Evaluation of Thrive's innovative digital 'Cultivating Wellbeing' app.

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Executive Summary

Context

Gardening is one of the most popular forms of nature-based activity and can be conducted in a variety of formats from self-directed, through to therapeutic provisions. Literature has demonstrated a range of physical and mental health benefits across gardening provisions including reductions in depression and anxiety, and improved wellbeing. However, there are numerous barriers to participation in gardening (e.g. time, space, knowledge), which may be heightened in individuals with specific health conditions or disabilities.

Cultivating Wellbeing

Cultivating Wellbeing is an innovative digital app provided by Thrive, a gardening for health charity. It is part of their nationwide gardening information and advice service, along with Get Gardening. The app enables individuals to manage/improve their own health by creating a personalised nature-based wellbeing plan connected to their own affinity for nature, available space, time and activity preferences. The University of Essex evaluated the impact of app usage on health outcomes, experiences, behaviours, and attitudes towards gardening, nature and self-care.

Methodology

The evaluation collected survey data from consenting users at baseline (T1) and an average of 12weeks later (T2). The survey captured demographic information and used eight bespoke questions to assess knowledge of how to make gardening fun and accessible (aim 1) and incorporate it into health and wellbeing (aim 2), feelings of self-confidence

(aim 3), pro-active approaches to self-care (aim 4), views about gardening and its benefits (aim 5) and time spent gardening and outdoors (aim 6). Standardised questions assessing wellbeing and connection to nature were also included (aim 3 and 6).

A sample of app users also took part in semi-structured interviews to explore use of the app and impact according to the six project aims.
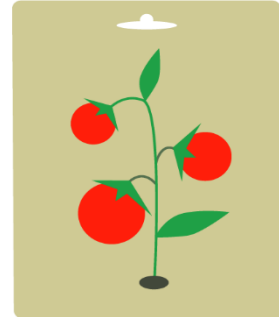
Findings

Surveys

Matched survey data at T1 and T2 was collected for 19 app users with a mean age of 57.4±11.8years, who were largely female (84.2%) and White British (73.7%).

Across bespoke questions assessing aims 1-5, there was an increase in the percentage of participants who "strongly agreed" or "agreed" that they knew how to make gardening easier, fun, and accessible (+26.3%), that they have the skills and tools to continue gardening (+5.3%), that they know how to incorporate gardening for the benefit of their wellbeing (+26.3%) and that they have the confidence and skills they need to garden (+10.6%). There were also increases in participants reporting that they know what they need to do to take care of themselves (+5.3%), and that they are passionate about gardening (+15.8%). There was no change in the percentage of participants reporting a belief that gardening benefits their physical and mental wellbeing, however, 94.7% reported that they either

"strongly agreed" or "agreed" at both timepoints.

By T2 participants also reported visiting a wider range of green and natural spaces (aim 6), with a 36.8% increase in gardening activities.

Personal wellbeing scores (aims 3) increased between T1 and T2, with life satisfaction and feelings of life being worthwhile increasing by 0.11, and 0.05, points respectively (Figure 1).
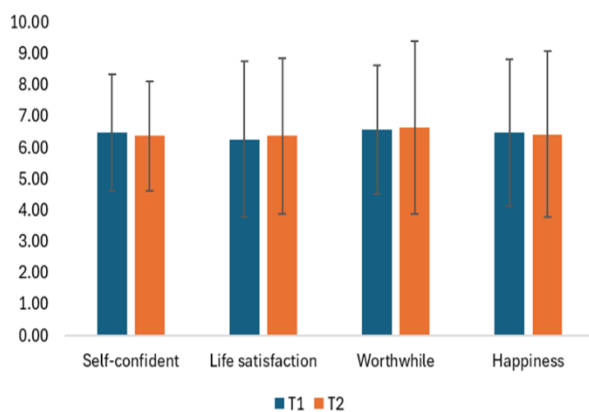

Figure 1: Mean ± standard deviation of personal wellbeing scores at timepoint one and two (following the 12-week intervention)

Nature connection scores (aim 6) also increased over time, with an increase of 3.1 points between T1 and T2 (Figure 2).
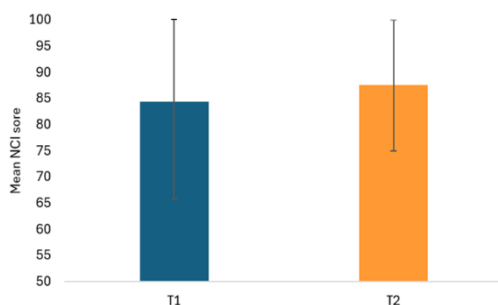

Figure 3: Mean ± standard deviation of nature connection scores at timepoint one and two (following the 12-week intervention)

Interviews

Six users of the app were interviewed. All were female, with a mean age of 56.3±6.7years. Participants reported positive experiences of the app, the range of activities available and ability to track mood over time but reported some amendments to the app interface that would enhance engagement and usability.

Participants also reported that the app increased their gardening skills and knowledge, making it more accessible and enjoyable, and increasing their confidence and understanding of the benefits it could provide for health and wellbeing (aims 1-5).

Participants also felt that the app had encouraged them to spend more time outdoors in nature and gardening (aim 6), which directly benefitted their wellbeing and improved their life satisfaction (aim 3).

Conclusion

The Cultivating Wellbeing app helped users to incorporate gardening and time in nature into their routines and enhanced their knowledge, skills, confidence, and passion for gardening. Qualitative evidence also demonstrated that it helped to make users more aware of the benefits of gardening and the impact on their health and wellbeing.

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1. Introduction

1.1. Contextual information

Gardening is one of the most popular forms of nature-based activity, with approximately 27million active gardeners in the UK [1]. Gardening can be conducted in a variety of formats, including self-directed gardening in home gardens, patios, windows or balconies, and social gardening in community or allotment spaces, through to more therapeutic provisions such as social and therapeutic horticulture (STH) for those with mild-moderate health conditions, and horticultural therapy (HT) for those with more complex health needs [2]. Literature has demonstrated a range of health benefits across gardening provisions including reductions in depression, anxiety, stress and loneliness, and improvements in quality of life, wellbeing, life satisfaction, cognition, social cohesion, and physical activity [3-12].

Despite the well-evidenced health benefits, factors such as time, space, lack of knowledge and cost have been identified as barriers to participation in self-directed gardening activities [13]. For example, one in eight households in the UK do not have access to a private or shared garden [14] and may be reliant on indoor spaces for gardening. Lack of knowledge of the type of plants to grow in different settings and climates may also prevent participation, especially if previous attempts at gardening resulted in unsuccessful outcomes. Furthermore, there may be additional barriers for those with specific conditions, disabilities or vulnerable groups (e.g. older adults) which make participation in gardening more challenging, especially without tailored support and guidance [15].

1.2. Project background and evaluation

Thrive, the UK's largest gardening for health charity, uses gardening to bring about positive changes in the lives of people living with disabilities or ill health, or who are isolated, disadvantaged, or vulnerable. They have over 45 years' experience of delivering STH, and currently deliver across three locations: Reading, Birmingham and London. They also provide gardening advice in hostels, care homes and the community, train other people to deliver STH and provide training and consultancy for those interested in using nature-based interventions for health.

Thrive also provide a free nationwide information and advice service ('Get Gardening'), that offers accessible, relevant, and impactful information for users to manage their health and wellbeing via gardening. The service was created and developed via user testing and review

and input from experts. Thrive are aiming to grow the impact of Get Gardening by reaching more beneficiaries and developing further condition specific content.

Alongside Get Gardening, Thrive identified an opportunity to support more people to use gardening for health, in particular, those who could use more motivation and support to garden, or individuals coming off STH programmes who could self-manage at home. As a result they developed an innovative digital app ("Cultivating Wellbeing") which enables individuals to manage/improve their own health by creating a personalised nature-based wellbeing plan connected to their own affinity for nature. Overall, Cultivating Wellbeing aims to:

1. Provide individuals with the tools and techniques to make gardening easier, fun, and accessible.
2. Increase individuals' knowledge of how to incorporate gardening into their own health and wellbeing.
3. Promote improvements in self-esteem and confidence.
4. Support individuals in taking a pro-active approach to self-care.
5. Support individuals in becoming passionate about gardening and the benefits to their physical and mental wellbeing.
6. Increase time spent outdoors.
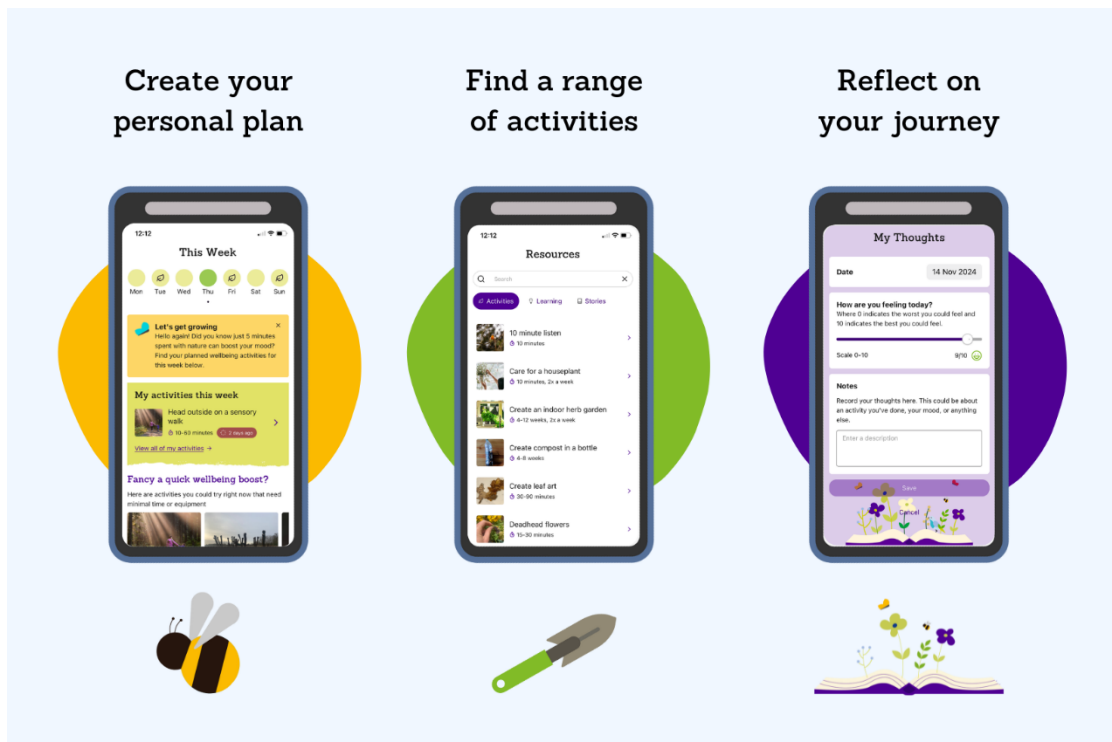
The Green Exercise Research Team at the University of Essex were commissioned by Thrive to independently evaluate the impacts of Cultivating Wellbeing against its intended aims through the collection of robust quantitative and qualitative data on the experiences and outcomes of individuals following Cultivating Wellbeing activities. An interim report was produced in January 2025, that incorporated pilot data collected between July 2024 and December 2024 [16]. This final report combines these interim findings and additional data collected up until the end of July 2025, following amendments to the app.

1.3. App updates between interim and final report

By the end of the app pilot period, 200 people had signed up to use the app. Following the interim report on the pilot data in January 2025, Thrive incorporated an annual subscription system for the app, with new subscribers paying £2.49 per year. By July 2025, data analytics on the app usage indicated that there were over 350 active subscribers (including 50 users from the pilot stage), who on average spent two minutes and 22 seconds using the app after signing in. The main features of the app that users engage with are the: 'This week' page (activities due this week), journey page (longer-term planner), activities list and learning guides within resources section, and the thoughts notes, which enables users to record their mood and journal their thoughts.

Following the app pilot, the app's running system was also upgraded and improved, increasing the speed of the app. Thrive have also added more activities, increasing the number from 32 at the end of the pilot stage to over 50 activities for users to choose from. New activities include summer harvesting, butterfly counting, and walking barefoot on the grass. The ability to hide activities that are no longer seasonally relevant has also been added, improving usability.

2. Methodology

2.1. Study Design

The evaluation adopted a mixed-methods approach to explore the impact of Cultivating Wellbeing on health outcomes, experiences, behaviours, and attitudes of participants (aims 1-6).

2.2. Informed consent

Participants who signed up to use the Cultivating Wellbeing app were asked if they would be happy to be contacted about the research study via their registered email address. Participants

who agreed were sent further information about the study and a link to an online version of the participant information sheet and consent form. Those who provided informed consent were given access to the first survey. All app users who agreed to be contacted about the research were contacted approximately 12 weeks later to ask if they would be willing to complete a follow-up survey. At this timepoint participants were asked to re-confirm their consent.

As part of the baseline survey during the pilot phase participants were asked to provide their email address if they were happy to be contacted regarding an interview on their experience of the app. Participants who agreed to take part in an interview after email contact, were sent the link to the information sheet and consent form that provided information specifically about the interview process. Participants were required to provide informed consent prior to the interview taking place.

2.3. Quantitative survey

Participants were invited to complete an online survey at the start of their Cultivating Wellbeing programme and again after approximately 12 weeks. The first survey (T1) captured demographic information and used bespoke questions to assess participants approach to self-care, their knowledge of how to make gardening fun and accessible and incorporate it into their own health and wellbeing, time spent gardening and outdoors, and feelings of self-confidence. Standardised questionnaires assessing personal wellbeing and connection to nature were also included. The second survey (T2) included questions on frequency and duration of app usage, alongside the original bespoke and standardised questions from the first survey.

2.3.1. Survey measures

2.3.1.1. Demographic characteristics

At T1, participants were asked to provide their date of birth, gender, ethnic group, and which region of the UK they lived in. Demographic characteristics were used to describe the sample and purposely select participants for interview to ensure diversity within the interview sub-sample. Date of birth was used as a unique identifier for each participant. Participants were asked how they heard about the Cultivating Wellbeing app, with seven response options provided; Thrive website, Thrive advertisement, Online advertisement, Link worker, GP or health professional, Social and therapeutic horticulture provider, Other (please specify). They were also asked whether they have any physical or mental health conditions or illnesses lasting or expected to last 12 months or more. Heart disease, type 2 diabetes, chronic pain,

mental ill-health were provided as examples of long-term health conditions. Participants responded from four response options: (1) both physical and mental health conditions, (2) a physical health condition, (3) a mental health condition, (4) no physical or mental health conditions. Following the pilot period and interim report, an additional question was added which asked participants to create a unique identifier based on the first two letters of their surname followed by the first two letters of the month they were born. This identifier aimed to enhance the ability to match participants between T1 and T2 surveys.

In the T2 survey, participants were asked to repeat their date of birth and/or unique identifier to enable matching of T1 and T2 surveys. They were also asked how often they had been using the Cultivating wellbeing app. Response options included daily, 5-6 times a week, 3-4 times a week, 1-2 times a week, less than once a week, less than fortnightly, less than monthly, other (please describe).

2.3.1.2.   Gardening, time outdoors and self-care

At both timepoints, participants were provided with eight statements about their skills, confidence, knowledge and beliefs about gardening and self-care and asked to identify whether they strongly agree, agree, neither agree nor disagree, disagree, or strongly disagree with each statement. The statements were:

1) I know how to make gardening easier, more fun, and accessible for myself (and my family) - Aim 1.
2) I have the skills and tools to enable me to continue gardening - Aim 1.
3) I know how to incorporate gardening for the benefit of my own health and wellbeing - Aim 2.
4) I have the confidence and skills I need to garden - Aim 3.
5) I know what I need to do to take care of myself - Aim 4.
6) I seek out and participate in activities that benefit my health and wellbeing - Aim 4.
7) I believe gardening benefits my physical and mental wellbeing - Aim 5.
8) I am passionate about gardening - Aim 5.

Participants responses to these statements are reported as the percentage of the sample at each timepoint that either "strongly agreed" or "agreed". In addition, the responses to each statement
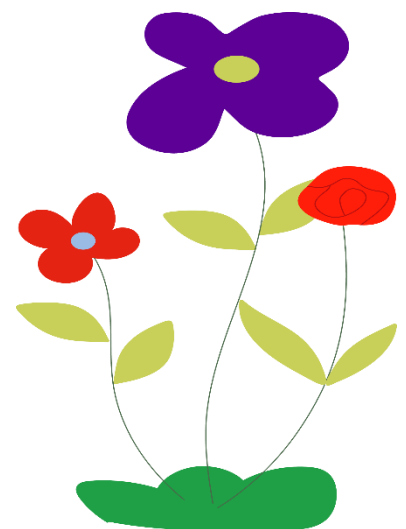
were converted into mean scores, where "strongly agree" was scored as 4, and "strongly disagree" was scored as 0. This method was employed to help demonstrate change over time, with higher scores indicating more favourable responses.

To explore how much time participants spent outdoors (aim 6), they were asked (1) which types of green and natural spaces they had visited during the last month; (2) on average how often they had spent free time in those green and natural spaces; and (3) how often they had gardened in the last month, including in their own garden or home, an allotment or community garden.

2.3.1.4 Personal Wellbeing

The ONS personal wellbeing questions [17] were used to ask participants to rate their life satisfaction, feelings of things in their life being worthwhile and happiness on a zero to ten scale, where 0 = "not at all" and 10 = "completely". Personal wellbeing data can be reported as an average score (out of 10) or categorised using the following thresholds low - 0 to 4, medium - 5 to 6, high - 7 to 8, very high - 9 to 10 [18]. In the UK adult population, the average score for life satisfaction is 7.45, feeling that things in life are worthwhile is 7.73 and happiness 7.39 [18]. An additional question asking participants "How self-confident do you feel right now?" was added to align with aim 3. The same response scale of 0-10 was used for this question.

2.3.1.5 Nature Connection Index

Nature connection (aims 3 and 6) was assessed via The Nature Connection Index (NCI) [20]; a six-item measure which represents the extent to which a person feels connected with the natural environment. Participants respond on a 7-point scale from "completely disagree" (1) to "completely agree" (7). A weighted points index is used to indicate the importance of each item, which are summed to calculate the NCI score ranging from 0-100. A higher NCI score indicates greater feelings of connection with the natural environment. The NCI has been developed and tested in the UK general population and correlates highly with other measures of nature connectedness [19]. The UK normative value for the NCI is 61.16.

2.4 Qualitative Interviews

One-to-one interviews were conducted with app users during the pilot stage following a semi-structured approach to explore use of the cultivating wellbeing app, the impact of the app on gardening and self-care, the time spent outdoors and their mental health and wellbeing (aims 1-6). Interviews were transcribed and anonymised by an independent transcription service

following completion of a confidentiality agreement. The transcriptions were checked for accuracy by a University of Essex researcher and analysed inductively using thematic analysis [20].

2.5. Secondary Data Analysis

In addition to the main survey conducted by University of Essex researchers, during July 2025 Thrive independently invited app users to participate in a separate survey focussing on their experience of the app. The survey consisted of two demographic questions which asked their age, and gender. Six further questions explored their experience of gardening and app use, including the aspects of the app that worked well, what could be improved and how they had benefitted from using the app. Participants of the survey consented for Thrive to share the anonymised data provided with University of Essex Researchers.

3. Results

3.1 Quantitative Findings

3.1.1 Participant demographics

At T1, 94 participants accessed the survey, 70 of whom (75%) submitted responses and are included in the T1 sample. All 70 participants provided their date of birth or unique ID to enable survey data submitted at T2 to be matched. Nineteen of the 70 participants (27%) subsequently provided their date of birth or unique ID at T2, resulting in 19 matched submissions. The average time between T1 and T2 responses was 12 weeks, ranging from 9 weeks to 14 weeks (Figure 1).

Participants were predominantly female (T1=94.3%, Matched=84.2%) and reported their ethnicity as White British (T1=82.9%, Matched=73.7%). Half of the participants at T1 reported having no physical or mental health conditions (50.0%), however, in the matched sample less than one quarter reported having both a physical and mental health condition (21.1%). Most regions of the UK were represented by the full T1 sample. However, a larger percentage of participants lived in Greater London (n=12, 17.1%), the Northwest (n=9, 12.9%) and the Southeast (n=8, 11.4%). Participant demographics from all participants who completed the survey at T1 and the participants who completed the survey at both T1 and T2 (matched) are shown in Table 1 to provide an overview of the sample. Data presented in all subsequent tables will focus on the sample of participants with matched data at both time points. At T2, 19 participants reported on the frequency of app use: 3-4 times a week (n=2, 10.5%), 1-2 times a

week (n=3, 15.8%), less than once a week (n=9, 47.4%), less than monthly (n=4, 21.1%), and other frequency (n=1, 5.3%)
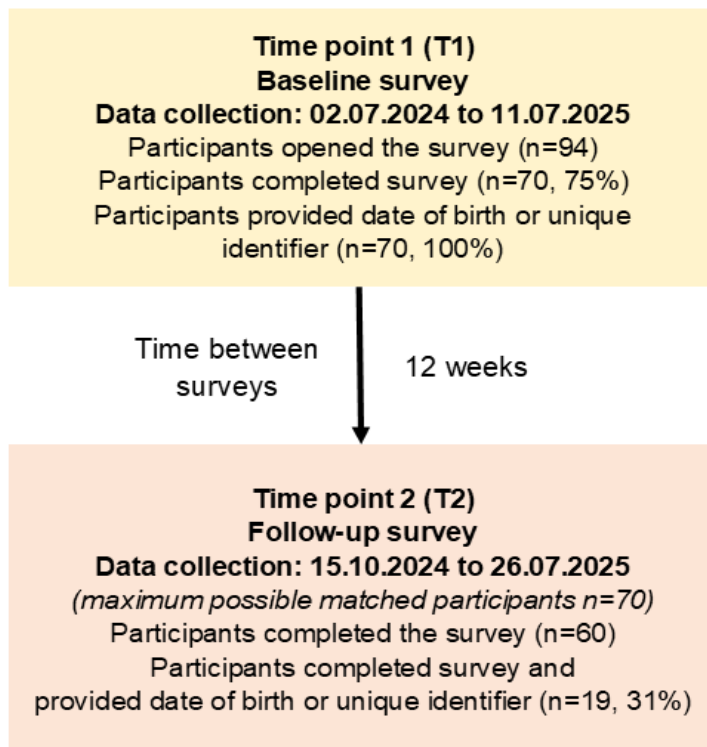

Figure 1: Survey time points and response rates.

3.1.2 Accessing and incorporating gardening and self-care (aims 1-5)

The overall percentage of participants who reported that they "strongly agreed" or "agreed" that they knew how to make gardening easier, more fun, and accessible (Q1, aim 1) and that they have the skills and tools to continue gardening (Q2, aim 1) increased by 26.3% and 5.3% between T1 and T2 respectively. There was also an increase in the percentage of participants who "strongly agreed" or "agreed" that they know how to incorporate gardening for the benefit of their own health and wellbeing (Q3, aim 2) and that they have the confidence and skills they need to garden (Q4, aim 3), with increases of 26.3% and 10.6% respectively. A greater percentage of participants also "strongly agreed" or "agreed" that they know what they need to do to take care of themselves (5.3% increase, Q5, aim 4), however there was a slight reduction (by 10.6%) in the percentage of participants reporting that they seek out and participate in activities that benefit their health and wellbeing from 89.5% to 78.9% (Q6, aim 4). There was no change in the percentage of participants that "strongly agreed" or "agreed" that gardening benefits their physical and mental wellbeing (Q7, aim 5), with 94.7% doing so at each timepoint.

There was a 15.8% increase in the percentage of participants who "strongly agreed" or "agreed" that they are passionate about gardening, with 100% of participants doing so at T2 (Q8, aim 5). The mean scores for each of the eight questions are presented in Figure 2. Across all questions mean scores increased, except for question seven (aim 5), which remained stable.

Table 1: Participant demographic information

	T1 all (n=70)	Matched final (n=19)
Age in years: range	28 to 83*	35 to 83**
Mean and standard deviation	54.2 (10.1)	57.4 (11.8)
Gender (female)	66 (94.3%)	16 (84.2%)
Ethnicity		
White-English/Welsh/Scottish/Northern Irish/British	58 (82.9%)	14 (73.7%)
Other ethnicity	12 (13.9%)	5 (26.3%)
Prefer not to say	2 (2.9%)	0 (0.0%)
Health conditions		
Physical and mental health condition	12 (17.1%)	4 (21.1%)
Physical health condition	12 (17.1%)	5 (26.3%)
Mental health condition	10 (14.3%)	2 (10.5%)
No health conditions	35 (50.0%)	8 (42.1%)
How participants found out about the app		
Thrive website	32 (45.7%)	10 (52.6%)
Thrive advertisement	17 (24.3%)	5 (26.3%)
Online advertisement	3 (4.3%)	0 (0.0%)
STH provider	3 (4.3%)	1 (5.3%)
Other	15 (21.4%) †	3 (15.8%) ††

*Age reported for 66 participants ** Age reported for 18 participants. Age was excluded for three participants due to likely error in date of birth provided.*

† = Thrive email (n=7), Thrive newsletter (n=1), previous contact with Thrive (n=1), friend via WhatsApp (n=1), I can't remember (n=1), article in Gardeners' World magazine (n=1), Which? Garden Magazine (n=1), Kitchen Garden Magazine (n=1), Bluesky (n=1).

†† = Thrive email (n=1), Previous contact with Thrive (n=1), I can't remember (n=1).
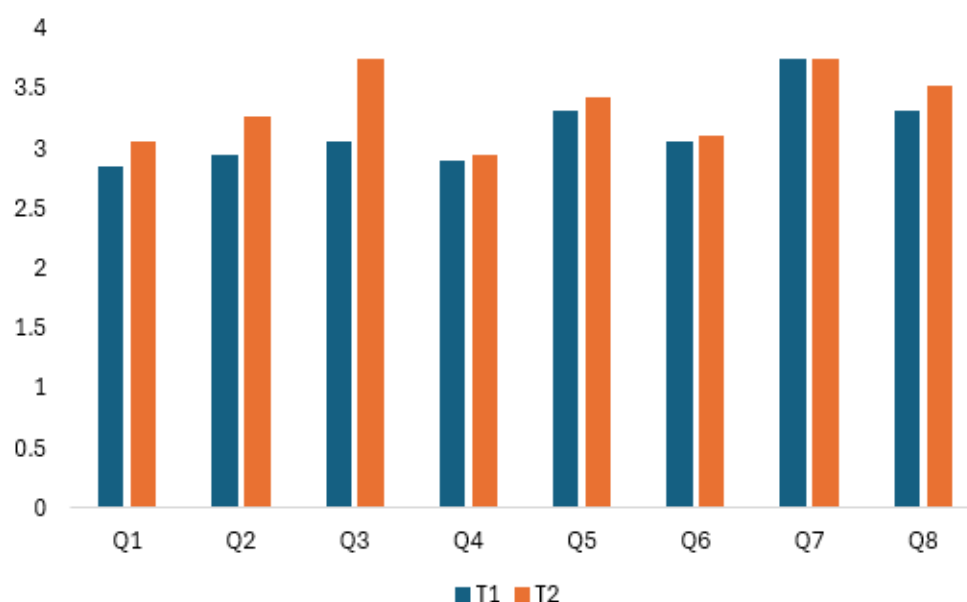
Figure 2: Mean scores for questions about gardening and time spent outdoors.

Note:

Q1. I know how to make gardening easier, more fun, and accessible for myself (and my family) - Aim 1.

Q2. I have the skills and tools to enable me to continue gardening - Aim 1.

Q3. I know how to incorporate gardening for the benefit of my own health and wellbeing - Aim 2.

Q4. I have the confidence and skills I need to garden - Aim 3.

Q5. I know what I need to do to take care of myself - Aim 4.

Q6. I seek out and participate in activities that benefit my health and wellbeing - Aim 4.

Q7. I believe gardening benefits my physical and mental wellbeing - Aim 5.

Q8. I am passionate about gardening - Aim 5.

3.1.3 Time spent outdoors (aim 6)

At T1, "Urban green space" and "allotment, community garden or own garden" were the types of green or natural space that participants were most likely to access. At T2, the participants reported visiting a wider range of green and natural spaces (as noted by the number of options selected increasing from 34 to 64). In addition, the number of people visiting an "allotment, community garden or own garden" nearly doubled (T1=8, T2=15; Table 2).

Table 2: Types of green and natural spaces visited.

Type of natural environment	T1	T2	% change
Urban green space (such as a park, field or playground)	7 (36.8%)	12 (63.2%)	26.3%
Grounds of a historic property or country park	2 (10.5%)	6 (31.6%)	21.1%
Allotment, community garden or own garden	8 (42.1.5%)	15 (78.9%)	36.8%
River, lake, or canal	2 (10.5%)	5 (26.3%)	15.8%
Hill, mountain, or moorland	3 (15.8%)	2 (10.5%)	-5.3%
Beach, other coastline, or sea	4 (21.1%)	7 (36.8%)	15.8%
Nature or wildlife reserve	1 (5.3%)	5 (26.3%)	21.1%
Fields, farmland, or countryside	5 (26.3%)	7 (30.8%)	10.5%
Another green space	2* (10.5%)	4** (36.8%)	15.8%
No visits in the last month	0 (0.0%)	0 (0.0%)	0.0%

*most of the above, I couldn't select multiple; regularly help a relative with their garden. ** Botanic garden; open greenspace with footpath,; woodland; informal woodland garden.*

In response to the question about frequency of visits to green and natural spaces, most participants responded that they visited "more than twice a week, but not every day" at both T1 and T2. The percentage of participants who reported visiting "everyday" increased from 31.6% (n=6) to 36.8% (n=7) between T1 and T2 (Table 3).

In comparison to the amount of time spent outside in green and natural spaces generally, participants most frequently reported that they were gardening "once a week" (31.6%, n=6) at T1. At T2, there was no change in the number of participants reporting gardening "everyday" or "more than twice a week" (26.3%, n=5) (Table 3).

Table 3: Frequency of visits to green and natural spaces and gardening activities.

Frequency	T1 nature visits		T2 nature visits		T1 gardening		T2 gardening	
	Freq	%	Freq	%	Freq	%	Freq	%
Everyday	6	31.6	7	36.8	3	15.8	3	15.8
More than twice a week, but not every day	9	47.4	9	47.4	5	26.3	5	26.3
Twice a week	0	0.0	1	5.3	1	5.3	0	0/.0
Once a week	2	10.5	1	5.3	6	31.6	5	26.3
Once or twice a month	2	10.5	1	5.3	3	15.8	5	26.3
Never	0	0.0	0	0.0	1	5.3	1	5.3

3.1.5 Personal wellbeing (aim 3)

The average self-confidence score for participants decreased by 0.11 points between T1 and T2. Life satisfaction and feelings of life being worthwhile increased by 0.11 points and 0.05 points between T1 and T2 respectively, with participants having "medium" scores in life satisfaction and feelings of life being worthwhile at both time points. Participants response to how happy they felt yesterday decreased by 0.05 points between T1 and T2, with scores being classified as "medium" at both timepoints (Figure 2).
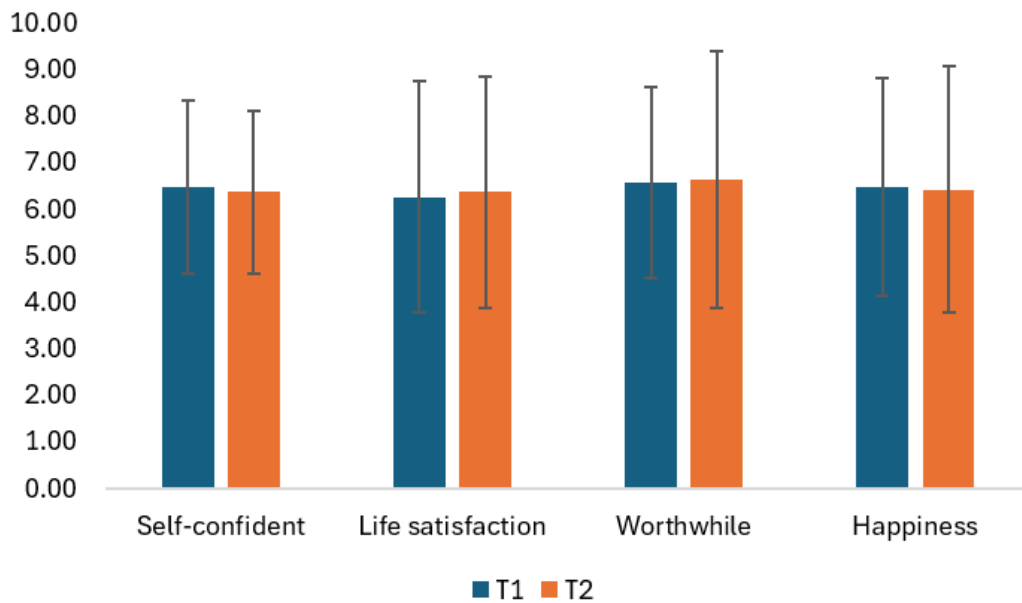

Figure 2: Mean ± standard deviation of personal wellbeing scores at timepoint one and two (following the 12-week intervention)

3.1.6 Nature Connection Index (aims 3 and 6)

The mean NCI scores at T1 and T2 were significantly higher than the UK normative NCI score of 61.16 (17). Throughout the data collection period, the average NCI score increased by 3.1 points (Figure 3).
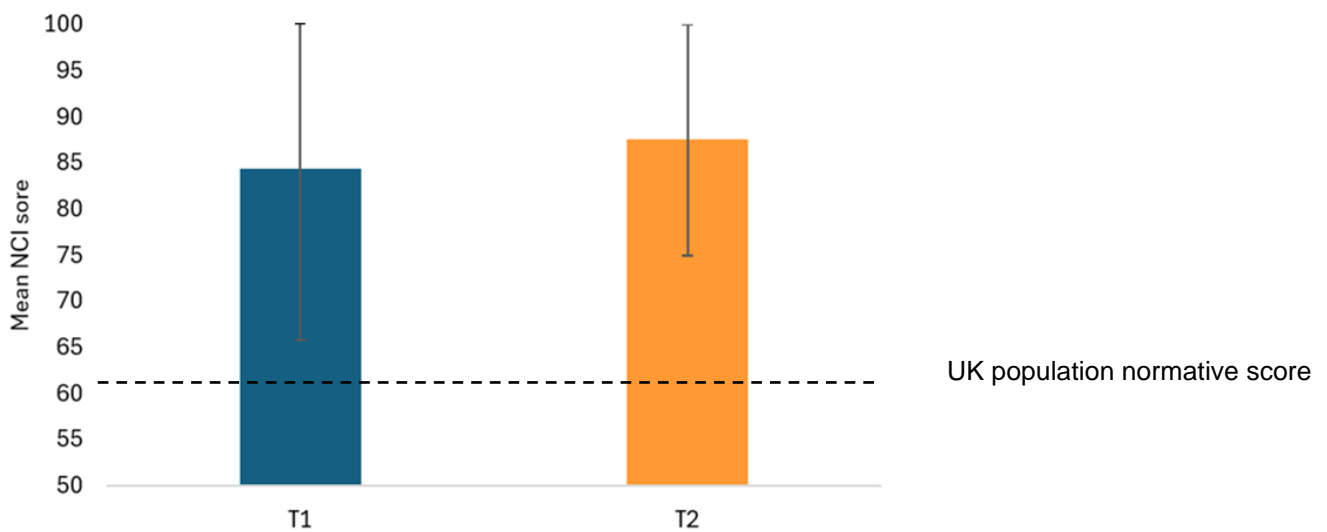
Figure 3: Mean ± standard deviation of nature connection scores at timepoint one and two (following the 12-week intervention)

3.2 Qualitative Findings

3.2.1 Participant Information

Six users of the Cultivating Wellbeing app were interviewed between 9 October 2024 and 7 November 2024. All participants were female and aged between 47 and 66 years old (mean=56.3 years, standard deviation=6.7). Participants came from Greater London (n=2), the East (n=2), the West Midlands (n=1) and Northern Ireland (n=1). Participants reported their ethnicity as White (n=3), Pakistani (n=1), Bangladeshi (n=1), and Caribbean (n=1). Participants reported having a mental health condition (n=2), physical health condition (n=1), physical and mental health condition (n=2), and no physical or mental health conditions (n=1).

All six participants reported hearing about the Cultivating Wellbeing app via the Thrive newsletter. Two participants could not recall how long they had been using the app, the remaining participants reported using the app for between 6 weeks and 6 months. All participants shared that they were already gardening prior to using the Cultivating Wellbeing App. Four participants had developed an interest in gardening later in life. One participant shared they had been undertaking citizen science activities prior to gardening, whilst another did not consider themselves a gardener but just liked being outdoors. Two participants described a long-standing interest in gardening and had achieved related educational qualifications and incorporated gardening or nature-based activities into their employment.

Participants had used both the structured programmes (n=3) and individual activities (n=4). In one case the participant shared that they had found managing the structured programme difficult due to the number of activities and had instead started using the individual activities instead, thus reporting use of both components of the app.

3.2.2   Use and Experience of the Cultivating Wellbeing App

3.2.2.1   Cultivating Wellbeing Interface

Four participants shared positive experiences of the apps interface. It was described as "user friendly", easy to navigate and that they could find the various sections of interest to them. Five participants reported that the resources available on the app were useful and were described as "gentle" by one participant. Participants shared that they had accessed the stories, information, and advice sections. The stories enabled participants to learn about the different groups of people who could benefit from gardening. One participant mentioned a personal connection with one of the stories.

Half of the participants felt that receiving reminders/notifications from the app would be helpful to keep them engaged. These comments suggest that not all participants are aware of how to set up notifications and possibly other functions that are available within the app to enhance and personalise use. In addition to issues with activating the notifications, some participants highlighted that greater control over the management of notifications would be beneficial. For example, repetitive reminders for reoccurring activities were not always received positively and led to one participant feeling as though they were being *"told off"* while another participant found the number of reminders being received was *"overwhelming".* It was suggested that once an activity had been missed that there should be no further reminders for that specific task. Where participants felt that they had a lack of understanding of how to set the app up in a way that worked for them, the participants reported negative experiences around notifications and functionality.

"It bothered me, yes. It was like I was being told off for not doing it on Monday."
(Participant one)

The ability to add photographs to the app was mentioned by two participants. It was felt that uploading photographs would be helpful when the individual did not know how to put something into words and to track progress, e.g. photos of plants as they are growing.

Two participants also shared that they would also appreciate opportunities to interact with other users of the app for example through a forum. Interaction with other likeminded people was described as an opportunity to benefit from gardening tips, advice, and encouragement, and build a sense of community. Launching group activities such as planting a flower at the same time and sharing progress updates would enable participants to achieve something together and feel like part of something *"bigger".*

"It definitely would have a sense of belonging, wouldn't it? And not being, not feeling like you're just doing it just for yourself and being all alone. You'd be part of something a bit bigger." (Participant one)

Two participants also described other apps that they used, e.g. an app to identify bird song, and thought there were opportunities to link with other apps to enhance experience and knowledge. Being able to access the app on different devices and syncing the account between devices, e.g. using both a mobile phone and a laptop with a bigger screen, was suggested by one participant to help increase accessibility.

Two participants shared their experience of submitting feedback via the app. One described feeling as though they had been left in *"limbo"* when they did not receive a response. Another participant mentioned that they did receive a response *"after some time".* Ensuring timely responses to questions and comments will ensure users feel valued.

3.2.2.2   Cultivating Wellbeing Activities

All participants enjoyed the range of activities available on the app and appreciated that there were activities for different durations. This allowed participants to select an activity based on the time they had available. The inclusion of activities that were related to gardening but did not require the participants to go out into the garden, such as nature writing or crafting was also mentioned.

"it's setting time for yourself and a small, manageable task that you can fit in your day".
(Participant three)

For one participant, using the app to select a gardening task took off the pressure of having to decide what tasks to do in the garden.

"it took away that extra brain power of going, what should I do? What choice should I make? Just by picking an activity, it was easier than having to think myself what I wanted to do next." (Participant six)

Half of the participants shared that they would like greater flexibility to add their own activities to the programmes/calendar and amend programmes/reminders based on their own routines. Participants mentioned this in relation to gardening activities and other nature-based activities, such as walking in woodlands. Two participants also shared that including activities to reflect the culture/heritage of different users e.g. growing non-native plants, vegetables, where the UK climate allowed, would increase inclusivity. In addition, when recording activities participants wanted to ensure all details could be recorded accurately. For example, one participant recalled entering an activity a few days late and wanting to be able to amend the date to when the task was completed, whereas the app recorded the date that the activity was added.

3.2.2.3   Mood Tracker

Participants reported that the ability to record their mood was useful, both journaling thoughts and using the indicator to track mood. Three participants described how this enabled them to see the beneficial effects of gardening on their mood. One participant mentioned entering a comment about a personal issue affecting their mood and felt there was a benefit of being able to recall where you were in that moment. This motivated continued engagement with the app and gardening activities.

"…because then you can look back on it. Whereas in normal life you just do things, and you might remember them if they're significant,.. But general times, you don't really think about it. So, I think that's what's good about it and gives you the chance to reflect on what you've been doing and what the impact was."
(Participant four)

Three participants spoke about potential improvements to the recording of their mood on the app. One participant felt the range of emotions available were limited. This was mentioned specifically in relation to the "angry" face representing low mood. The participant reflected that just because they were experiencing low mood did not mean that they were angry and a wider range of emotions to choose from when recording mood would enable participants to express their individual experience. The participant also mentioned that they could not select zero on the scale, despite the instructions saying the scale ranged from 0 to 10. Another participant shared that opportunities to track mood and activities overtime through visual outputs such as

graphs would enhance their understanding of how gardening was beneficial to their mood and how their gardening skills and knowledge were developing.

"I really enjoyed that [journaling emotions], but I couldn't work out how to see how my feelings have changed over a period of time or what might have influenced [them]. I do like graphs and things like that, or visual stuff." (Participant five)

3.2.3 Gardening and time outdoors

3.2.3.1 Gardening skills, knowledge, and activities (aims 1-5)

Using the app made gardening more fun and accessible for participants, increasing the range of activities that they undertook in their gardens and building their confidence. Three participants described wanting to challenge themselves by growing different plants and having ideas about additional things that they can do in their garden or trying different activities listed in the app. Participants shared that through the app they gardened on a more frequent and regular basis and that it had become part of their routine. Two participants also described that using the app had resulted in gardening in a more structured way. This was through increased knowledge enabling them to plan for the season ahead.

"Because I always remember I always planted seeds late in the day and now I'm thinking about ordering, you know, actually having a plan to order things now in preparation for January." (Participant five)

One participant reflected that despite having a garden for many years they had never seen any changes in how it looked. They described the app as a companion that walked them through activities that they could be doing which opened up new opportunities.

3.2.3.2 Time spent outdoors (aim 6)

Having an increased awareness of the beneficial effect of gardening motivated four participants to spend more time in the natural environment beyond their gardens. This included walking, park bathing and volunteering. One participant shared how they had been using an app to identify birds from their song in their garden and were now doing this in nearby woodlands. Since using the app, the participant had also thought about identifying other species. Another participant shared that they had increased the amount of time they volunteered at a nature-based charity that supports people's mental health.

"It's just made me think more about nature and how I can think about it"
(Participant three).

Participants had greater awareness of the natural world around them and of their impact on the natural environment. For one participant, this resulted in engaging in pro-environmental behaviour such as recycling and composting. Use of the app was also linked with food consumption with two participants reporting eating what they had grown.

"It's more increasing my ability and knowledge around putting things back,
giving back, sustainability, that sort of thing". (Participant five)

"You know, I find that incredibly relaxing and rewarding as well because you've
got some sort of end product to what you're doing, haven't you?" (Participant
six)

Overall, being more aware of the nature and the different ways they could experience nature and the natural environment both in their gardens and more widely was spoken about positively by participants.

3.2.4   Personal Wellbeing

3.2.4.1   Impact on awareness of wellbeing and self-care (aims 2, 4 and 5)

Five participants mentioned that using the app ensured that they made time for gardening and for three participants, making time meant taking a break from other demands that could negatively impact their mental health, including work stresses and caring responsibilities. The gardening activities gave participants a focus and helped them to be in the moment.

"So that's where the real benefit is, just to have that completely different focus
and so, you know, use the app to boost different activities that are those things
that switch you off from work". (Participant six)

Using the Cultivating Wellbeing app also gave participants an insight into how gardening positively affected their mental wellbeing, and all participants described how they now actively used gardening to manage their mental health and wellbeing. Even the participants who had been gardening for many years shared that they had not made the connection between mental health and gardening prior to using the app.

"It's made me more able to think about that [gardening] as a way to address my low mood… it's made me make that connection more … like it's an overt connection, not just a chance connection" (Participant four)

"The garden's now my go-to for my mental wellbeing. It's an actual conscious thing as opposed to, "I'll just pot around the garden." (Participant five)

Using the app to record mood enabled participants to reflect on how beneficial gardening had been for them. Talking about their mood, one participant acknowledged that although their mood was still low, they would have felt worse if not for gardening.

"I've sort of rated it [mood] around threes, fours, somewhere like that. But if I hadn't been doing this, I'd probably been like ones, twos, even lower."
(Participant one)

3.2.4.2   Impact of gardening activities on wellbeing (aims 3 and 5)

All participants reported that they felt gardening was beneficial for their wellbeing. One participant shared that they made the time to sit in their garden every morning and look at the plants which recharged them for the day ahead.

"But just getting out, having a bit of fresh air and just looking at the green, it just, I think, recharges me a little to come back and start all over again."
(Participant one)

Three participants spoke about the beauty and diversity of nature offering new and different experiences of gardening. One participant reflected how the seasons could help provide a positive framing of the experience of poor mental health

"So I like the fact that the garden is always offering something different or new or it's variety…There's no day or no thing that's the same when I go out there".
(Participant five)

"…from a mental health point of view, that's really helpful, that kind of everything changes but everything comes back around again" (Participant six)

Tending to their gardens gave participants purpose and resulted in sense of achievement and pride. Participants appreciate the nurturing side of gardening, both through the plants they were growing and seeing how their gardens support wildlife in the area. This also helped keep participants motivated to complete gardening tasks, persisting even if the weather or other factors made it more difficult.

…so you feel you're doing your bit, no matter how small, like, your bit for the biodiversity of the area…" (Participant three)

Two participants spoke about including others in their gardening activities, which gave a sense of community and an opportunity to share their gardening knowledge. For example, sharing and growing sunflower seeds with neighbours.

One participant described how they had not been able to attend their regular counselling sessions and gardening had become a way to manage their mental health. Another shared that they had stopped taking anti-depressants since gardening and appreciated that managing their mental health through gardening gave them a sense of control

*"…but I think this has also given me like something that's under my control...
and that I can actually do to improve my mood and just improve how I feel." P4
"So I can see how my mood changes and how the garden's helped me to do that
and I'm more proactively going to the garden to deal with that as opposed to
anything else really." (Participant five)*

Observing nature helped one participant to put their own worries into perspective, talking about watching birds gather for migration they commented:

*"Well, they've got to fly thousands and thousands of miles. Now here's me worrying about
something that's comparatively minor." (Participant five)*

All participants felt that gardening programmes, such as the Cultivating Wellbeing app, should be made available to people with a range of health care and social needs. Specific groups mentioned included refugees, people living with a disability or dementia, people with a physical or mental health need both in community and inpatient settings, and vulnerable populations such as older adults and people who are lonely.

"I think it's really beneficial for, well, for people from all walks of life, to be honest,
and certainly, yeah, a lot of people that are lonely as well". (Participant one)

"…it's a fundamental requirement I think in terms of helping people get better."
(Participant five).

Participants all agreed that it would be beneficial for gardening programmes to be embedded in NHS healthcare systems, so that anyone who might benefit could access them.

3.2.4.3   Impact of gardening activities on life satisfaction (aim 3)

All participants shared that experiencing improvements in their mental health and wellbeing translated to their life more generally. One participant described they could use gardening to *"just switch off from anything that's worrying me basically."* Another participant shared that they felt happier and more confident which enabled them to go out and socialise with friends. They also no longer held the impression of themselves as a "stroppy person" since stopping taking anti-depressants.

"I feel more confident about or happier whether confidence or happy which it is,
but happier about going out, meeting up with a friend or something like that and
coming off anti-depressants, struggling with withdrawal symptoms and hated
being a "stroppy" person." (Participant four)

For one participant, gardening helped maintain their mobility and they also reflected that wanting to achieve specific tasks in their garden had taught them to ask for help. This had also challenged their existing attitudes around other people asking for help.

3.3 Secondary Data Analysis: User Experience Survey

Seventeen app users responded to the User Experience survey. All respondents were female, and most respondents reported being experienced gardeners (70.6%). Five respondents provided words to describe the Cultivating Wellbeing app. Three respondents provided positive words: helpful, calming, engaging, creative, informative, easy to use, relevant, and encouraging. One participant offered unfavourable words: vanilla, neutral, and bland, while another participant described the app as a "necessary evil".

Four respondents reported that the features of the app that worked well are the information (the advice about cultivating Sunflower seedlings was specifically mentioned), brief topics, reminders, and seasonal activities. One participant felt nothing had worked well for them.

When asked what could improve the app, two respondents offered suggestions of more monthly gardening and wellbeing tips, and more ideas around places for plants, small projects, plant combinations. Three respondents reported that there was nothing that could improve their experience of the app. Reasons given included the simplicity of the app and that it *"works brilliantly".*

Two respondents shared that using the app had benefitted their wellbeing. This was through an awareness of nature, and the app providing a reminder to take time out and facilitating learning about gardening. Three respondents indicated that they intended to explore more, that they were reminded of things previously learned when using the app, or that they felt the app had not benefitted their wellbeing.

Four respondents provided positive comments about the app. Comments included how it was helpful for people who lacked social connections and supports improving gardening ability, that it was fresh, useful and user friendly. One respondent felt the app was unimaginative.

4. Summary and Recommendations

4.1 Summary of findings

Aim 1 of the Cultivating Wellbeing project was to provide individuals with the tools and techniques to make gardening easier, fun, and accessible. The survey data demonstrated an increase in the percentage of participants who felt this was the case by T2. Interview data also revealed that participants felt able to engage in a wider range of gardening activities and plan ahead for the changing seasons. Having a list of activities to choose from also made gardening easier for those who were less experienced gardeners. The findings suggest that the Cultivating Wellbeing app may have supported individuals in overcoming some of the previously reported barriers to self-directed gardening [13].

In line with aim 2, to increase individuals' knowledge of how to incorporate gardening into their own health and wellbeing, the survey data indicated that participants engaged in gardening more frequently by T2. Coupled with improved scores for life satisfaction and feelings of life being worthwhile, this suggests participants may be using gardening to improve their health and wellbeing. Interview data revealed that the use of the app had drawn attention to the benefits of gardening and being in nature for their health and wellbeing. This awareness

allowed participants to use gardening as a tool to help manage their mental health and encouraged them to incorporate gardening into daily routines. Given the well-documented health benefits of gardening and nature contact [3-12, 21-26], these potential behavioural shifts may have longer-term impacts on health and wellbeing.

The survey data revealed a slight decrease in self-confidence, which may indicate that additional strategies are needed to achieve aim 3. However, the interview participants shared that developing gardening skills and knowledge helped to build self-esteem and confidence. This was framed in different ways such as the reward from nurturing plants from seed, sharing newly gained knowledge or items grown in the garden with other people, and the desire to challenge themselves by trying new things. In contrast to activities that offer immediate rewards, gardening's delayed rewards (e.g. flowers blooming) may result in the slower development of self-confidence which is cultivated through sustained effort over time.

Aim 4 of the project was to support individuals in taking a proactive approach to self-care. At T2, the number of participants agreeing that they seek out and participate in activities that benefit their health and wellbeing increased, as did participants' belief that they knew what to do to take care of themselves. These findings indicate aim 4 was achieved. Interview participants spoke about how gardening afforded an opportunity for them to make time for themselves, away from pressures or responsibilities, and that this helped them to clear their minds, recharge, and put any problems into perspective. These findings align with literature on the wellbeing benefits of gardening and nature-based activities [3-12, 21-26].

Participants' responses to the survey indicated no change in the belief in gardening and nature being beneficial for their wellbeing, indicating that aim 5 was not fully achieved. However, 94.7% of matched participants "strongly agreed" or "agreed" with this statement at both timepoints, indicating that the app may have engaged participants who already strongly believed in the benefits of gardening. The survey findings also revealed that the app supported users in incorporating gardening into their health and wellbeing (aim 2), indicating it may be playing a key role in encouraging people to garden. In support of aim 5, participants also felt more passionate about gardening as a result of using the app. Interview participants also reported that using the app gave them an insight into how gardening positively affected their mental wellbeing, including participants who had been gardening for many years. Interviewees also believed that opportunities for gardening via healthcare systems should be made available to anyone who would benefit, both in community and inpatient settings. This suggests an awareness of the potential benefits of gardening across a range of settings and health needs, in line with established 'gardening' levels [2].

The final aim of the project was to increase time spent outdoors. At T2 participants reported visiting a wider range of green and other natural environments and an increase in the frequency of visits to natural environments and participation in gardening. All interview participants spoke about how they planned to keep gardening and increase their engagement through more regular use of the app and activities and by spending time in nature more generally. Given that increased time spent outdoors in nature is associated with a range of physical and mental health outcomes [3-12, 21-26], the impact of app use on broader time in nature may have substantial impacts on participants health and wellbeing.

4.2 Recommendations

Based on the findings from the surveys and interviews, recommendations have been developed to enhance the user experience of the app and ensure the aims of the app are achieved. These recommendations are to:

- Provide instructional information on how to set up and personalise the app to help users maximise functionality according to their preferences.
- Ensure reminders and notifications provide positive reinforcement for participants to support continued engagement.
- Incorporate opportunities for interaction between users to build sense of community and belonging, for example via a forum. This would also provide a feedback loop via users having the opportunity to ask questions within the community (and offer advice to others) and may help increase confidence.
- Enable users to add their own activities and amend programmes in line with their own routines and preferences, including uploading images. This may further support aim 1 of making gardening easier, more fun and accessible.
- Consider amending the mood tracker to include a greater range of emotions and options for visually tracking changes in mood. This may enable participants to record and recognise smaller improvements to their wellbeing supporting the achievement of aim 5.
- Consider whether the app can be linked with other nature-based apps and whether accounts could be synced across multiple devices.
- Engage and evaluate the impact of the app for individuals who do not already garden or are not already passionate about the health and wellbeing benefits of gardening to determine whether outcomes differ for this population.

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