellbeing over time and compare the full-app to a control group who only received the signposting section of the app.

A secondary aim was to quantitatively explore changes in wellbeing over time for both the full-app group and the control group. However, given the small sample we did not expect the results of this to provide sufficient data to enable us to make any concrete claims about the effectiveness of the app and this is not the aim of a feasibility trial.

Practicality of testing the app

The first aim of this study was to provide information on the practical delivery of the app; identify any challenges in the processes of recruiting and retaining participants; and trial the series of outcome measures to determine the sample size for a future RCT. There were difficulties making the app available on the Apple App Store due to more stringent restrictions from Apple. In terms of recruitment, COVID-19 prevented being able to recruit through the military bases and recruitment had to be done through social media. This presented some challenges in obtaining valid responses and retaining people once they had shown interest. It is unclear why substantial

numbers of participants stopped participating as most did not respond after multiple attempts to contact them. However, problems with retention have been reported in previous research into mobile health apps, with app engagement declining over time (23). A similar study to ours that explored the feasibility and acceptability of an app for mental health monitoring in veterans had 83 participants complete baseline measures and 67 (81%) were retained at three months follow-up (24). The number retained at follow-up was slightly lower in our study (68%), which may have been due to the technical difficulties experienced in our study. In addition, our participants were recruited predominantly via social media whereas the above study recruited individuals who were already involved in the Veterans' Affairs centre and so possibly had increased opportunities to maintain contact and engage them in the study.

Acceptability and usability of the app

There was a substantial variation in app usage – some participants were highly interactive, others did not use the app very much at all, and some interacted with the app a moderate amount. This is in keeping with other smartphone app research, with a systematic review of veterans' mental health apps highlighting the considerable variability in duration of app use as a limitation of most feasibility studies (25). The questionnaires and the *People* section had the most time spent on them, which is unsurprising as they required the participant to actively engage with the app. The least time was spent on the Signposting section, which was also expected as it was not a main part of the navigation menu and had minimal interactive elements within it. It is also possible that participants did not make use of the Signposting section as they preferred to manage problems themselves which is a relatively common finding in veterans research (7).

Both the full MeT4VeT app group and the control group reported finding the app easy to use. It is worth noting that the full-app group rated their app to be more useful than the control group, which is perhaps understandable given the range of resources available on the full-app. It is also important to note that the control group rated the interface and functionality of their app more highly, indicating that changes to the way information is organised in the full-app may be beneficial. However, it may be that the higher rating was given because the control group app was uncomplicated in design with only a single page listing veteran organisations. Overall, the full-app group appeared to be satisfied with the app. Ten participants were asked if they would continue to use the app and eight indicated they would, with two participants stating they would likely continue using the app if it was updated with more content.

Ease of accessibility and ease of use were also highlighted as positive aspects of the app in the qualitative study, which is common in app research (26). It is interesting to note that usability and accessibility were viewed positively in our sample despite over a quarter of participants being over 50 years old, and the mean age being 42 years; this finding is heartening since previous research has suggested that older populations are more likely to find smartphone apps difficult to use (27).

Participants described finding the app to be a convenient way of monitoring their health and managing symptoms, which is consistent with previous research suggesting that veterans appreciate smartphone apps for being available 24/7 and the fact they can be used as and when needed, at the user's convenience (10).

Some participants noted technical difficulties as a challenge of using the app, which appears to be common in app research; whilst there is no easy fix for this, it has been suggested that app providers can share their experiences with one another and suggest best practices for dealing with situations where areas of an app might become unavailable or not work properly due to technical problems (28).

Feedback on the app

The qualitative study provided further insights into the aspects of the app that participants liked as well as those they found challenging. We received generally positive feedback about the content of the app. Participants appeared to particularly value the *People* section of the app, reporting that they liked the veterans' stories and felt able to relate to them; the value of this section is highlighted in how many times it was used (see Table 8). Participants suggested they wanted more of these, including stories illustrating different mental health issues. Reading other veterans' stories appeared to be helpful in showing veterans that they are not alone in their feelings and was reported to have helped them to identify their own thoughts, feelings, and behaviours. This highlights that the CBT techniques used within the app were well understood and appreciated by the participants. Prior research has shown that mobile apps incorporating elements of CBT can be useful for reducing symptoms of depression and anxiety (29). However, it should be noted that the intention was not to use the app as a replacement for therapy; rather it was more an educational tool for veterans to understand the symptoms they may be experiencing, implement self-help and seek professional help if they need to.

The *Tools* section was reported to be helpful, and there were some suggestions that using this section when feeling anxious helped participants to calm down and relax; previous research has also suggested that self-management tools are particularly helpful for veterans (30).

The *Tasks* section was praised by some for giving participants concrete goals to focus on. However, other participants struggled with the tasks, with one reporting they had not found the example tasks, and another suggesting the example tasks given were not relevant to them. **We therefore suggest the MeT4VeT app should be modified to a) make the example tasks easier to find and b) include more example tasks which may appeal to a wider range of veterans.**

The *Tracking* section was reported to be helpful to some, with veterans appreciating the ability to monitor their own mental health, which is consistent with previous research (24, 31, 32). However, others reported this section to be confusing, so **added clarity on how to use the Tracking section might be a useful addition**. Participants also reported that they approved of the app's general appearance and visual features, such as the logo and fonts.

Several participants mentioned issues they experienced when transitioning out of the military, such as not receiving support for their mental health. They felt as though they had not been prepared enough for the transition into civilian life and had been left to care for it themselves. This highlights a potential issue where improvements can be made, as male veterans are often reluctant to seek professional help and compared to women, often rely upon informal support from friends or family (33). The participants appreciated having the app to guide them to understand what mental difficulties they may be experiencing and the ways of seeking help.

Participants were generally positive about the use of an app for mental health support – which is somewhat unsurprising, given that they agreed to take part in the study; we can perhaps assume that veterans who are against the use of mental health apps would not have taken part. However, the participants varied in how useful they thought apps could be. Some felt apps were an extremely important aspect of care, providing them with support and guidance when they felt unable to reach out elsewhere. Others perceived limitations of an app, suggesting apps would not be able to address some of the problems they faced such as reducing social isolation or helping with a lack of purpose, although many believed an app would be a good starting point for veterans reluctant to seek help in other ways.

Participants provided suggestions on how the app could be improved, which can be used to guide further development of the app. In particular,

they appeared to want more varied content, regular updates to keep them interested, ways of connecting with other veterans, more guidance around tasks, ways of tracking progress with tasks and more military-relevant tools. App navigation and linking pages together more clearly were also suggested. There were suggestions by some participants that marketing the app with mental health as the focus may be off-putting for some veterans so consideration would need to be taken for how to advertise it, for example, focusing on military related issues such as transitioning.

It appeared from the qualitative data that participants wanted different things out of the app. Some features which were reported to be particularly helpful for some veterans were perceived as irrelevant to others, and their suggested improvements also varied a great deal. This highlights that there is no 'one-size-fits-all' approach to veteran mental health, and that interventions could benefit from focusing on individuals and targeting individual needs. For example, one participant suggested that the app should have different features depending on whether the user was a veteran of the Royal Navy, Army, or Royal Air Force. Similarly, participants in another study suggested that they would want an app to accommodate the personal needs of each veteran (34). **Therefore, it may be useful to develop more content for the app whilst allowing users to choose options which best fit their situation, and essentially allows them to tailor the app to their own needs.**

Overall, the findings suggest that MeT4VeT may be a promising avenue for supporting mental health needs, although we acknowledge that this study had a small sample size and that further research is needed. The findings of the qualitative component of the study are broadly consistent with existing research which suggests smartphone apps can be helpful for veterans who are willing to use them (10). The barriers our participants reported, including both technical challenges and lack of

knowledge about how best to use the app and all of its features, are similar to those found in previous research on smartphone apps for veterans (28, 35, 36). Technological advances, newer generations of veterans tending to be more 'tech savvy' and the COVID-19 pandemic changing the way people interact with each other all suggest that smartphone apps are likely to be more desirable than perhaps they were in the past. Additionally, several participants reported feeling that there was no other support available for them, suggesting that the app could fill a gap in support needs.

Mental health outcomes

Whilst this study did not primarily aim to assess if the MeT4VeT app was effective in terms of improving users' mental health, we found that the full-app group showed improvements in mental health, post-traumatic stress symptoms, well-being, and quality of life at one month follow-up, and further improvements at three months follow-up. The differences were significant between the pre-intervention to post-intervention (one month) mental health and post-traumatic stress symptom scores, but were not significant for any other measures at that point or at the three-month follow up. We also found that the control group improved in terms of their mental health, post-traumatic stress symptoms and well-being, although not to the same extent as the full-app group. The difference was significant between the pre-intervention to post-intervention (one month) mental health scores but not for any other measures or at the three-month follow up. It may be that simply having 'an app' had a positive effect on the veterans and they believed they were improving their mental health by using the app (e.g. a possible placebo effect). However, the sample size was small and so the findings should be interpreted with caution. It is also notable that the full-app group continued to improve between one month and three month follow-ups, although not to a significant extent at three months. Whereas, the control group appeared

to improve between baseline and one month and then further improvements were not seen at three months. However, due to the small sample size it is difficult to draw any significant conclusions from these results, and this should be further explored in a future RCT. A much larger sample size of 560 was suggested to determine significant effects in an RCT and to account for possible low acceptance rates to the trial and drop-out rates over time.

Strengths

The main strengths of this trial lie in the rigorous randomised controlled design and the design of the MeT4VeT app itself, which had a strong conceptual framework behind the app development. The app design was informed by evidence from military mental health literature as well as discussions with stakeholders and feedback from the KCMHR Veteran Advisory board. Importantly, app development was also informed by interviews with veterans themselves, helping us to understand the issues important to veterans and what they would find helpful (and unhelpful) in a smartphone app.

Limitations

The study had a relatively small baseline sample size; this is due in part to the COVID-19 pandemic which led to discharge meetings being held remotely, making recruitment more difficult than anticipated. Additionally, a number of participants were lost to follow-up, resulting in a small final sample who completed all measures. However, the sample size was still adequate for a feasibility trial and gave us useful findings to take forward for future research.

The study population was limited to male veterans to reflect the all-male population of the Stigma and Barriers to Care study (8). This limits generalisability to the veteran population as a whole. The population was also limited to those who had left the Armed Forces within the last two years. Although it was a deliberate choice to

target those with a recent transition in order to start them on a positive mental health journey right at the beginning and potentially prevent problems later on, it is important to note that those who left service more than two years ago could also benefit from the app. For example, Combat Stress suggest it takes an average of 13 years for veterans to seek mental health support after leaving the Armed Forces (37). So whilst it is important that support (such as the MeT4VeT app) is provided soon after leaving service to prevent problems becoming severe, such an app may also be appreciated by others who left service over two years ago.

Recommendations: future development of MeT4VeT

- ♦ Additional content to expand upon the *People* section, such as more individual stories from different veteran populations and stories addressing a range of different mental health problems.
- ♦ Make the examples in the *Tasks* section easier to find and add additional tasks to the *Tasks* section, with a wider variety that might appeal to different populations of veterans.
- ♦ Re-development of the *Dashboard* and *Tracking* sections to make them clearer and easier to understand.
- ♦ Enhance navigation around the app and the linking of pages together.
- ♦ Allow more options and choices regarding which content participants can access, to allow them to tailor the app to their individual needs. For example, setting the frequency of notifications to receive them every day or every week.
- ♦ Consider improving accessibility of the app to reach others who may have different needs to those who participated in this study – e.g. accessibility options for veterans with impaired sight.

Recommendations: future research

- ♦ Identify an effective recruitment and retention process prior to further studies. For example, by working with veteran partnerships and transition teams within the Ministry of Defence. Given the difficulties we had with recruitment we consider this stage as an essential precursor to an RCT.
- ♦ Subsequent to a positive outcome of the above, conduct a RCT to identify if MeT4VeT usage leads to positive mental health outcomes. This would be undertaken with the same population profile as the current study.
- ♦ Subsequent to a positive outcome from the RCT, we would recommend future trials of an adapted version of the app for other populations such as females and veterans transitioning from different age groups; the app would likely need modifying to match the needs of these different groups.
- ♦ If the above are successful, then the app could potentially be extended to target other military areas outside of transition such as younger populations that are just starting their military career or veterans that have left the military more than two years ago.
- ♦ Previous research suggests that veterans in rural areas are more likely to oppose smartphone apps, describe smartphones as hard to navigate, and report financial limitations and connectivity issues than urban veterans (27). Therefore, future trials should collect data on the location of participants (i.e. rural, suburban, or urban) and consider rurality as a potential predictor of acceptability and usability of the app.
- ♦ More research can use longitudinal usability testing to track participants over time, such as at one, three, six and 12 months' time points and understand the long-term significance of using an app for their mental health.

Conclusion

The acceptability and usability of the MeT4VeT app were generally supported. Benefits included helping veterans to recognise their own thoughts, feelings, and behaviours; helping with the development of concrete goals; aiding in relaxation; developing the ability to self-monitor mental health; and providing a source of comfort and guidance at a time when many veterans felt they did not have other sources of mental health support. Feedback provided by participants did not indicate a need for substantial modifications but did provide some suggestions for additional content and suggested there were some areas where more

clarity around how to use the various sections of the app was needed. Additional content and clarity should be the focus of further development of the app to ensure that veterans continue to engage with it. The MeT4VeT app shows some promise as a useful, accessible way for veterans to monitor and manage their mental health. Recruitment from a wider range of sources and retention processes will need to be determined before conducting further research. Once this has been considered, a RCT can be conducted to identify the mental health outcomes of the app and subsequently, recruitment from other populations such as females and veterans of other age groups.



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Appendices

Appendix 1. Scoping review

The research team conducted a scoping review of existing toolkits; the review was split into two separate searches:

1. Toolkits that aimed to help with mental health difficulties designed specifically for ex-service personnel from the Five Eyes countries: Australia, United Kingdom, United States, Canada, and New Zealand.
2. Toolkits that aimed to help with mental health difficulties for the general adult population in the United Kingdom.

The first review was limited to the Five Eyes countries due to similarities in military life and the services available to veterans. The second review was limited to the United Kingdom due to the vast number of toolkits available worldwide for the general adult population; time constraints meant it was not feasible to extend this search internationally and additionally each country's approach to accessing professional healthcare was likely to be different.

A range of databases were searched, including OVID; MedLine; PsycINFO and PubMed. The search was also extended to grey literature. In addition to this, the UK Apple and Google app stores were searched. The toolkits identified were primarily mobile phone applications (apps) which were then evaluated by the research team based on their ability to overcome the three core barriers detailed above. Using a traffic light system (red for 'does not meet the aim', amber for 'partially

meets the aim' and green for 'fully meets the aim'), toolkits were rated on the following criteria:

Definition: Support the identification of mental health problems across the spectrum of mental health, particularly PTSD and common mental health disorders such as depression and anxiety.

Recognition of Need: Aid assessment of the degree of impact of a mental health problem on an individual's life (health, relationships, occupation) and identify when support is appropriate.

Access: Present various mental health support options alongside clear eligibility criteria.

Each of the tools were also assessed in terms of the following criteria:

- Type of intervention, e.g. psycho-educational, Cognitive Behavioural Therapy.
- Delivery method, e.g. book, online, mobile app.
- Effectiveness: the extent of proven effectiveness (research evidence) supporting the use of the tool.
- Appropriateness: how appropriate the tool may be for the military veteran population.

The top-scoring toolkits were presented to stakeholders including the Ministry of Defence, NHS, Samaritans, Royal Foundation, Combat Stress, Walking With The Wounded, Contact, Help for Heroes, The Royal British Legion, SSAFA and the RAF Benevolent Fund. Stakeholders were shown a presentation outlining the relevant tools identified before discussing any additional potentially useful tools that may have been missed in the scoping review.

LIST OF TOOLS REVIEWED

11 lessons I learnt from depression

About Face

ACT Coach

AIMS

Airborne Hazards and Open Burn Pit Registry

Annie

ASK (Mental Health America of Texas)

Be Mindful

Beat Panic

Beating the blues

Big White Wall (now Togetherall)

Blue Ice

Breathe2Relax

Calm Harm

Catch it

CBT-i Coach

Chill Panda

Cove

CPT Coach

Cypher

Daily Yoga

distrACT

Ecouch Anxiety and Depression

Eventful

Every Mind Matters

Exposure Ed

Headspace

High Res

Ieso

Joining Forces

Life Armor

MeeTwo

MindDistrict

Mindfulness Coach

Mission Reconnect

Mood Coach

MoodGYM Depression

MOVE! Coach

Moving Forward

MY Compass Resilience and Wellbeing

My possible self

ON TRACK with The Right Mix.

Operation Life

OSI Connect

Parenting2Go

PE Coach

PHIT for duty

PTSD Coach

PTSD Coach Australia

PTSD Coach Canada

RADAR-CNS

REVAMP

Road to Mental Readiness (R2MR)

Sanvello

Shout

Silver Cloud

Sleepio

Sleepstation

Stay Quit Coach

T2 Mood Tracker

Tactical Breather

Thrive

Together Strong

VA Launchpad

VA Online Scheduling

VA Video Connect

Vet Change

Veteran Family Toolkit

Veterans Matter

Virtual Hope Box

WoeBot

What's up?

**Underlined tools are veteran-specific whereas the other tools are aimed at the general population.*

Appendix 2. Feasibility trial

Feasibility trials are an essential part of developing interventions and hold particular significance when those interventions are smartphone apps, the decided format for the toolkit. Feasibility trials allow for an evaluation of the interface and navigational features of an app, as well as users'

satisfaction with app use; each of these elements has been shown to play a key role in affecting users' perceptions of electronic mental health interventions quality, perceived therapeutic benefit and indeed their engagement with the intervention (11).

Appendix 3. App development: veteran interviews

Participants

Veterans were recruited from the previous Stigma and Barriers to Care Project (8). A random sample of the participants (n=30) who took part and stated that they were happy to be contacted again for future research studies were invited to participate in the interviews.

Eligibility criteria for phase one

- ♦ Served in the UK Armed Forces for at least two years.
- ♦ Had left the UK Armed Forces.
- ♦ Screened positive for a mental health problem within the earlier stigma and barriers to care study.
- ♦ Had agreed to future contact.

We aimed to invite ten veterans for the app development interviews, but only five veterans agreed to participate in the first interview and three of those in the second interview.

Procedure

Two sets of interviews were held at different stages in the app development. The first interviews were held in January 2020 in person and lasted approximately one hour. Participants were reimbursed with a £25 Amazon voucher for their time. The second set of interviews were held in July 2020 and were remotely conducted over video call due to the ongoing COVID-19 pandemic. These interviews lasted approximately an hour and veterans were also reimbursed with a £25 Amazon voucher for their time. All interviews were recorded, and key points/themes were extracted to inform the toolkit's development.

Interview schedule

The first set of interviews began with the researcher presenting an outline of the project background and aims as well as preliminary ideas for the proposed toolkit. A semi-structured interview then followed this. See Table 1 and Table 2 (Appendix 5) for the interview schedules and below for the themes identified from the interviews.

First interviews

Format of app

Veterans were asked which mode of delivery would be most usable and acceptable for them. Several suggestions were presented and discussed including but not limited to a website, a mobile phone application (app), a paper booklet and a training course summarised below:

- ♦ An app or a website was the most popular format amongst interviewees due to anonymity and access (most people now own a smartphone or have access to internet). The ability to access this resource from anywhere was also viewed as being important, for example, having it on the London underground, which can be a difficult environment for some veterans who suffer from PTSD.
- ♦ There was some concern expressed over whether the elderly population would use an app or website, but it was recognised that as this toolkit is aimed at those who have recently left service, the demographic of veterans will most likely own a smartphone or computer.
- ♦ Some veterans were cautious of data security and sharing so if the toolkit was internet-based then clear information was needed to explain why certain data was being obtained and how it would be stored.

Engagement

Veterans were asked how a toolkit can be best marketed and positioned to ensure high engagement, outside of a research setting. Several suggestions were made:

- ♦ Introducing a toolkit at the beginning of someone's military career, for example basic training, would not be effective. This population would not believe they will develop mental health difficulties so will not take any notice of a toolkit. Whereas during transition, a lot of people may already be anxious and so this would be the best time.
- ♦ Raising awareness of this toolkit through the

Career Transition Partnership (CTP) could be useful but there needs to be an alternative access point for those who do not engage in CTP.

- ♦ One way to engage users is linking the goals to discounts. For example, if the toolkit is goal-focused and one of the goals is 'go to the gym', the app could link to discounted gym memberships.
- ♦ Avoid marketing the toolkit as mental health focused, this could put people off who do not believe they have a mental health problem. Alternatively, marketing it as helping with transition and wellbeing could be more accessible.

Appendix 4. App development: stakeholder events

Various stakeholders from statutory and third sector organisations were invited to provide feedback on the scoping review in November 2019. This marked the first stakeholder event in a series which provided valuable expertise and knowledge and helped with the development of the toolkit. Three development stakeholder events were then held (November 2019, February 2020, and September 2020). A final stakeholder was held towards the end of the project in February 2022 to inform stakeholders about the results of the feasibility trial. The themes and discussions from the three development stakeholder events are presented below.

Stakeholder event one

The first stakeholder event was held very soon after the project's inception, in November 2019. The aims of the project were introduced to stakeholders, and then several existing toolkits identified in the scoping review were presented. Stakeholders were asked to reflect on the existing toolkits and were invited to discuss what they felt a future toolkit should incorporate.

Themes from ideal toolkit discussion

The themes from the stakeholder discussion on the 'ideal toolkit' are detailed below.



Military specific: Stakeholders discussed whether the toolkit's target audience (military veterans) would need to be reflected in the style, language, and appearance of the toolkit. An understanding of some veterans' reluctance to go to civilian organisations due to the belief that they will not be understood informed stakeholders' proposal that the toolkit reflect military culture. One suggestion on how to do this was to incorporate military jargon into the content so the language of the toolkit was familiar. However, stakeholders noted the difficulty in doing this when the jargon varied across the three services. Therefore, an alternative was to incorporate military values which resonated with all three services, for example, working towards a goal.

In addition to the language, it was suggested that the toolkit signpost to veteran-specific organisations such as NHS Op Courage and third sector organisations as it was felt veterans often prefer these services to ones open to the general population. This was viewed as particularly important for those who had just transitioned out.

Accessibility: Depending on the format of the toolkit, stakeholders believed it was important to present information in various ways (audio, visual and written word). They also identified needs that would need to be considered, including colour blindness and the size of the font. If it were a digital resource like an app or website, stakeholders emphasised the need for it to be simple and easy to use for those not technology-minded.

Engagement: To increase engagement in the toolkit, it was suggested that the toolkit could link to resources beyond mental health support, such as housing and financial assistance. In doing so, the toolkit may attract individuals who do not recognise they have a mental health problem but are seeking support in other areas, and by using the toolkit, they start to understand more about their mental health and wellbeing.

Stigma: Many stakeholders felt that including diagnostic tools such as self-report measures would not add any value. Firstly, it would not be anything novel as many such tools can be found online, including a list of symptoms on the NHS website. Secondly, it would have the potential to isolate those individuals who do not meet the 'cut-off' and may put them off working on their mental health even though they are still struggling.

Stakeholders agreed that the toolkit must ensure it avoids stigmatising language such as strength. They also suggested that showing a range of mental health problems with varying impacts would help overcome the stigma that people with mental health problems are always severely unwell and hospitalised.

Stakeholder events two and three

The second and third stakeholder events were held in February 2020 and September 2020 respectively. Draft versions of the app were presented to stakeholders and their feedback helped refine and improve the app further. Final amendments were made following the third stakeholder event before releasing a beta version of the app on the Google and Apple app stores to be tested in the feasibility trial.

Appendix 5. Tables

Table 1. Interview schedule for first set of veteran interviews.

Category	Question(s)
Aims	Will this toolkit address the three key aims of the project (definition; recognition of need; access)?
Utility	Do you think the toolkit will be useful? a. What will be most useful? b. What will be least useful?
Improvements	Would you make any additions/changes?
Military relevance	To what extent do you think the toolkit should be targeted to the military in terms of content and language?
Engagement	If you had just left service and came across this toolkit, would you use it? What would encourage you to use the toolkit?
Toolkit Format	What would be the most appropriate medium (e.g. app, website, hard-copy resource)?

Table 2. Interview schedule for second set of veteran interviews.

Category	Question(s)
People	<ol style="list-style-type: none"> 1. Do you think reflecting on someone else’s experience would help? 2. Do the veteran stories sound believable/relatable? 3. Are there any key symptoms you feel we’ve missed?
Tasks	<ol style="list-style-type: none"> 1. Do you think veterans would engage in goal setting?
Tools	<ol style="list-style-type: none"> 1. Do you think veterans would engage? 2. What do you think of tools? 3. Are there any tools you would add or remove?
Tracking	<ol style="list-style-type: none"> 1. Is it easy to understand the purpose and aim? 2. Do you think veterans would review their progress reports? 3. Do you think it would aid veterans in recognising a need for help if tracking demonstrated things weren’t progressing?
Engagement	<ol style="list-style-type: none"> 1. Do you think veterans would try an app? 2. Would veterans be more or less likely to try self-help tools like this as opposed to seeking professional help? 3. Is there anything that would help veterans engage? 4. What language would market it most effectively E.g. Mental Health/ Mental Fitness/Wellbeing? 5. Is there anything that would put veterans off? 6. What do you think would be the best points of access? Are there any places/organisations that you think veterans take notice of/first use when they leave?

Table 4. Mental health measures.

Measure	Number of items	Health issue	Example item
General Health Questionnaire (GHQ-12)	12	Common mental disorders (anxiety/depression)	Have you recently been feeling unhappy and depressed?
PTSD Checklist (PCL-C)	17	Post-Traumatic Stress Disorder	Repeated, disturbing memories, thoughts, or images of a stressful experience from the past?
Warwick Edinburgh Mental Well-being Scale (WEMWBS)	14	Well-being	I've been thinking clearly
World Health Organization Quality of Life Assessment (WHOQOL-BREF)	26	Quality of life	How satisfied are you with yourself?

Table 5. Interview guide for full-app participants.

Topic	Question(s)
General	Do you think the app was useful? How often did you use the app?
People section	What did you think about the people section?
Tasks section	What did you think about the tasks section?
Tools section	What did you think about the tools section?
Tracking section	What did you think about the tracking section?
Notifications	What did you think about the notifications?
Ease of use/accessibility	How easy or difficult did you find the app to use? What did you think about the way the app looked?
Veteran specific	Do you think the app is relevant to military veterans?
Other	Do you think that an app is the best format for a mental health toolkit? Is there anything missing from the app that you would have liked to see? Do you think that you would carry on using the app? Would you recommend the app to a friend?

Table 10. Themes relating to positive feedback for MeT4VeT.

Theme	Sub theme (Participants, N)	Example quotes
Content	People (8)	...it's mainly the people one for me seeing what people's days are and stuff like that and where they are at and stuff because where I come from or what I'm doing today is obviously connection is a big one for me because I'm obviously in recovery. So yes connections, connection is the best one for me.
	Tasks (5)	...some people might just say well it's not for me or wasn't for me but for myself personally it's good just giving the feedback because it's like giving yourself a pat on the back and you know you are helping yourself and you are staying focused as well which is good.
	Tools (8)	...so I'd done progressive muscle relaxation, I'd done that previously. So again using the App that reminded me that is quite a useful one for me. I did revert back to the App to do the breathing exercises and that sort of stuff from time to time. So yes, those sort of tools.
	Tracking (5)	...that was one of the elements that made it quite intuitive, quite easy to understand. I could see how I was changing each week, well how I was doing it, how I was progressing.
	Tutorials (4)	Obviously when you go into the task it offers you a couple of options but the videos of how to deal with a task which was good.
	Identifying thoughts, feelings & behaviours (10)	I think gives you a handrail in which to sit back and do your own reflection to try and understand what it is you are feeling, experiencing and so forth.
	Military relevance (9)	I think more military people might use it because it's geared up to me, it's geared up to military and a lot of the guys who are talking it's military jargon.
Information & Appearance	Logo & font (11)	I like it to be honest. I like the colours, they're very neutral, warming and you've got the red handle across which really stands out a bit more.
	Tone & language (8)	I mean it's certainly same language and tone I've seen everywhere else, so I think that's fine.
Usability	App format (9)	I think it's good because you don't always want to go and speak to someone and go and ask for help but on that App you can without having to see someone face to face which helps.
	Ease of use (7)	It's pretty I'd say simple, it's not overly complicated, it speaks for itself really.
	Continue to use the app (10)	Certainly for the short term and I'd be interested if it's expanded.

Table 11. Themes relating to challenges faced using MeT4VeT.

Theme	Sub theme (Participants, N)	Example quotes
Content	Tasks (3)	I didn't really get on with the tasks setting section because it wants you to set your own tasks and I didn't really think, I don't know what tasks to set myself.
	Tools (2)	I think I didn't see the relevance of it, but I can see how it could be important to other people.
	Tracking (8)	...so I couldn't really tell what it was trying to achieve so because of that...I didn't understand it, I then didn't really follow it through I suppose.
Usability	App format (4)	I think the main issues that my general and personal impression that veterans face is, it's limited as to what an App can do.
	Technical difficulties (5)	I had trouble getting videos to work for me. So even on the <i>people</i> section I generally ended up just reading it because I couldn't get the videos to work.

Table 12. Suggestions for improving MeT4VeT.

Theme	Sub theme (Participants, N)	Example quotes
Content	Add content (6)	I think the only other thing would be to have maybe the content updated or slightly rejigged or possibly different people added in. I think the only thing would be that I get to a point that I've saturated everything that's in the App currently.
	Dashboard (3)	Perhaps your <i>dashboard</i> could include elements of your tracking and then where you've got your personal, where you've got your additional sources of information could then become one of your bottom menu.
	People (4)	I mean the people's stories are well thought out, as I say I enjoyed the ones that there are, but I'd try and get some more.
	Signposting (2)	...all the organisations that are on there are good organisations and there's probably another 10 you could easily add to that list.
	Tasks (5)	You know if I've given myself a task for a month that I can go in and say, put a little note in there saying on this day I'm nearly there to give me a bit of a boost, to say when I go back to the task a week before you've actually achieved this, and it gives you that moral boost.
	Tools (3)	There didn't seem to be anything, I know they took NHS or mindful breathing stuff but there didn't seem to be any military based Apps or anything in it.
	Tracking (2)	...maybe if you were to click on it tell you how to improve on that, sort of tell you what it is you need to do whether it is that you haven't done enough of the videos, or you haven't done enough of your own tasks, just something to say.
Usability	Navigation (5)	I think perhaps things linked together so whenever you look at your behaviours and your thoughts and your feelings in the <i>people</i> section perhaps that could link into something you could do to set as a task instead of having to go to tasks.
	Personalisation (3)	Maybe you know where you put your picture in maybe, I don't know, give you a chance to put you a bit more information about yourself.
	Recruitment (5)	It's how you get it into that market I think is the biggest. You know expanded upon an App not everybody uses Apps it's got to be fairly easy. When people are leaving is the right time to do it. If there's any way of getting it into the resettlement space, later stages of the resettlement space would be a great time to do it.

Table 13. Other identified themes.

Theme	Sub theme (Participants, N)	Example quotes
App usage	App usage frequency (10)	I use it daily just to take five minutes to myself and reorganise myself.
	Notifications (11)	I have all my notifications turned off... I just can't do it, it would just be pinging. I'm an ex-radio operator so pinging does my nut in.
Military	Transitioning (5)	If somebody is leaving service, there is a number of interviews you get when you leave service and mental health isn't one of them. So you'll get maybe an interview on housing, you'll get an interview on job search, but nobody tells you or talks about this huge change of civilian life from military life to civilian life.



Appendix 6. Figures

Figure 2. Themes from first set of veteran interviews.



Figure 3. User journey through the MeT4VeT app.

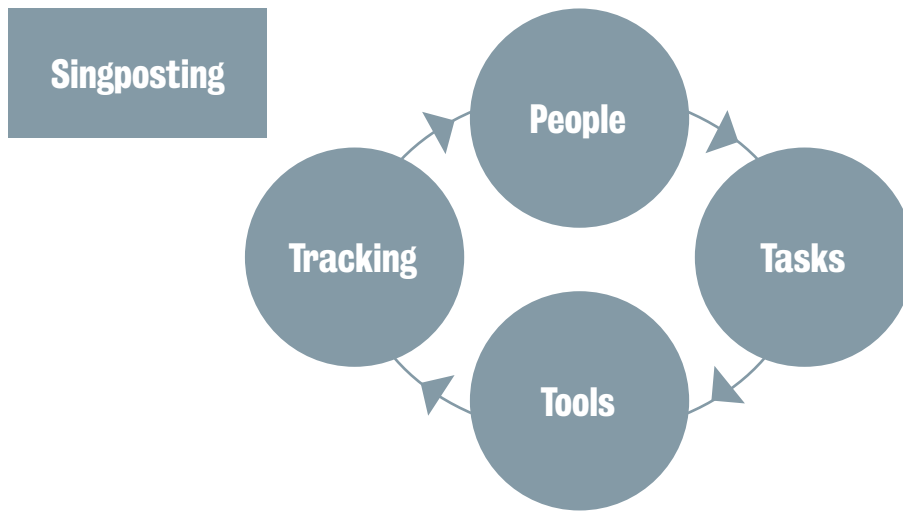


Figure 4. Example of veteran story in the people section.

Mike (Anxiety)

Mike's story will be read by a male with just an image of Mike. A text version will be available if the user prefers.

I left the Army 6 months ago. I really enjoyed my service and met friends for life, but I felt it was time to move on. Since leaving, I've become a dad for the first time! My daughter is now 4 months old.

Things have been feeling strange for a while, even before I left the Army. When my daughter was born, I was so excited and thrilled to become a dad and start this new chapter and thought things would get better, but if anything I feel they've got worse.

I lie in bed at night thinking about all the things that could go wrong, worrying if my daughter is okay. I have these overwhelming feelings that **I'm not going to be good enough** for her, I have no clue what I'm doing, and I'm not cut out to be a dad.

In the mornings, I wake up and feel **my heart pounding. Even simple things can set me off.** Like if my wife asks me to change our daughter, **I feel sweaty and hot.** I've been **finding it really hard to concentrate** on what my wife is saying recently, and I end up **snapping at her a lot of the time.**

I managed to find a job, but I feel like I've been rushed into taking a job I don't really enjoy. When I was in the army, I was part of a team, we all helped each other out but, in this job, I'm just left at my desk to get on with stuff. The thought of going to work makes me **feel sick every morning.** I'm worried that **they're going to realise I'm a fraud** and not able to do the job. When I'm at work, I find myself **just staring at the screen, I can't focus.**

I only took the job because my wife was nagging me constantly to find something. I understand why she did that because I'm meant to be taking care of my family. I'm just worried **I'm going to fail at my job and fail my family. I'm finding it hard to cope at the moment.**

Figure 5. Compensation received by both groups for completion of questionnaires.

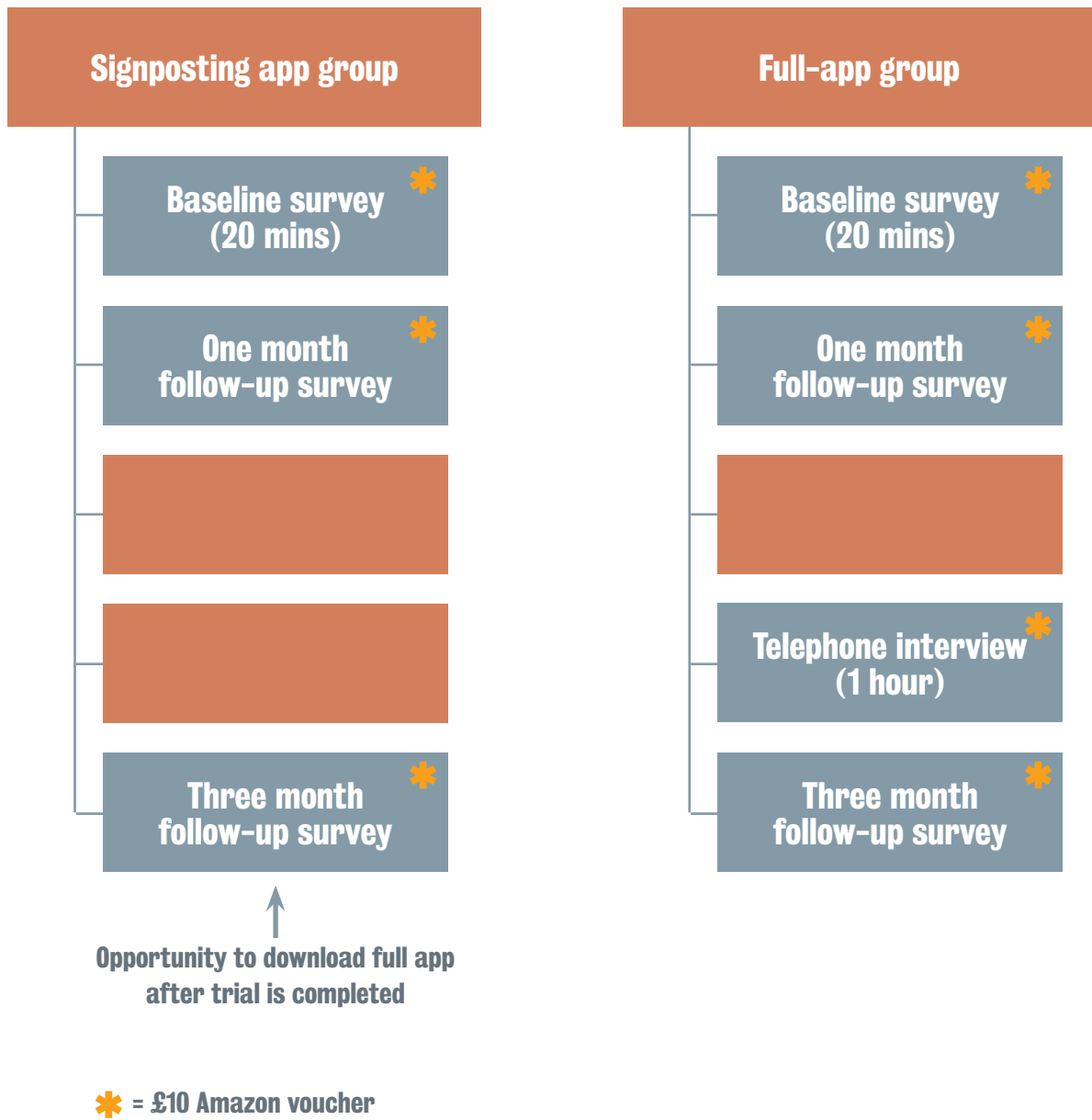


Figure 8. General Health Questionnaire (GHQ-12) scores for both groups across all timepoints.

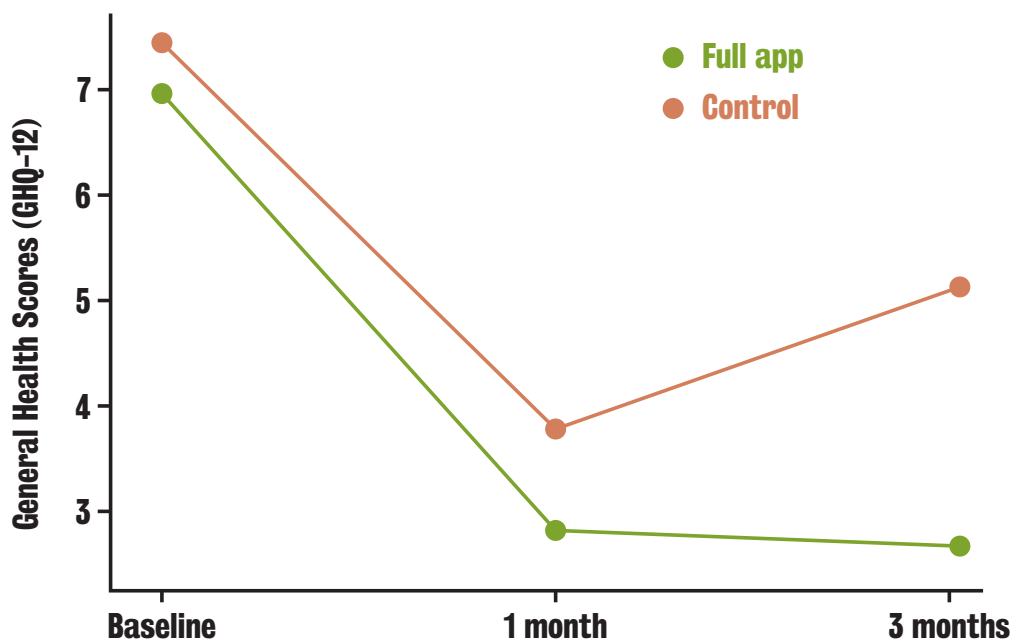


Figure 9. PTSD Checklist (PCL-C) scores for both groups across all timepoints.

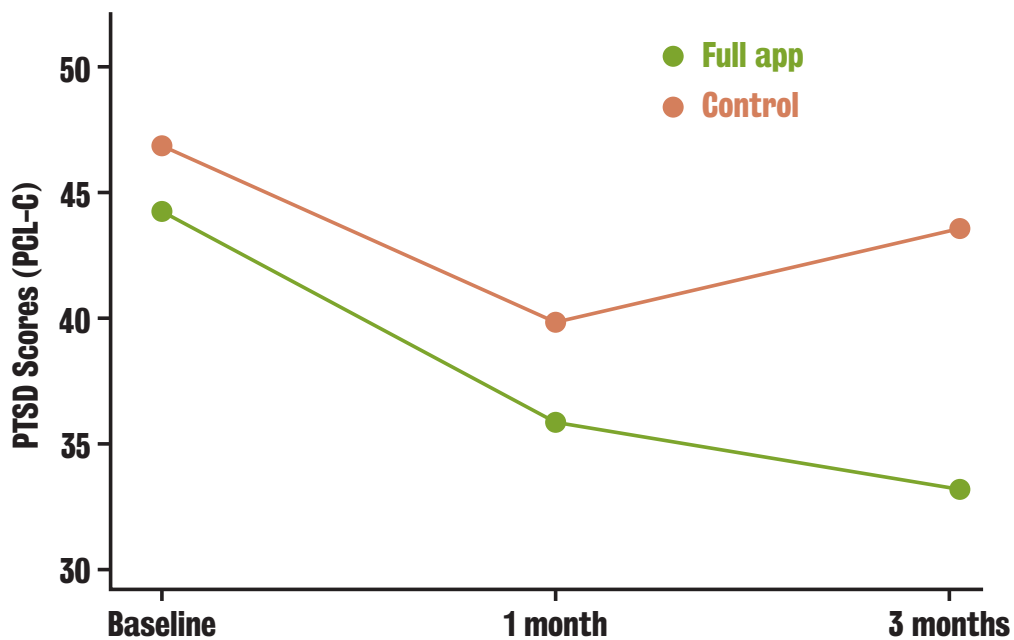


Figure 10. Warwick Edinburgh Mental Well-being Scale (WEMWBS) scores for both groups across all timepoints.

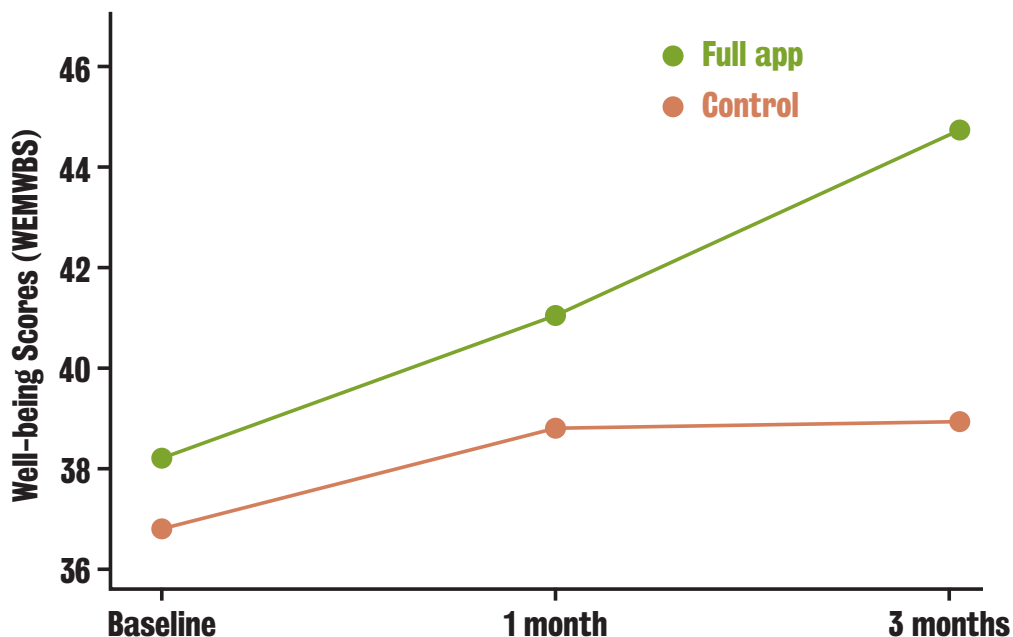
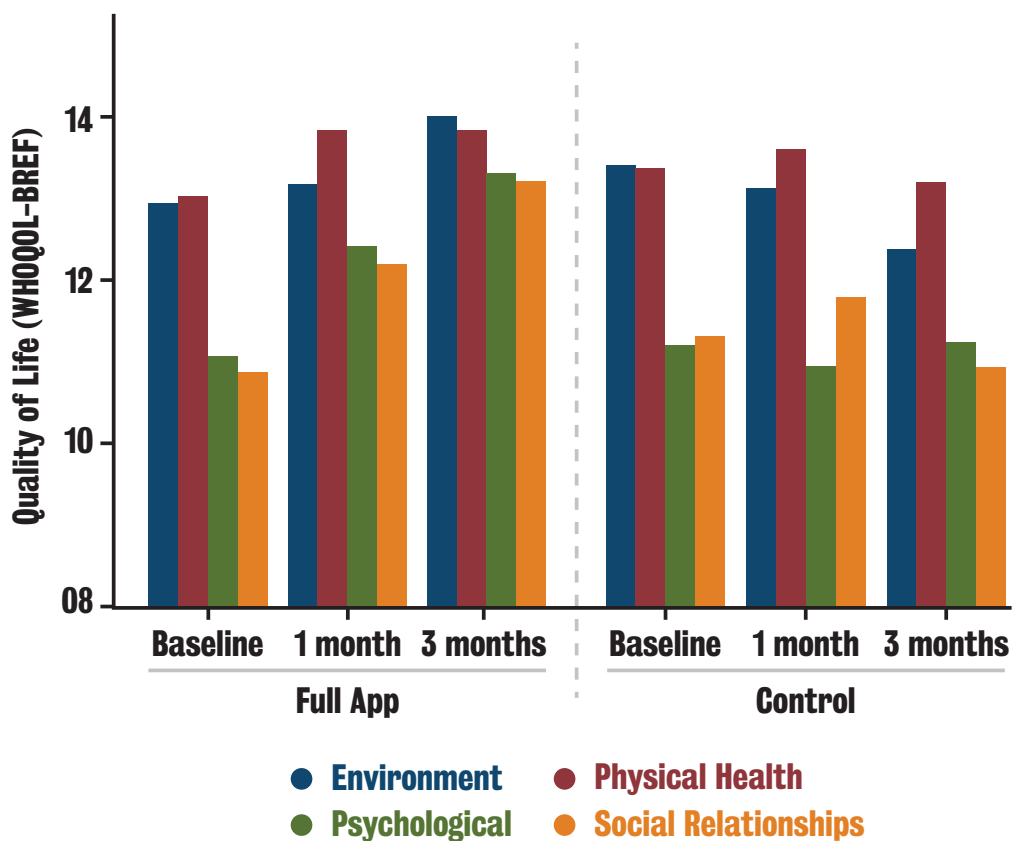


Figure 11. World Health Organization Quality of Life Assessment (WHOQOL-BREF) scores for both groups across all timepoints.



Appendix 7. App sections

People

People

Video Guide →

Search to find a person with an element you are interested in (e.g. problems sleeping in).

Search...

Steven
See your story...

Jack
Jack has found himself facing bad memories coming back.

Mike
Mike is struggling to cope with feelings of worry and has lost his self-belief.

Ollie
Ollie has recently left the Armed Forces and is finding it difficult to adjust to his new life.

Tom
Tom generally feels good but recently has been feeling frustrated.

People | Tasks | Dashboard | Tools | Tracking



DONE Jack

Introduction to Jack
Jack has found himself facing bad memories coming back.

What is Jack experiencing?

Your Behaviours

Your Thoughts

Your Feelings

People | Tasks | Dashboard | Tools | Tracking



Information **DONE**

This task will ask you to distinguish between thoughts, feelings and behaviours. To help you, here's a reminder of what thought, feelings and behaviours are

A thought is a belief one has about themselves, or thoughts of a situation.
E.g. "I am no good." Or "I am going to fail this exam."

A feeling can be either an emotion or a physical sensation.
E.g. "I feel happy" or "My heart is beating fast."

A behaviour is a reaction to these thoughts/feelings.
E.g. "I don't go out anymore." Or "I am not sleeping."



Jack's Feelings

Select the option which represent Jack's sensations, emotions/, or feelings

Is this a feeling?

I feel constantly on alert.

YES NO

Progress: 0/8

Selected Feelings.



Jack's Thoughts

Can you identify Jack's thoughts, things that are running through his head?

Is this a thought?

I can't get the images out of my head.

YES NO

Progress: 1/16

Selected Thoughts.



Jack's Behaviours

Can you identify Jack's behaviours, the actions that he takes?

Is this a behaviour?

The world is not a safe place.

YES NO

Progress: 3/27

Selected Behaviours.

People

Jack's Thoughts CLOSE

These are Jack's thoughts. Which ones do you relate to personally?

Do you relate to this thought?

The world is not a safe place.

Progress: 0/7

Selected Thoughts.

Jack's Feelings CLOSE

These are Jack's feelings. Which ones do you relate to personally?

Do you relate to this feeling?

I get overwhelming sensations sometimes like smells.

Progress: 1/9

Selected Feelings.

Jack's Behaviours CLOSE


These are Jack's behaviours. Which ones do you relate to personally?

Do you relate to this behaviour?

I lose my temper at the smallest thing.

Progress: 0/11

Selected Behaviours.



These are the thoughts, feelings and behaviours you said you related to last week.

For each, select if it is 'Gone', 'Worse', 'Improving' or 'No change' from last week. [Click here for more information.](#)

My dog keeps me company and cheers me up.

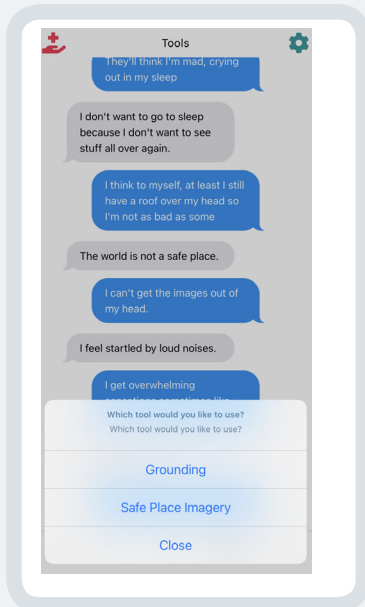
I feel lonely.

I can't trust anyone.

I walk my dog every day to cope.

I hear a sudden noise and I feel hot and sweaty.

Tools



Signposting

