EVALUATION OF BRAINYAPP:
USER EXPERIENCES OF A SMARTPHONE APPLICATION TO IMPROVE KNOWLEDGE AND CHANGE BEHAVIOUR RELATED TO BRAIN HEALTH AND DEMENTIA RISK REDUCTION

DR ELODIE O’CONNOR
DR MAREE FARROW
CONTENTS

Executive Summary ............................................................................................................. 4

1. Introduction ...................................................................................................................... 6

2. Method .............................................................................................................................. 6

2.1. Participants .................................................................................................................... 6

2.2. Measures ....................................................................................................................... 6

  Usability and access ........................................................................................................ 6

  User tracking ..................................................................................................................... 7

  Impressions ....................................................................................................................... 7

  Other resources ................................................................................................................ 7

2.3. Procedure ....................................................................................................................... 7

2.4. Aims of this report ......................................................................................................... 7

3. Results ............................................................................................................................... 7

3.1. Use of apps and internet ............................................................................................... 7

3.2. Usability and access – quantitative data ...................................................................... 7

  Previous use of BrainyApp, reaction to survey score and recommendation to others ......... 7

  Mode of access and intentions for future use .................................................................. 7

  Frequency and duration of use ......................................................................................... 8

  BrainyApp activities ........................................................................................................ 9

  Unable to access BrainyApp ............................................................................................ 10

3.3. Usability and access – qualitative data ....................................................................... 10

  Reasons for non-use of BrainyApp .................................................................................. 10

  Intentions to keep using BrainyApp .............................................................................. 11

  Intentions to discontinue use of BrainyApp .................................................................. 12

  Reasons participants were unable to access BrainyApp .................................................. 14

  Reasons BrainyApp was difficult to navigate ................................................................. 15

3.4. Impressions – quantitative data .................................................................................. 17

  Overall impression .......................................................................................................... 17

  How interesting participants found the eHealth tools .................................................... 17

  How easy to understand participants found the eHealth tools .................................... 17

  How easy to navigate participants found the eHealth tools ........................................ 18

  How helpful participants found the eHealth tools ......................................................... 18

  How much participants learned ....................................................................................... 19
3.5. Impressions – qualitative data .........................................................19
  Key messages of BrainyApp................................................................. 20
  Main strengths of BrainyApp.................................................................22
  Main limitations of BrainyApp...............................................................24
3.6. Other resources – quantitative data..................................................28
  Other resources. ..................................................................................28
3.7. Other resources – qualitative data......................................................29
  Your Brain Matters website..................................................................29
  Alzheimer’s Australia website.................................................................29
  Bupa website. .....................................................................................29
  Other health and lifestyle resources.........................................................31
  Other dementia risk reduction resources................................................31
4. Discussion .........................................................................................31
  4.1. Usability and access ................................................................. 31
  4.2. Impressions .................................................................................32
  4.3. Other resources .............................................................................33
  4.4. Participant characteristics............................................................33
5. Conclusions .......................................................................................34

Suggested citation:
Executive Summary

BrainyApp (BA) is an eHealth tool developed by Alzheimer’s Australia in partnership with Bupa Health Foundation to help people improve their brain health and reduce their risk of dementia. This report details findings of a research project which aimed to evaluate the effectiveness of eHealth tools in encouraging users to assess and change their behaviour relevant to dementia risk factors. Participants completed a baseline questionnaire and then used BA or an information-based website (Brain-Heart Health Program; BHHP) for a period of four weeks. Participants were then asked to complete a post-intervention questionnaire online. This report details findings for the BA participants, with some comparisons made to the BHHP group.

114 participants were randomly allocated to the BA group (average age 52 years; 68% female; 72% aged over 50 years; 52% university educated). 46 participants (40%) completed the intervention and follow-up questionnaire. On average, participants used BA a few times a week or more, for 10 minutes or less at a time. 116 participants were allocated to the BHHP group and 66 (57%) completed the intervention.

Usability and access

The majority of BA participants did not report any difficulties accessing or using the app. Problems that were reported included technical issues such as the app or word tennis game freezing, problems downloading BA, and the app not working properly. Other participants were frustrated by the lack of instructions on how to use BA and how to play the games, or difficulties understanding the scoring system and what the points mean. The findings suggest that the user experience of BA might be improved by providing additional instructions and explanations of the functions and purposes of the app, and making the scoring system easier to understand.

Around 90% of BA participants reported using the Survey, which allows users to assess their risk factors, but only 70% reported using the Top Three recommendations based on their survey responses. Around 90% reported using the Games and Brain activities sections, while around 70% reported using the Diet, Habits, Heart and Body activities sections. Three quarters used the Facts, but few shared facts or their score on Facebook. Additional brain games and opportunities to undertake mental activity may be popular enhancements to BA, but the findings also suggest a need to further encourage a holistic approach to brain health that addresses other risk factors.

67% of BA participants reported they intended to keep using the app, compared to 81% of BHHP participants who intended to continue using the website. Reported reasons for intending to continue using BA included: a good reminder to improve habits, increased awareness, a sense of achievement, and that it was fun and useful. The 33% of BA participants who intended to stop using the app gave reasons including: no time, not very interesting, not helpful, no motivation to use, and confusion due to lack of instructions. Participants’ comments indicated a lack of understanding about how to use BA and a lack of interest in what the app provided. However, while there were several comments about BA being boring, the majority of participants did find it interesting.

Impressions of BrainyApp

Participants’ impressions of BA were generally positive. The majority found it interesting, helpful, easy to understand, and easy to navigate, and felt that they learned something after their four weeks of use. However, on each of these measures the BHHP website was rated higher than BA. The findings suggest that while BA provided many positive benefits, for this cohort the more detailed information provided by the website may be more appealing and useful. Consideration might therefore be given to enhancing links within BA to this kind of information.

BA participants indicated they felt the main strengths of the app included the games, that it was informative, the brain and dementia facts, the survey, the activities, and that it acts as a reminder to keep up healthy habits. They felt the main limitations of BA included the games, scoring issues, etc.
it was boring, and provided inadequate response options for the activities. Several participants reported they found BA and its scoring system difficult to understand. Consideration may need to be given to simplifying the scoring and/or providing information about why points are allocated in certain ways and the importance of a holistic approach to brain health.

BA participants perceived the key messages of the eHealth tool to be in the areas of reducing the risk of dementia, brain health, and general health. This suggests that BA is effective in getting across the messages it was designed to promote.

Use of other resources

Very few BA participants visited the Your Brain Matters, Alzheimer’s Australia, or Bupa websites, and some reported not seeing the links to these sites. Around a quarter of BA participants accessed other health and lifestyle resources, but very few accessed other dementia risk reduction resources. Consideration could be given to enhancing links in BA to other relevant resources, to provide users with recommendations to credible information and tools to value add to BA.

There were low rates of visiting a health professional in relation to dementia risk factors; however, a few more participants reported intending to visit a health professional in the future. It is reassuring that several BA participants reported intending to visit a health professional, particularly for the heart related factors, suggesting the important messages of having health checks and the link between heart and brain health were successfully promoted by BA.

Participant characteristics

The number of BA participants who completed the intervention study (46) was relatively small. Nevertheless, the majority were positive about BA, and the feedback they provided highlights the areas in which BA might be improved. The people who volunteered to participate tended to be older, female, highly educated, born in Australia, and already pursuing a brain healthy lifestyle.

Participants also volunteered because they have an interest in brain health and dementia risk reduction, and are looking for authoritative information, strategies and resources. For some, BA did not provide what they were looking for, or they had difficulty understanding what BA could do for them. This is an important group because they are the people most likely to want to use BA and keep using it. Making BA easier to use, providing instructions on how to get the most out of the app, and providing links to more detailed information and other relevant resources could be considered for future enhancements of BA. Of course, a balance is needed that caters for people who are seeking help as well as people with little prior interest in brain health or dementia who don’t yet know they need help.

Conclusions

Overall, most participants formed a positive impression of BA, finding it interesting and helpful, feeling they learned something from it, and intending to keep using the app. However, on each of these measures, BHHP participants indicated greater satisfaction with the website. There were a number of issues reported by BA participants related to the lack of instruction, as well as not understanding the app and its scoring. The findings suggest that BA might be improved by incorporating more detailed information or links to such information, making it easier to use, and providing some instructions for use and making the most of the app.

The Games and Brain activity sections were the most popular. Providing additional games and ways to undertake and record mental activity may appeal to BA users. However, it is also important to ensure that BA encourages a holistic approach that addresses other risk factors. Encouragingly, several participants reported they intended to keep using BA because it was a useful reminder for them to adopt healthier habits every day. This is a core aim of the eHealth tools and one that BA appears to have achieved for these participants.
1. Introduction

In 2012-2013, the authors conducted a research project, the objective of which was to evaluate the effectiveness of eHealth tools in encouraging users to assess their behaviour relevant to dementia risk factors, and change their behaviour toward evidence-based dementia risk reduction strategies. One of these tools was BrainyApp (BA), a smartphone/tablet application developed by Alzheimer’s Australia in partnership with Bupa Health Foundation and launched in 2011.

BA allows users to complete a health survey and receive feedback about the areas of their health that could be improved to reduce their risk of dementia. Users can also record details of their activities in relation to mental, social and physical activity, diet, habits and health checks, within five activity areas – Brain, Body, Heart, Diet, and Habits. They can read facts about the brain and dementia and share these on Facebook. BA also includes two brain games. Using each of these components of BA attracts points toward the brain-heart health score.

This report focuses on the evaluation of participants’ use of BA during a four-week intervention and their impressions of its benefits and limitations. While BA is available for both Apple and Android devices, due to technical limitations Apple users were able to be included in this study. Some comparisons are made in this report with a control group who used an information-based website. It was hypothesised that the BA group would be more engaged and satisfied with the interactive app, than the control group with the static information only.

2. Method

2.1. Participants

Eligible participants (n=370) completed a baseline questionnaire online. Participants were then randomly allocated to use one of three eHealth tools for four weeks: BrainyApp (BA; an app available for Apple devices); the Brain-Heart Health Program (BHHP; an information-based website, and the control group for this study); and the Brain-Heart Health+ Program (BHHP+; an interactive website).

114 participants were randomly allocated into the BA group (average age 52 years; 68% female). Around three quarters (72%) were between 50 and 80 years of age. The majority (75%) were born in Australia; 72% lived with their partner and/or children; and 52% had an undergraduate or postgraduate university degree. Around one third (32%) were employed full-time, and 25% were employed part-time; 21% were health professionals.

Forty six (40%) BA participants completed the four-week intervention and follow-up questionnaire. A significant drop-out rate was expected, but it was higher for the BA group (60%) than the control group (43%).

2.2. Measures

Usability and access. In the follow-up questionnaire completed after the four-week intervention, participants were asked whether they’d heard of or used BA prior to the intervention, how they accessed the tool during the intervention, how often they used it, how long they used it for each time, which sections they used, whether they intended to keep using it, whether they’d recommended it to anyone, and whether they were surprised by their scores on the survey.
User tracking. Participants’ use of the eHealth tool was tracked throughout the four-week intervention. Data included number of days used, number of sessions, and average duration of sessions.

Impressions. Participants were asked about their overall impression of the eHealth tool, whether the information provided was interesting, easy to understand, and easy to navigate, whether they were ever unable to access the tool, how helpful they found the tool, how much they felt they learned, and the main strengths and limitations.

Other resources. Participants were asked whether they visited the Your Brain Matters website, the Alzheimer’s Australia’s website, or the Bupa website, during the intervention period. They were also asked whether they accessed any other health and lifestyle resources. Finally, participants were asked whether they had visited a health professional regarding any of the ten health behaviours addressed within the eHealth tools, or whether they planned to visit a health professional in the future.

2.3. Procedure
Participants completed a baseline questionnaire and then engaged with the app or website for a period of four weeks. During this time, participants’ use of the tool was monitored by automatic logging of the frequency and duration of their use of the app or website. At the conclusion of the four weeks, participants were asked to complete a post-intervention questionnaire online.

2.4. Aims of this report
This report details findings from the four-week follow-up questionnaire completed by BA participants, with some comparisons made to the BHHP (control) participants, focussing on the measures described above. The report aims to provide a comprehensive overview of what participants thought about BA, and to draw some conclusions from these findings that may inform future changes or enhancements to the app.

3. Results
3.1. Use of apps and internet
60% of BA participants reported downloading and using a new app on their iPhone or iPad at least monthly or weekly. However, the majority (82%) reported either never or rarely downloading and using a new health-related app. Almost all (93%) BA participants reported using the internet to search for general information weekly or daily; however, they tended to use the internet to search for health-related information less frequently (29% rarely or never; 39% monthly; 28% weekly; 4% daily).

3.2. Usability and access – quantitative data
Previous use of BrainyApp, reaction to survey score and recommendation to others. 22% of BA participants had heard of BA prior to the intervention; 18% had previously used BA. The majority of participants were not surprised by their score on the survey, and most had not recommended BA to others (see Table 1).

Mode of access and intentions for future use. 63% of BHHP participants completed the intervention using their desktop or laptop computer; for BA participants, the most common mode of access was iPhone (51%; see Figures 1 and 2). The majority of participants from both the BHHP and BA groups indicated that they intended to continue using the tool (81% and 67%, respectively; see Figure 3).
Table 1. Previous use of BrainyApp, reaction to survey score, and recommendation to others.

<table>
<thead>
<tr>
<th></th>
<th>BA n(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Previous BrainyApp</strong></td>
<td></td>
</tr>
<tr>
<td>Heard of</td>
<td>10 (22.2)</td>
</tr>
<tr>
<td>Used</td>
<td>8 (18.2)</td>
</tr>
<tr>
<td><strong>Surprised by survey score</strong></td>
<td></td>
</tr>
<tr>
<td>Yes, scored higher than expected</td>
<td>9 (20.0)</td>
</tr>
<tr>
<td>Yes, scored lower than expected</td>
<td>8 (17.8)</td>
</tr>
<tr>
<td>No</td>
<td>28 (62.2)</td>
</tr>
<tr>
<td><strong>Recommended to anyone</strong></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>15 (33.3)</td>
</tr>
<tr>
<td>No</td>
<td>30 (66.7)</td>
</tr>
</tbody>
</table>

Figure 1. Mode of access for BHHP.

Figure 2. Mode of access for BA.

Figure 3. Participants’ intentions to keep using BHHP and BA.

**Frequency and duration of use.** Table 2 details the frequency and duration of use of BHHP and BA. Participants from the BA group were more likely to report using the eHealth tool a few times a week or more, and for 10 minutes or less; while participants from the BHHP group were more likely to report using the eHealth tool weekly or less, and for 15 minutes or more. This indicates that the BA participants were more likely to use the app regularly, for shorter periods of time, as expected for an app compared to a web-based tool. User tracking data confirmed this difference, with more
regular use but shorter duration of sessions for the BA group compared to the BHHP group (see Table 2).

BA results were compared between self-reported use and direct user tracking. Results indicated that 15.9% of participants self-reported using BA less than once a week, compared to 31.8% according to user tracking. Additionally, 65.9% of participants self-reported using BA a few times a week or more, compared to 19.1% who used BA more than half the days according to user tracking. This indicates that participants over-reported their use of BA. Similar over-reporting of use was observed for the BHHP group (see Table 2). User tracking indicated that for BA use, the average number of sessions (20.5) was much higher than the average number of days used (9.6); that is, participants were quite likely to complete more than one session on any one day of use. However, this was not asked in the self-report questionnaire.

User tracking also indicated that the average session length of BA use was 5 minutes 12 seconds. However, 38.1% of sessions were less than one minute. By contrast, only 4 (9.1%) participants self-reported that the average duration of their BA use was 5 minutes or less. Again, this indicates that participants potentially over-reported their use of BA.

### Table 2. Frequency and duration of use.

<table>
<thead>
<tr>
<th></th>
<th>BHHP n(%)</th>
<th>BA n(%)</th>
<th>User tracking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency of use</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Every day</td>
<td>0 (0)</td>
<td>2 (4.5)</td>
<td>Average no. of days</td>
</tr>
<tr>
<td>Most days</td>
<td>4 (6.3)</td>
<td>12 (27.3)</td>
<td>Less than once a week</td>
</tr>
<tr>
<td>A few times a week</td>
<td>14 (22.2)</td>
<td>15 (34.1)</td>
<td>More than half the days</td>
</tr>
<tr>
<td>Weekly</td>
<td>15 (23.8)</td>
<td>8 (18.2)</td>
<td></td>
</tr>
<tr>
<td>Fortnightly</td>
<td>13 (20.6)</td>
<td>4 (9.1)</td>
<td>Average no. of sessions</td>
</tr>
<tr>
<td>Monthly</td>
<td>13 (20.6)</td>
<td>2 (4.5)</td>
<td>Less than 5 sessions</td>
</tr>
<tr>
<td>Not at all</td>
<td>4 (6.3)</td>
<td>1 (2.3)</td>
<td>More than 30 sessions</td>
</tr>
<tr>
<td><strong>Average duration</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 minutes or less</td>
<td>5 (7.9)</td>
<td>4 (9.1)</td>
<td>Average duration (mm:ss)</td>
</tr>
<tr>
<td>5 to 10 minutes</td>
<td>8 (12.7)</td>
<td>22 (50.0)</td>
<td>Less than 1 minute</td>
</tr>
<tr>
<td>15 to 20 minutes</td>
<td>21 (33.3)</td>
<td>12 (27.3)</td>
<td>More than 10 minutes</td>
</tr>
<tr>
<td>25 to 30 minutes</td>
<td>20 (31.7)</td>
<td>3 (6.8)</td>
<td></td>
</tr>
<tr>
<td>More than 30 minutes</td>
<td>9 (14.3)</td>
<td>3 (6.8)</td>
<td></td>
</tr>
</tbody>
</table>

**BrainyApp activities.** Almost all participants reported using the Survey and Games components of BA (see Table 3). More participants reported using the Brain section of the app than each of the other health behaviour activity sections; followed by Body, then Heart, with Diet and Habits having the least reported use. Around two thirds reported using the Top Three function (in feedback following completion of the survey, participants are told the top three health areas they should aim to improve, based on the areas they scored lowest on in their survey). Three quarters of participants read the Facts, but relatively few shared their score or facts on Facebook (see Table 3).
Table 3. Numbers of participants who used components of BrainyApp.

<table>
<thead>
<tr>
<th>Activities engaged in</th>
<th>BA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n(% yes)</td>
</tr>
<tr>
<td>Survey</td>
<td>40 (91.1)</td>
</tr>
<tr>
<td>Games</td>
<td>41 (91.1)</td>
</tr>
<tr>
<td>Diet</td>
<td>29 (67.4)</td>
</tr>
<tr>
<td>Brain</td>
<td>39 (88.6)</td>
</tr>
<tr>
<td>Body</td>
<td>31 (72.1)</td>
</tr>
<tr>
<td>Heart</td>
<td>29 (69.0)</td>
</tr>
<tr>
<td>Habits</td>
<td>29 (67.4)</td>
</tr>
<tr>
<td>Top Three</td>
<td>30 (69.8)</td>
</tr>
<tr>
<td>Facts</td>
<td>34 (75.6)</td>
</tr>
<tr>
<td>Sharing of score on Facebook</td>
<td>3 (7.0)</td>
</tr>
<tr>
<td>Sharing of facts on Facebook</td>
<td>5 (11.6)</td>
</tr>
</tbody>
</table>

Unable to access BrainyApp. Over 80% of both BA and BHHP participants reported they had no issues accessing the eHealth tool during the intervention period (see Table 4).

Table 4. Inability to access BrainyApp or BHHP website.

<table>
<thead>
<tr>
<th>Ever unable to access</th>
<th>BHHP n(%)</th>
<th>BA n(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>9 (14.3)</td>
<td>7 (15.6)</td>
</tr>
<tr>
<td>No</td>
<td>54 (85.7)</td>
<td>38 (84.4)</td>
</tr>
</tbody>
</table>

3.3. Usability and access – qualitative data

Five areas concerning usability and access were explored using qualitative data analysis: reasons for non-use, intentions to keep using, intentions to discontinue use, reasons unable to access, and reasons difficult to navigate. Qualitative responses were categorised according to a number of major themes that arose from examination of the data. Note: underlined sections indicate that the response has been coded under two different themes.

Reasons for non-use of BrainyApp. Participants who indicated they did not use BA were asked to indicate the reasons for their non-use; there were a range of motivational and technical issues reported for non-use. Figure 4 details the number of participants who provided comments for non-use.

![Figure 4. Numbers of participants who reported reasons for non-use of BrainyApp.](image-url)
**Motivation issues.** This theme centred on participants’ lack of motivation to continue using the app.

“Need my reading glasses keep forgetting just not interested in computer games I am the wrong generation Don’t do Facebook and don’t like compromising my privacy like that.” (59 year old female)

“I used the app before I registered because I was able to access it directly. When I downloaded it for the study my iPad would not allow me to interact with it. When I did use it I found it very boring.” (68 year old female)

“Felt that I had no time to use app or when opportunity existed I was not motivated to.” (31 year old female)

**Technical issues.** A number of participants reported that they experienced technical issues which impacted their use.

“I used lumosity everyday and found I was blocked too many time for using Brainy App it kept saying I had used my time up” (66 year old female)

“I had trouble with it not working due to my software not being upgraded and so didn’t take it with me when I went overseas for 10 days.” (52 year old female)

“At first it did not seem to be working properly but it has been OK for the past week.” (68 year old female)

**Intentions to keep using BrainyApp.** Participants were asked whether they intended to continue using BA following the intervention, and reasons for their intentions to continue use. Reasons included: brain training, the games, a good reminder to improve habits, a sense of achievement, increased awareness, and that it was fun and useful. Figure 5 details the number of participants who provided comments for intending to continue use.

**Brain training.** Some participants intended to keep using BA for the brain training aspect.

“To use the games & exercise my brain more than usual” (52 year old female)

“To remind me how bad my bad habits are to me To improve memory” (62 year old female)

“To keep my mental state active” (64 year old male)

**Games.** Participants also felt that the games were a good reason to continue using BA.

“just the games” (49 year old male)

“Games are fun and engaging, sense of achievement in ting off activities” (23 year old female)

“I like the 2 brain games. It is a good reminder tool to focus yourself towards doing, and maintaining, different activities.” (54 year old male)
**Evaluation of BrainyApp**

**Good reminder to improve habits.** This theme centred on participants’ perception that BA provided a good reminder to improve habits.

“To remind me how bad my bad habits are to me” (62 year old female)

“Seems like its a useful poke reminder toy bad habits, and I am motivated to increase my current really really bad minus score” (44 year old male)

“It’s a good reminder. I like reading the facts. I’m finding the games quite challenging which is good for me.” (56 year old female)

“It serves as a reminder to keep good habits going at all times” (68 year old female)

“It is good to have something to prompt me to keep doing the right things for my health and to remind me of where I need to make improvements.” (67 year old female)

“I like the idea of having something to use that I can check that I am actually doing the things it suggests” (77 year old female)

“I like the 2 brain games. It is a good reminder tool to focus yourself towards doing, and maintaining, different activities.” (54 year old male)

**Sense of achievement.** One participant intended to continue using BA for the sense of achievement.

“Games are fun and engaging, sense of achievement in ting off activities” (23 year old female)

**Increased awareness.** Two participants felt that BA increased their awareness and they intended to continue using the app for this reason.

“It made me aware of things I wasn’t doing” (54 year old female)

“It keeps me aware of what I should be doing a d has improved my awareness and habits.” (71 year old female)

**Fun and useful.** One participant intended to keep using BA because it was fun and useful.

“I felt it was useful and also quite fun” (58 year old male)

**Intentions to discontinue use of BrainyApp.** Participants were asked whether they intended to continue using BA following the intervention, and reasons for their intentions to discontinue use. Reasons included: time issues, that it wasn’t very interesting, that it was not helpful, that participants had no motivation for continued use, that they experienced confusion due to lack of instructions, that they forget to use it, and scoring issues. Figure 6 details the number of participants who provided comments for intending to discontinue use.
Time issues. This theme centred on time issues playing a role in intentions to discontinue use.

“Time. I work full time and have lots of other things to do” (51 year old female)

“I struggle to find time to "play" on my phone.” (61 year old female)

Not interesting. Some participants reported that BA was not interesting and thus they intended to discontinue use.

“It’s not very interesting, and from what I have learnt from my time using it is that I’m on the right track. I don’t think it is an app anyone would use long-term but is a good eye-opener and indication of health.” (19 year old female)

“It wasn’t very interesting. I didn’t feel at all engaged by it” (49 year old male)

“It doesn’t stimulate my interest as much as some of the other games I play. The games were repetitive and became boring. Labyrinth would often not work, which was frustrating.” (57 year old female)

“I found the activities boring” (50 year old female)

“As stated before” (“I used the app before I registered because I was able to access it directly. When I downloaded it for the study my iPad would not allow me to interact with it. When I did use it I found it very boring.”) (68 year old female)

Not helpful. Some participants reported that BA was not helpful and thus they intended to discontinue use.

“the points were a bit meaningless to me. I felt like I kept getting the same reminders i.e find a new hobby - this isn’t really helpful to me as I have a busy life with work and my hobbies that I already participate in. Also I got a bit bored - perhaps some recommendations with play sudoku or jump rope for 5 mins or something like that would motivate me to keep using it and would also encourage me to mix up my day” (29 year old female)

“I already knew what to do to make my health better as I think a lot of people my age who are educated enough to either be worried and or have access to iphone and ipads. I didn’t find it gave me any motivation to change or any constructive way of doing so- it seemed a bit futile to try and gain points and then it seemed that it was pretty easy to reach the maximum allowed for each activity. The brain games were quite fun but the instructions for laberynth weren’t very clear- it took my husband and my son and me a bit of time to figure out how it worked.” (52 year old female)

No motivation for continued use. This theme centred on a lack of motivation to continue using BA.
“After initial use and poking around all the categories, I found no reason or motivation to bother continuing clicking the buttons. Once you’ve been told this information, you know it and will either use it or not. There was no incentive to keep on clicking buttons to produce a score that was ultimately meaningless. The saving grace could have been the games, but they were pretty basic and not terribly challenging. It seemed (to me) to be aimed at people who were not particularly computer literate/tech savvy - would that be right?” (55 year old female)

“I’d like to keep using it, although I find it often slips off my radar. Perhaps implementing some kind of reward, or social contract (similar to Hello Sunday Morning) could motivate continued use.” (27 year old male)

**Confusion due to lack of instructions.** Some participants experienced confusion due to lack of instructions and thus intended to discontinue use.

“I do like the word activity, however the movement one was rather confusing to me. Did not appear to matter what I did.” (61 year old female)

“I already knew what to do to make my health better as I think a lot of people my age who are educated enough to either be worried or have access to iphones and ipads. I didn’t find it gave me any motivation to change or any constructive way of doing so - it seemed a bit futile to try and gain points and then it seemed that it was pretty easy to reach the maximum allowed for each activity. The brain games were quite fun but the instructions for labrynth weren’t very clear - it took my husband and my son and me a bit of time to figure out how it worked.” (52 year old female)

“It took me a while to realise I should be accessing all activities” (63 year old male)

**Forget to use.** Some participants indicated they forgot to use the app.

“I have been intending to use it but often put off doing things and the four weeks passed before I noticed. I will try to improve on this.” (54 year old male)

“I am not sure about it but I think I mostly forget using it” (27 year old female)

**Scoring issues.** Two participants indicated they experienced scoring issues which resulted in them intending to discontinue use.

“I was frustrated when I kept getting the ‘You have reached your limit for this activity this week’ - some activities were based on daily recording and others on weekly scores” (61 year old female)

“Brainy app is good at reminding me to do things and giving me suggestions. But it also makes me feel bad about myself if I haven’t done anything that day. And when my score was minus 500 I felt really bad about myself. I don’t think I’d been particularly unhealthy, just not overly proactive. Eg if I’d been at work for 10 hours I know I’ve been doing a lot of physical activity and social interaction but there is nowhere to record that. Also I was confused about where and when to record things. It would be better if it kept a more accurate record of activities done each day and give you a weekly summary, to help work out how many times a week I do things on average, because everyday is so different it’s hard to do know my average.” (24 year old female)

**Other.** There were various other reasons for intentions to discontinue use.

“I like lumosity and spend at least 1/2 hour each day on it” (66 year old female)

“I looking for professional plan to boost my lifestyle” (37 year old male)

“I would like to see more brain games” (54 year old male)

**Reasons participants were unable to access BrainyApp.** Those participants who experienced difficulties accessing BA were asked to indicate the reasons. Overall, there were issues with games, control size, and scoring, as well as a couple of more general issues. Figure 7 details the number of participants who provided comments for inability to access BA.
Issues with games. One participant experienced an issue with the games in BA.

“There was a couple of times when the word game would not work. I tried moving the letters around & they were frozen.” (52 year old female)

Issues with size. One participant experienced an issue with the size of the controls.

“found screen too small on iphone & controls too small” (53 year old male)

Scoring issues. One participant experienced an issue with the scoring in BA.

“Alot of the things you could only fill out once a week or you are over your quota and couldn’t score again” (66 year old female)

General issues. Two participants experienced general issues with BA.

“Once I finally got it successfully downloaded it didn’t actually crash but some days it was just not quite right so it was not very useful.” (68 year old female)

“As above- i had to download it twice inially and then it worked for a little while and then froze again and so it got left behind when i went away- i had intened to take it to continue to use it for your study” (52 year old female)

Reasons BrainyApp was difficult to navigate. Participants were asked to elaborate on why they thought BA was difficult to navigate. Responses indicated that reasons included: a lack of instruction, technical issues, and a lack of understanding about scoring. Figure 8 details the number of participants who provided comments for navigation difficulties.

Lack of instruction. This theme centred on a lack of instruction causing BA to be difficult to navigate.

“My first issue was that I did not know how often I should access Brainyapp (there were no instructions on how often to use Brainyapp). After I did my initial survey and checked everything out I did not check it for a week. After that first week I got a surprise when my score had almost reduced to zero! After that I checked it every day or every other day to make sure my score was being maintained.” (54 year old male)

“I think you need to provide better instructions on the use of the ipad version. I always lock my ipad screen in a horizontal position & couldn’t use the app unless the ipad was locked in the vertical position. It took me a while to work out the problem. Also having never played computer games i had trouble working out the labyrinth game.....had to get my children to show me.” (52 year old female)

“The movement activity didn’t appear to work at all for me. Maybe the instructions were a problem” (61 year old female)

“Instructions for the activities were limited and not always clear especially in the games. Not enough options in some of the sections” (77 year old female)
“I figured that having no instructions was part of the plan” (49 year old male)

“Apart from the issue with the instructions for the labyrinth game as there really weren’t any! Also my software had not been upgraded to the latest version and so I had a lot of trouble initially which I think would have meant I didn’t bother with it if I hadn’t been doing your study. It needs to state this to people downloading it.” (52 year old female)

**Technical issues.** There were also a number of technical issues impacting ease of navigation.

“I think you need to provide better instructions on the use of the iPad version. I always lock my iPad screen in a horizontal position & couldn’t use the app unless the iPad was locked in the vertical position. It took me a while to work out the problem. Also having never played computer games I had trouble working out the labyrinth game….had to get my children to show me.” (52 year old female)

“Didn’t rotate on my iPod some features wouldn’t activate” (51 year old female)

“Apart from the issue with the instructions for the labyrinth game as there really weren’t any! Also my software had not been upgraded to the latest version and so I had a lot of trouble initially which I think would have meant I didn’t bother with it if I hadn’t been doing your study. It needs to state this to people downloading it.” (52 year old female)

**Lack of understanding about scoring.** A number of participants indicated that navigation was made difficult due to a lack of understanding about scoring.

“I could not be sure I ever saw any ‘score’ or was sure I was playing the games properly” (58 year old male)

“For example I could not understand how does the app score me the days that I do not use it. And also some questions where about last week, then I found it useless to answer a question about last week every day. I mean I should have waited a week to answer that question, otherwise it would be useless.” (27 year old female)

“as I said before, the points didn’t mean much to me. I could see if they were good or bad but not much more…Sometimes the app told me that I had done enough in that area I didn’t understand this as some days I play more sport or do more thinking than others” (29 year old female)

**Other.** There were various other reasons BA was difficult to navigate.

“The games were a bit tricky at first and were somewhat annoying to play. I had to indicate less physical activity than I would normally undertake due to having family from overseas staying with me and because of having a broken toe but there was no option for recording any qualifying information.” (68 year old female)

“Diet is in two sections which is confusing” (24 year old female)

![Figure 8. Numbers of participants who reported reasons BrainyApp was difficult to navigate.](image-url)
3.4. Impressions – quantitative data

Overall impression. Participants were asked to rate their overall impression of the eHealth tools. The most common response for both the BA and BHHP groups was “good” (see Figure 9); participants from the BHHP group were more likely to indicate that they thought the eHealth tool was “excellent” than the BA participants.

![Figure 9](chart.png)

Figure 9. Percentage of participants who chose each rating of overall impression of BHHP and BA.

How interesting participants found the eHealth tools. Participants were asked to indicate how interesting they found the eHealth tools. The most common response for both the BA and BHHP groups was “somewhat interesting” (see Figure 10); participants from the BHHP group were more likely to indicate that the eHealth tool was “very interesting” than the BA participants.

![Figure 10](chart.png)

Figure 10. Percentage of participants who chose each rating of how interesting they found BHHP and BA.

How easy to understand participants found the eHealth tools. Participants were then asked to indicate how easy to understand they found the information in the eHealth tools. The most common response for both the BA and BHHP groups was “just right” (see Figure 11); participants
from the BA group were more likely to indicate that they thought the eHealth tool was “simplistic” than the BHHP participants.

![Bar chart showing percentage of participants who chose each rating of how easy to understand the information was in BHHP and BA.](chart11.png)

**Figure 11.** Percentage of participants who chose each rating of how easy to understand the information was in BHHP and BA.

**How easy to navigate participants found the eHealth tools.** Participants were asked to indicate how easy they found it to navigate the eHealth tools. Participants from the BHHP group were more likely to indicate that they thought the eHealth tool was “very easy” to navigate than the BA participants (see Figure 12). The most common response for BA participants was “somewhat easy”.

![Bar chart showing percentage of participants who chose each rating of ease of navigation in BHHP and BA.](chart12.png)

**Figure 12.** Percentage of participants who chose each rating of ease of navigation in BHHP and BA.

**How helpful participants found the eHealth tools.** Participants were asked to indicate how helpful they found the eHealth tools. Participants from the BHHP group were more likely to indicate that they thought the eHealth tool was “very helpful” than the BA participants (see Figure 13). The most common response for BA participants was “somewhat helpful”.

![Bar chart showing percentage of participants who chose each rating of helpfulness in BHHP and BA.](chart13.png)

**Evaluation of BrainyApp**
How much participants learned. Participants were asked to indicate how much they learned using the eHealth tools. Participants from the BHHP group were more likely to indicate that they learned “a fair bit” or “a great deal” than the BA participants (see Figure 14). The most common response for BA participants was “something”.

3.5. Impressions – qualitative data

Three areas concerning usability and access were explored using qualitative data analysis: key messages, main strengths, and main limitations. Qualitative responses were categorised according to a number of major themes that arose from examination of the data. Note: underlined sections indicate that the response has been coded under two different themes.
Key messages of BrainyApp. Participants were asked to indicate what they thought the key messages of BA were. Responses indicated that perceived key messages included: can reduce the risk of dementia, general health, brain health, and other. Figure 15 details the number of participants who provided comments for key messages of BA.

Figure 15. Numbers of participants who reported what they thought the key messages of BrainyApp were.

Can reduce the risk of dementia. This theme centred on participants’ perception that the key message of BA was that they could reduce their risk of dementia.

“We can reduce our risk of dementia by paying attention to our health” (27 year old female)

“We can help reduce the risk of dementia with lifestyle choices” (62 year old female)

“To keep doing the activities and keep up the lifestyle that are helpful to lessening dementia risk” (61 year old female)

“That keeping physically and mentally active is important in helping to reduce the possibility of dementia or at least, delay it’s onset.” (54 year old male)

“That it is possible to reduce the likelihood of suffering dementia by reducing risk factors and improving healthy choices” (63 year old male)

“Take care of yourself, physically and mentally, and you can lower your risk of suffering some types of dementia.” (55 year old male)

“Strong connection with physical and mental health. That dementia is not inevitable and steps can be taken to reduce the risk of dementia. Social and emotional health are components of dementia risk.” (67 year old female)

“Reduce risk of dementia by making lifestyle choices” (49 year old male)

“Lifestyle choices you make everyday can have long term effects not just on your physical health but your mental health. You need to act ow to delay or minimise your dementia risk. Little things add up both in a negative and positive sense.” (23 year old female)

“It is to reduce the risk of dementia.” (64 year old male)

“Empowering people to take action to reduce their risk of dementia. Providing information for people to think about in relation to their dementia risk. That diet, exercise, lifestyle are important factors in the prevention of dementia.” (56 year old female)

“dementia is preventable through lifestyle factors” (19 year old female)
“Decreasing your chances of dementia is about whole of lifestyle” (58 year old male)

“Choosing activities from all areas to help reduce your chances of developing Alzheimer’s” (54 year old male)

“I think the messages will vary depending on the individual but I think the key messages are that there are more than one aspect that contributes to the risk of dementia and therefore more than one aspect where one can intervene i.e physical exercise, mental exercise, diet, social etc.” (52 year old female)

**General health.** Participants also reported that general health was a key message of BA.

“Your health can be in your own hands. Mental and physical exercise is important” (76 year old male)

“To live a healthy lifestyle both in diet and exercise and to keep active mentally and physically” (52 year old female)

“Stay healthy!” (20 year old female)

“Stay healthy, exercise ,watch diet and stay connected.” (65 year old female)

“Maintain healthy diet and stay active to reduce risks” (49 year old male)

“Look after your health, keep active mentally and physically, watch diet, limit alcohol, mix with people, have variety in life -socially, stimulation, activities.” (77 year old female)

“Look after health. Same as heart and eye health messages” (51 year old female)

“Live healthier through diet and brain use and exercise and you have a better prevention strategy” (44 year old male)

“It is important to balance physical and mental activity and control weight” (64 year old female)

“Improve your physical and mental lifestyle and diet.” (57 year old female)

“Do something!” (58 year old male)

“Do something- anything can help.” (31 year old female)

“Diet, health & exercise” (54 year old female)

“Develop and maintain good health/social/learning habits” (68 year old female)

“BrainyApp want to evaluate my mental an physical healthy as a unique process” (37 year old male)

“A variety of daily exercise, reduce alcohol and unhealthy snacks, use a variety of mental activities, eat enough serves of vegetables, fruit and fish” (61 year old female)

“Try to be aware of every choice and try to make positive choices and reduce risks.” (24 year old female)

“Keep Fit  Keep eating right and try try and try to get that weight down  (It doesn’t wont to come off any more) and the keep my brain going everyday” (66 year old female)

“Keep active in body and mind and look after your lifestyle in general.” (71 year old female)

**Brain health.** Participants also reported that brain health was a key message of BA.

“To keep your brain active” (50 year old female)

“motivation to do things to keep brain healthy” (62 year old female)

“Keep Fit  Keep eating right and try try and try to get that weight down  (It doesn’t wont to come off any more) and the keep my brain going everyday” (66 year old female)

“Keep active in body and mind and look after your lifestyle in general.” (71 year old female)

“Healthy body leads to a healthy mind.” (54 year old male)

“health relating to heart & brain” (53 year old male)

**Other.** There were some other perceived key messages.

“stop using aluminium” (29 year old female)

“Not sure” (73 year old female)
“Vary the activities you do within each of the activity areas” (62 year old male)

**Main strengths of BrainyApp.** Participants were asked to indicate what they thought the main strengths of BA were. Responses indicated that the main strengths included: games, survey, activities, facts, easy to use, informative, acts as a reminder, educational, visual effects, feedback, accessible, daily or weekly check in, other and none. Figure 16 details the number of participants who provided comments for the main strengths of BA.

**Figure 16.** Numbers of participants who reported what they thought the main strengths of BrainyApp were.

**Games.** This theme centred on games being a main strength of BA.

“the word games” (61 year old female)

“The brain games.” (64 year old male)

“puzzles” (53 year old male)

“I liked using the activities, especially the games.” (65 year old female)

“games :)” (19 year old female)

“Facts & games” (54 year old female)

“The initial survey was quite useful to show you where you could do better and the games are fun” (52 year old female)

“The puzzles, and also the constant reminder of the sorts of things you can do to reduce your risks of dementia. It was like a daily nudge. The spin-off is that doing these things positively affect most other parts of your life as well - in that regard it is an all round useful tool.” (54 year old male)

“It taught me what the risk factors for dementia are. The games are good.” (24 year old female)

“Information and brain games” (62 year old female)

“Brain games, diet and body.” (63 year old male)

“I enjoyed the games and the fact you could continue to increase the degree of difficulty. The other benefit was that this was something I could do anywhere and in the last month I have spent lots of time in hospital and waiting rooms with my elderly father.” (52 year old female)

“The facts and information. The games. The check up of weekly activities, diet etc to keep on track.” (56 year old female)

**Survey.** Some participants thought a survey was the main strength of BA.

“the survey” (20 year old female)
“The initial survey was quite useful to show you where you could do better and the games are fun” (52 year old female)

**Activities.** A number of participants thought the activities were a main strength of BA.

“I liked using the activities, especially the games.” (65 year old female)

“Easy to use. Looking at the activities (eg body) reminded you to look at increasing the range of activities you are involved in.” (62 year old male)

“Activities” (31 year old female)

**Facts.** Another theme centred on the facts being a main strength of BA.

“gave some cool facts” (29 year old female)

“Facts & games” (54 year old female)

“Facts” (27 year old female)

“The immediate feedback and visual graph of scores. Really enjoyed the facts/information.” (67 year old female)

“The facts and information. The games. The check up of weekly activities, diet etc to keep on track.” (56 year old female)

“I liked the different sections that had a focus. I liked the facts that are reminders as well as give information” (77 year old female)

**Easy to use.** Three participants indicated that ease of use was a main strength of BA.

“Easy to use. Looking at the activities (eg body) reminded you to look at increasing the range of activities you are involved in.” (62 year old male)

“Easy to use, informative, engaging” (23 year old female)

“Easy to use” (76 year old male)

**Informative.** A number of participants thought the information provided was a main strength of BA.

“The information was useful.” (55 year old female)

“The information was extremely easy to understand” (68 year old female)

“The immediate feedback and visual graph of scores. Really enjoyed the facts/information.” (67 year old female)

“Information and brain games” (62 year old female)

“all the good information and the check in lists” (54 year old male)

“The facts and information. The games. The check up of weekly activities, diet etc to keep on track.” (56 year old female)

“I liked the different sections that had a focus. I liked the facts that are reminders as well as give information” (77 year old female)

**Acts as a reminder.** Two participants indicated that a main strength of BA was that it acted as a reminder.

“The puzzles, and also the constant reminder of the sorts of things you can do to reduce your risks of dementia. It was like a daily nudge. The spin-off is that doing these things positively affect most other parts of your life as well - in that regard it is an all round useful tool.” (54 year old male)

“reminding you to do something different” (66 year old female)

**Educational.** Two participants thought the educational aspect of BA was a main strength.

“Making you aware of what is important to keep your body and mind in sync.” (71 year old female)

“It taught me what the risk factors for dementia are. The games are good.” (24 year old female)
**Visual effects.** Another theme centred on the visual effects being a main strength of BA.

“Visually appealing” (58 year old male)

“The immediate feedback and visual graph of scores. Really enjoyed the facts/information.” (67 year old female)

**Feedback.** Two participants thought the feedback provided was a main strength of BA.

“The immediate feedback and visual graph of scores. Really enjoyed the facts/information.” (67 year old female)

“Gave me feedback on progress” (64 year old female)

**Accessible.** Two participants thought accessibility was a main strength of BA.

“Accessible” (51 year old female)

“I enjoyed the games and the fact you could continue to increase the degree of difficulty. The other benefit was that this was something I could do anywhere and in the last month I have spent lots of time in hospital and waiting rooms with my elderly father.” (52 year old female)

**Daily or weekly check in.** The daily or weekly check in was also considered to be a main strength of BA.

“The facts and information. The games. The check up of weekly activities, diet etc to keep on track.” (56 year old female)

“Had to record your efforts daily” (61 year old female)

**Other.** There were various other main strengths identified.

“The make relation between weight and blood pressure with mental diseases” (37 year old male)

“doesn’t ask much.” (54 year old male)

“Covered all bases” (58 year old male)

“It was consistent” (49 year old male)

“Made you think about your habits” (44 year old male)

“I liked the different sections that had a focus. I liked the facts that are reminders as well as give information” (77 year old female)

**None.** Four participants thought there were no strengths of BA.

“Not really sure. I probably didn’t use it to its full capacity” (50 year old female)

“Not much” (73 year old female)

“Not much” (57 year old female)

“I didn’t really like it. It just wasn’t something I felt motivated to use. I’d rather do relevant things.” (49 year old male)

**Main limitations of BrainyApp.** Participants were asked to indicate what they thought the main limitations of BA were. Responses indicated that the main limitations included: scoring issues, games, boring, response options, doesn’t allow for specific health/lifestyle issues, not interpretable, can’t track activities, no solution if forgot to use, none, and other. Figure 17 details the number of participants who provided comments for the main limitations of BA.
### Scoring issues

This theme centred on scoring issues being a main limitation of BA.

- "You were not allowed to score on the braingames when you reached the limit for the week." (64 year old male)

- "The structure could be changed slightly so that the weekly scoring activities (e.g. I dont smoke) could be lumped together and the daily scoring activities (e.g. how many hours spent in the last day on physical activity) separately lumped together." (54 year old male)

- "The points system and lack of brain games" (31 year old female)

- "I mentioned the flaws in previous page" ("For example I could not understand how does the app score me the days that I do not use it. And also some questions where about last week, then I found it useless to answer a question about last week every day, I mean I should have waited a week to answer that question, otherwise it would be useless"). (27 year old female)

- "I never knew when the next week was to begin. I'd like a clear time line for each week." (56 year old female)

- "I didn't find it very motivating or helpful the way it was set up to try and gain points so don't think I would bother to keep going with that" (52 year old female)

- "I am not sure the 'reaching your weekly limit' is a positive thing to have. There needs to be more brain games to keep people using the app. More Facts needed as they tended to get repetitive" (54 year old male)

- "please see previous comments" (the points were a bit meaningless to me. I felt like I kept getting the same reminders i.e. find a new hobby - this isn't really helpful to me as I have a busy life with work and my hobbies that I already participate in. Also I got a bit bored - perhaps some recommendations with play sudoko or jump rope for 5 mins or something like that would motivate me to keep using it and would also encourage me to mix up my day" and "as i said before, the points didn't mean much to me. I could see if they were good or bad but not much more... Sometimes the app told me that I had done enough in that area I didn't understand this as some days I play more sport or do more think") (29 year old female)

### Games

A number of participants thought the games were a main limitation of BA.

- "Would have liked more brain games." (71 year old female)

- "The points system and lack of brain games" (31 year old female)

- "The games need to be more engaging." (50 year old female)

- "games could have been better..." (49 year old male)

- "Chunky games functions" (51 year old female)
“Brain games - a few more games would be good. Habits - if you didn’t have one of the habits you didn’t need to refer back to this section” (62 year old male)

“Instructions for Brain Games were not clear.” (67 year old female)

“The simplistic nature and repetition of the games. The questions about diet should be ““today”” not this week as were the ones about exercise.” (57 year old female)

“Some of the multiple choice answers did not quite fit what I wanted to input and the games did not appeal to me.” (68 year old female)

“limited mental activities to engage in” (20 year old female)

“In the spelling games not giving the answer after a certain time, I’m a lousy speller & found it frustrating if I couldn’t work it out.” (54 year old female)

“I was frustrated when playing word games that when a prompt came and you still could not get it it did not move on. would have been better to give the answer.” (65 year old female)

“I am not sure the ““reaching your weekly limit”” is a positive thing to have. More Facts needed as they tended to get repetitive” (54 year old male)

**Boring.** Several participants indicated that a main limitation of BA was that it was boring.

“Boring, had to spend time looking at a screen doing fairly tedious things” (49 year old male)

“Bit boring” (73 year old female)

“didn’t maintain my attention” (19 year old female)

“Once I’d have a good look around, there was no incentive to use it again. I set the daily fact notification up to push me to use it because of this trial, but otherwise I wouldn’t have bothered. Sorry.” (55 year old female)

“please see previous comments” (“the points were a bit meaningless to me. I felt like I kept getting the same reminders i.e find a new hobby - this isn't really helpful to me as I have a busy life with work and my hobbies that I already participate in. Also I got a bit bored - perhaps some recommendations with play sudoku or jump rope for 5 mins or something like that would motivate me to keep using it and would also encourage me to mix up my day” and "as i said before, the points didn't mean much to me. I could see if they were good or bad but not much more...Sometimes the app told me that I had done enough in that area i didn’t understand this as some days I play more sport or do more think”) (29 year old female)

**Response options.** Some participants thought that the response options were a main limitation of BA.

“The simplistic nature and repetition of the games. The questions about diet should be ““today”” not this week as were the ones about exercise.” (57 year old female)

“That it recorded too high re habits and exercise ... Some cases not enough options” (44 year old male)

“Some of the multiple choice answers did not quite fit what I wanted to input and the games did not appeal to me.” (68 year old female)

“I mentioned the flaws in previous page” (““For example I could not understand how does the app score me the days that I do not use it. And also some questions where about last week, then I found it useless to answer a question about last week every day, I mean I should have waited a week to answer that question,otherwise it would be useless.”) (27 year old female)

“Stopping me answering all the questions” (66 year old female)

**Doesn’t allow for specific health/lifestyle issues.** Three participants indicated that a main limitation of BA was that it doesn’t allow for specific health or lifestyle issues.

“My heart is healthy, but I suffer from intermittent atrial fibrillation which is controlled by medication that keeps my heart rate fairly constant. There is nothing in BrainyApp that takes account of these sorts of problems. As we age, many of us develop issues that we force us to adjust the way we live. Your app needs to cater as much fo those with limitations as it does to others. I guess it has been designed by someone who is under 30.” (59 year old female)
“It is quite difficult for someone with addictions eg alcohol to limit drinks even though they are aware of risks. Not a fault of Brainy apps though. Maybe some extra info on how to get help if unable to do ot for yourself” (62 year old female)

“In answering some of the areas of activity there is no place for what you might do in a work situation or activities that you continue to be involved in e.g. Organizations., committees, conferences. There is no information about what your brain health score really means. Is there a goal to reach? What should you be?” (77 year old female)

**Not interpretable.** Some participants thought that a main limitation of BA was that it was not interpretable.

“In answering some of the areas of activity there is no place for what you might do in a work situation or activities that you continue to be involved in e.g. Organizations., committees, conferences. There is no information about what your brain health score really means. Is there a goal to reach? What should you be?” (77 year old female)

“Information provided was too simplistic, no explanation of how your lifestyle choices actually affect your risk” (23 year old female)

“I don’t think the survey aspects were well explained. Was it meant to be re done? What did the graph show, how was it changed?” (63 year old male)

**Can’t track activities.** Two participants indicated that not being able to track activities was a main limitation of BA.

“Would prefer there was a reminder function ie. when you switch on ipad for the first time in the day it reminds you to use Brainy app as I sometimes forgot to use it. Maybe also provide some targets that people can commit to regardless of whether it is diet, exercise, smoking etc. E.g. The individual sets a weekly target & then is prompted at the end of the week on how close they got to target....ie to motivate us more.” (52 year old female)

“It didn’t keep track of my activities well enough, I’d like to be able to compare them with previous days. When I lost too many points I felt bad about myself and less motivated to use the app.” (24 year old female)

**No solution if forgot to use.** Two participants thought that the lack of solution if they forgot to use it was a main limitation of BA.

“Would prefer there was a reminder function ie. when you switch on ipad for the first time in the day it reminds you to use Brainy app as I sometimes forgot to use it. Maybe also provide some targets that people can commit to regardless of whether it is diet, exercise, smoking etc. E.g. The individual sets a weekly target & then is prompted at the end of the week on how close they got to target....ie to motivate us more.” (52 year old female)

“Couldn’t go back to the previous day if I had forgotten to record my daily efforts” (61 year old female)

**None.** Some participants indicated that there were no limitations of BA.

“nothing really” (61 year old female)

“None to mention” (76 year old male)

“None” (58 year old male)

**Other.** There were various other main limitations identified.

“runs on a iphone and not in my brain.” (54 year old male)

“more the limitations of the iphone than the app” (53 year old male)

“I was never sure I was using it properly” (58 year old male)

“I can not access to another sections, i mean mental activity, social activity to declain the risk of mentally deases” (37 year old male)

“I am not sure the “”reaching your weekly limit“” is a positive thing to have. There needs to be more brain games to keep people using the app More Facts needed as they tended to get repetitive” (54 year old male)
3.6. Other resources – quantitative data

Other resources. Table 5 details the other resources utilised by BHHP and BA participants during the intervention period. Participants from the BHHP group were more likely to report visiting the Your Brain Matters and Alzheimer’s Australia websites than BA participants. Around 13% of BA participants visited the Bupa website; no link to the Bupa website was provided to the BHHP group. There were similar rates of accessing other general health and lifestyle resources between the BHHP and BA participants; however, BHHP participants were more likely to access other dementia risk reduction resources than BA participants.

Table 5. Numbers of participants who accessed other resources during the intervention.

<table>
<thead>
<tr>
<th></th>
<th>BHHP n(% yes)</th>
<th>BA n(% yes)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Visited linked websites</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Your Brain Matters website</td>
<td>26 (42.6)</td>
<td>2 (4.4)</td>
</tr>
<tr>
<td>Alzheimer’s Australia website</td>
<td>23 (37.7)</td>
<td>5 (11.1)</td>
</tr>
<tr>
<td>Bupa website</td>
<td>N/A</td>
<td>6 (13.3)</td>
</tr>
<tr>
<td><strong>Accessed other resources</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other health and lifestyle resources</td>
<td>18 (28.6)</td>
<td>12 (27.3)</td>
</tr>
<tr>
<td>Other dementia risk reduction resources</td>
<td>8 (12.9)</td>
<td>3 (6.7)</td>
</tr>
</tbody>
</table>

Table 6. Numbers of participants who visited health professionals during the intervention or intend to visit health professionals after the intervention for each of the ten health behaviours addressed.

<table>
<thead>
<tr>
<th></th>
<th>BHHP n(% yes)</th>
<th>BA n(% yes)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Visited health professional</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td>0 (0)</td>
<td>1 (2.2)</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>8 (12.9)</td>
<td>6 (13.3)</td>
</tr>
<tr>
<td>Body weight</td>
<td>3 (4.8)</td>
<td>8 (17.8)</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>9 (14.8)</td>
<td>5 (11.1)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>7 (11.9)</td>
<td>5 (11.1)</td>
</tr>
<tr>
<td>Diet</td>
<td>4 (6.6)</td>
<td>5 (11.1)</td>
</tr>
<tr>
<td>Mental activity</td>
<td>1 (1.6)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Physical activity</td>
<td>2 (3.3)</td>
<td>3 (6.7)</td>
</tr>
<tr>
<td>Smoking</td>
<td>1 (1.7)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Social activity</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td><strong>Plan to visit health professional</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td>0 (0)</td>
<td>2 (4.5)</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>10 (15.9)</td>
<td>8 (18.2)</td>
</tr>
<tr>
<td>Body weight</td>
<td>7 (11.1)</td>
<td>7 (15.9)</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>13 (20.6)</td>
<td>12 (26.7)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>7 (11.3)</td>
<td>6 (13.3)</td>
</tr>
<tr>
<td>Diet</td>
<td>6 (9.8)</td>
<td>6 (13.6)</td>
</tr>
<tr>
<td>Mental activity</td>
<td>3 (4.8)</td>
<td>3 (6.8)</td>
</tr>
<tr>
<td>Physical activity</td>
<td>2 (3.2)</td>
<td>6 (13.6)</td>
</tr>
<tr>
<td>Smoking</td>
<td>0 (0)</td>
<td>1 (2.3)</td>
</tr>
<tr>
<td>Social activity</td>
<td>0 (0)</td>
<td>1 (2.3)</td>
</tr>
</tbody>
</table>

Across both groups, there were low rates of visiting a health professional for any of the ten health behaviours addressed by the eHealth tools (see Table 6). The most commonly reported subject of a visit to a health professional for the BHHP participants was cholesterol, while for BA participants it
was body weight. A higher number of participants reported planning to visit a health professional, with the most commonly reported reason being cholesterol across both BHHP and BA participants.

These findings indicate that the BHHP participants were more likely to access other resources during the intervention period, and to visit or intend to visit a health professional about the health behaviours detailed in the eHealth tools.

3.7. Other resources – qualitative data

Five other resources potentially utilised during the intervention were explored using qualitative data analysis: Your Brain Matters website, Alzheimer’s Australia website, Bupa website, other health and lifestyle resources, and other dementia risk reduction resources. Qualitative responses were categorised according to a number of major themes that arose from examination of the data. Note: underlined sections indicate that the response has been coded under two different themes. Figures 18 and 19 detail the number of participants who provided comments for the five resources.

**Your Brain Matters website.** Participants were asked to detail their reasons for visiting the Your Brain Matters (YBM) website during the intervention. Only two BA participants reported visiting the YBM website and no reasons were provided. Two other participants reported they did not see the links to websites.

“Where was the information that directed me to these as I did not see it.” (57 year old female)

“I just looked at it” (27 year old female)

“Do not even know where we are directed to those sites” (77 year old female)

**Alzheimer’s Australia website.** BA participants were asked to detail their reasons for visiting the Alzheimer’s Australia website during the intervention. Responses indicated that reasons included: information about Alzheimer’s disease, and other.

**Information about Alzheimer’s disease.** This theme centred on participants wanting to find further information about Alzheimer’s disease as the reason for visiting the Alzheimer’s Australia website.

“The likelihood of being affected by Alzheimer’s because of hereditary factors.” (68 year old female)

“Information on forms of dementia, symptoms etc as my father has been diagnosed with dementia in the last month.” (52 year old female)

**Other.** There were various other reasons for visiting the Alzheimer’s Australia website.

“Just to see the link” (77 year old female)

“It’s butiroses’s role” (44 year old male)

**Bupa website.** BA participants were asked to detail their reasons for visiting the Bupa website during the intervention. Responses indicated that reasons included: further health information, financial reasons, and other.
**Further health information.** This theme centred on participants wanting further health information as the reason behind visiting the Bupa website.

“To test my health age as opposed to my real age.” (68 year old female)

“Running programme” (51 year old female)

**Financial reasons.** Two participants indicated financial reasons behind visiting the Bupa website.

“To see whether using this app and publishing any kind of public data about my health would affect future policy premiums.” (27 year old male)

“cheaper rates” (62 year old female)

**Other.** There were various other reasons for visiting the Bupa website.

“These websites were not mentioned in the app” (27 year old female)

“Again just to see the link” (77 year old female)

<table>
<thead>
<tr>
<th>Lack of direction</th>
<th>Information about Alzheimer’s disease</th>
<th>Other</th>
<th>Further health information</th>
<th>Financial reasons</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your Brain Matters website</td>
<td>Alzheimer’s website</td>
<td>Bupa website</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 18.** Numbers of BA participants who commented on Your Brain Matters, Alzheimer’s Australia, and Bupa websites.

<table>
<thead>
<tr>
<th>Physical activity and diet resources</th>
<th>Mental activity resources</th>
<th>Other resources</th>
<th>Brain training</th>
<th>Alzheimer’s Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other health and lifestyle resources</td>
<td>Other dementia risk reduction resources</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 19.** Numbers of BA participants who commented on accessing other health and lifestyle resources, and other dementia risk reduction resources.
Other health and lifestyle resources. BA participants were asked to provide further information about other health and lifestyle resources they accessed during the evaluation period. Responses indicated that resources accessed included: physical activity and diet resources, mental activity resources, and other resources.

**Physical activity and diet resources.** This theme centred on participants accessing other physical activity and diet resources.

“Yoga iPhone app” (61 year old female)
“used a pedometer to try to encourage myself to walk more.” (54 year old male)
“My Fitness APP” (62 year old female)
“Weight watchers” (51 year old female)
“Sydney morning herald health, nine man health, map my run, health recipe websites” (23 year old female)
“I subscribe to a Yoga magazine. It has information about relaxation, exercise and diet. Watch a few TV program’s with a health focus.” (56 year old female)
“lumosity Read book on eating too much sugar and stopped all sugar” (66 year old female)

**Mental activity resources.** Participants also reported accessing other mental activity resources.

“Lumosity and happyneuron websites” (49 year old male)
“Loaded various brain games to iPad and iPhone (eg Fit Brains) to play” (58 year old male)
“lumosity Read book on eating too much sugar and stopped all sugar” (66 year old female)

**Other resources.** There were various other resources accessed.

“Not sure I was aware that was an option” (54 year old female)
“No apps or web based programs just information on dementia, treatment etc.” (52 year old female)
“Medibank Private website. As a result i downloaded the apps called “”My Symptoms”” and “”My Energy” (54 year old male)
“Advertised On Facebook there is a health conference coming up - I looked into that” (29 year old female)

**Other dementia risk reduction resources.** BA participants were asked to provide further information about other dementia risk reduction resources they accessed during the intervention period. Responses indicated that resources accessed included: brain training, and Alzheimer’s Australia.

**Brain training.** One participant reported accessing other brain training resources.

“Lumosity” (77 year old female)

**Alzheimer’s Australia.** One participant reported accessing Alzheimer’s Australia resources.

“Attended a three day Living With Memory Loss program and received a lot of information.” (56 year old female)

4. Discussion

4.1. Usability and access

On average, participants used BA four times a week, for around 10 minutes at a time, and two thirds intended to continue using BA following the intervention. Of those who indicated why they didn’t use BA regularly, reasons included lack of motivation or interest and technical issues. The most common reason participants intended to continue use was that BA served as a good reminder to
improve habits, while the most common reason for intending to discontinue use was that BA was not interesting or motivating.

Given a much higher number of BHHP participants intended to keep using the website (81% versus 67% for BA), the reasons BA participants provided for not using or intending to stop using BA should be considered. Comments (see pages 11 to 13) indicated a lack of understanding about how to use BA and a lack of interest in what the app provided. However, while there were several comments about BA being boring, the majority of participants did find it interesting.

Around 9 out of 10 BA participants reported using the Survey, Games and Brain sections of the app. Given the Survey is important to get the most out of BA, consideration might be given to how to get the other 10% to complete it. The Brain section was the most commonly used health behaviour section, consistent with previous work that has revealed mental activity is the lifestyle factor most people associate with cognitive health and dementia risk reduction, and have an interest in improving in their own life. This is also the factor that sets BA apart from other health apps focussed on physical health. Providing additional opportunities to undertake and record mental activities, and additional brain games, could be attractive enhancements for BA users.

Most participants reported no issues accessing BA throughout the intervention. However, some participants reported experiencing technical issues such as the app or the word game freezing, and one participant found the screen and control size on the iPhone too small.

For those who completed the intervention and follow-up questionnaire, the majority did not have any technical issues, suggesting for most BA works smoothly. But there is no way of knowing what issues led 60% of BA participants to drop out before completing the study. Feedback indicated that several participants had difficulties installing the study version of BA, which required first installing TestFlight. This led some to give up and drop out. Others likely dropped out for similar reasons that those participants who completed the follow-up gave for intending to discontinue use of BA after the intervention (not finding the motivation or interest to use BA).

4.2. Impressions

Over half the participants rated their overall impression of BA as “good”, but very few rated it as “excellent”. By contrast, nearly one third of BHHP participants rated the website as “excellent”. Just over half the participants found BA to be somewhat interesting, and one in five found it very interesting. BHHP participants were twice as likely as BA participants to rate the eHealth tool as “very interesting”. Around three quarters of BA participants reported that the eHealth tool was somewhat or very helpful, suggesting BA was useful to most. However, over 90% of BHHP participants found that tool helpful, suggesting the website offered more benefits to more people compared to the app.

While almost half the participants found the ease of understanding of information presented in BA to be just right, a similar number rated the information as either somewhat or very simplistic. BHHP participants were more likely to rate the website information as just right (60%), and less likely to rate it as simplistic (30%).

Around one third of BA participants felt they learned a fair bit or a lot from the eHealth tool, compared to two thirds of BHHP participants. This suggests that people are more satisfied with what they are learning from the detailed information provided by the website, compared to the interactive but briefer information provided by BA. Consideration could be given to finding ways to link to additional information from BA, perhaps through the YBM website, to provide greater understanding of why BA suggests the activities it does. Improving knowledge about dementia risk reduction is important for getting people to adopt brain healthy lifestyles, as is providing tools and resources to help people change their behaviour as BA does.

Evaluation of BrainyApp
Most BA participants found the app easy to navigate; 18% found navigation difficult. BHHP participants were more likely to rate the website as easy to navigate, which is to be expected as there were no interactive components to work through as in BA. It is concerning, however, that almost one in five BA users found the app difficult to navigate and this result along with some of the comments from participants suggest a need to consider additional instructions being added to BA.

Participants were asked what they thought the key messages of BA were, along with the main strengths and limitations of the app. The key messages that users perceived were around the areas of reducing the risk of dementia, brain health, and general health. This suggests that BA is effective in getting across the messages it was designed to promote. The three most common strengths identified by participants included the games, the daily facts, and that it was informative. The three most common limitations identified by participants included scoring issues, the games, and that it was boring.

Several participants reported liking the brain games, some would like BA to include more brain games, while some found the games boring or frustrating. It will always be difficult for BA to compete with other apps or websites dedicated to games. Based on participants’ comments, most used and liked the games; however, providing some instructions for the existing games, having a time out for the word game if you can’t solve a word, and perhaps adding additional games, could be considered.

Several participants reported they found BA and its scoring system difficult to understand. Others were frustrated by not being able to gain points after reaching the limit for a particular section. The scoring system and allocation of points across the different behavioural sections was implemented for very good reasons in the original design of BA, with the brain-heart health score representing how well the user is doing across all dementia risk reduction factors, not just how many brain games they have played. However, consideration may need to be given to simplifying the scoring and/or providing information about why points are allocated in certain ways and the importance of a holistic approach to brain health (i.e. achieving points across the different behavioural sections).

4.3. Other resources

Very few BA participants visited the Your Brain Matters website, the Alzheimer’s Australia website, or the Bupa website. Of concern, some participants reported not knowing that links to these sites were provided in BA. Around a quarter of BA participants accessed other health and lifestyle resources, but very few accessed other dementia risk reduction resources. Other resources accessed included physical activity and diet resources, mental activity resources, brain training resources, and Alzheimer’s Australia resources. Consideration could be given to enhancing links in BA to other relevant resources, to provide users with recommendations to credible information and make use of existing resources to value add to BA.

There were also low rates of visiting a health professional for any of the ten health behaviours; however, a higher rate reported intending to visit a health professional in the future. The most commonly reported health behaviour concern for visiting a health professional was body weight, while the most common health behaviour concern for future intentions to visit a health professional was cholesterol. In a short four-week intervention, a low number of visits to health professionals are to be expected. It is reassuring that several BA participants reported intending to visit a health professional, particularly for the heart related factors, suggesting the important messages of having health checks and the link between heart and brain health were successfully promoted by BA.

4.4. Participant characteristics

The number of BA participants who completed the intervention study (46) was relatively small. Nevertheless, their ratings and comments suggest that the majority were positive about BA, and the feedback they provided highlights the areas in which BA might be improved. The people who volunteered to participate tended to be older, female, highly educated and born in Australia. While
they are not quite a representative sample of the population, they are typical of those who volunteer for this type of health research. They also tend to be health conscious and health literate, and participants’ responses indicated many were already pursuing a brain healthy lifestyle.

Participants also volunteered because they have an interest in brain health and dementia risk reduction. They are an audience for eHealth tools who are looking for authoritative information, strategies and resources that will help them improve their brain health. For some, BA did not provide what they were looking for, or they had difficulty understanding what BA could do for them. Results from this study indicated that, on average, those using the BHHP website were more satisfied than those using BA. For this cohort (older, well educated), the more detailed information provided by the website may be more useful than the interactive activities provided by BA. This is an important group because they are the people most likely to want to use BA and keep using it. Making BA easier to use, providing instructions on how to get the most out of the app, and providing links to more detailed information and other relevant resources could be considered for future enhancements of BA.

Of course, there is another audience that BA needs to cater for, those with little prior interest in brain health or dementia. An important aim of the eHealth tools is to educate people who might be at higher risk but who don’t know that their lifestyle impacts their brain health and dementia risk. A tool like BA that provides entertainment as well as education could be beneficial for engaging such people. A balance is needed that caters for people who are seeking help as well as people who don’t yet know they need help.

5. Conclusions

Overall, most participants formed a positive impression of BrainyApp. The majority of BA participants found the eHealth tool interesting, helpful, easy to understand and easy to navigate, felt they learned something from it, and intended to keep using the app. However, on each of these measures, BHHP participants rated the website higher, indicating greater satisfaction with the website compared to BA. There were also a number of issues reported by BA participants related to the lack of instruction, as well as not understanding the scoring.

These findings suggest that BA might be improved by incorporating more detailed information or links to such information, making it easier to use, and providing some instructions for use and making the most of the app.

The Games and Brain activity sections were the most used, consistent with the fact that people associate mental activity with brain health and dementia risk reduction more than other health and lifestyle factors. Providing additional games and ways to undertake and record mental activity may appeal to BA users. However, it is also important to make sure that BA encourages a holistic approach that addresses other risk factors.

Encouragingly, several participants reported they intended to keep using BA because it was a useful reminder for them to adopt healthier habits every day. This is a core aim of the eHealth tools and one that BA appears to have achieved for these participants.