Introducing tablet technology as a therapeutic tool in acute older adult psychiatric inpatients: A quality improvement project to target predictors of frailty by improving client mood and engagement.

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1 Introduction

1.1 Frailty

Frailty is acknowledged to be a condition of advanced age characterised by a critical decrease of the functional and physiological reserves of multiple organic systems (Schuurmans, 2004). This subsequently results in an increased risk of adverse outcomes, including chronic depression, falls, disability, hospitalisation, institutionalisation and death (Sourial et al., 2012). Frailty is a hugely common phenomena among elderly populations worldwide (Clegg et al., 2013). The English Longitudinal Study of Ageing (Gale, Cooper & Sayer, 2015) found that- the overall weighted prevalence of frailty within the UK was 14%, - this becomes increasingly common as age rises and is associated with difficulties in completing Activities of Daily Living (ADLs). These difficulties, in turn, have a negative impact upon mental health (Andrew, Fisk & Rockwood, 2012). Although the concept of frailty conventionally focussed narrowly upon physical domains, researchers and clinicians alike now recognise the important link between frailty and mental health (Arts et al., 2015).

There are a number of predictors of frailty which are related to mental health and that are beyond physical vulnerabilities alone (Duarte & Paul, 2014). Cognitive decline is a well-evidenced and researched predictor of frailty (Robertson et al., 2013). The domains most associated with frailty are executive function and attention; memory does not appear to be strongly related to frailty. A number of epidemiological studies have reported that frailty increases the risk of future cognitive decline and dementia, and that cognitive impairment, in turn, increases the risk of frailty (Duarte & Paul, 2014; Godin et al., 2016; Godin et al., 2017; Kulmala, 2014; Mhaoláin et al, 2011; Robertson et al., 2013). This suggests that cognition and frailty interact within a cycle of decline associated with ageing (Robertson, 2013). Mhaoláin et al. (2011) suggested that the coincidence of cognitive impairment and frailty may accelerate the trajectory of decline in dementia, and that frailty may therefore be a target

for intervention to address the adverse consequences of the combined effects of frailty and cognitive impairment.

Research has also found that social vulnerabilities are associated with both frailty and cognitive impairment (Godin et al., 2017). Much research has investigated the social determinants of frailty with findings evidencing that increased social isolation, reduced social support and decreased social participation in community or religious activities are associated with increased frailty (Andrew et al., 2008; John, Montgomery & Tyas, 2013; Peek et al., 2012; Salem et al., 2013; Theou et al., 2013; Woo et al., 2005; Woo et al., 2006). Consequently, these factors are associated with depression, and decreased psychological wellbeing and mental health (Chen & Feeley, 2014; Holtfreter, 2017). Furthermore, psychiatric illnesses have also consistently been found to be individual predictors of frailty, independent of these social factors (Duarte & Paul, 2014; Lohman et al., 2017; Mezuk et al., 2012). Mhaoláin et al. (2012b) found that frailty is associated with a higher likelihood of clinically significant anxiety and depression, independent of age, gender, and a history of depression or anxiety requiring pharmacotherapy. Moreover, Soysal et al. (2017) recently found that frail individuals are over four times more likely to experience depression than non-frail people. They concluded a reciprocal interaction between mental health deterioration and frailty in older adults, with frailty and depression each being considered a risk factor for development of the other.

Poor psychological wellbeing can be considered a broader predictor of frailty than the aforementioned risk factors, and likely encompasses aspects of each (Dent & Hoogendijk, 2014). Gale et al (2014) found that low levels of psychological wellbeing are associated with frailty, and concluded that maintaining a strong sense of psychological wellbeing can act as a protective factor against the development of frailty. The association between poor psychological wellbeing and frailty has been described as a ‘frailty identity crisis’ (Fillit &

Butler, 2009). This sense of 'crisis' has been proposed to occur when challenging transitions from independence to frailty are accompanied by maladaptive psychological responses. Affected individuals are said to experience a decline in psychological wellbeing as they are faced with losses in health and independence that mark the transition from fitness to frailty (Fillit & Butler, 2009). Andrew, Fisk and Rockwood (2012) concluded that psychological wellbeing impaired by a frailty identity crisis may play an important role in defining subjective health in older adults.

The literature demonstrates that frailty is inextricably linked with mental health through poor psychological wellbeing, which incorporates: cognitive decline; social isolation; and depression and anxiety. The associations between these many factors are undoubtedly complicated and overlapping, and it is beyond the scope of the present research to discuss them here. However, it is noteworthy that frailty is susceptible to active intervention (Bortz, 2002), suggesting that interventions which target the aforementioned factors may be beneficial in going some way to prevent the progression of frailty. Since frailty predicts mortality, health status, functional decline and use of health services, its prevalence has considerable public health implications, particularly if it can be considerably ameliorated (Woo et al., 2005; Woo et al., 2006). Hence, Lancashire Care NHS Foundation Trust's (LCFT) current CQUIN (Commissioning for Quality and Innovation) focuses upon frailty in mental health. As part of this CQUIN, the current proof of concept project aimed to target the aforementioned known predictors of frailty in service-users residing within an advanced care and dementia acute psychiatric inpatient setting. The nature of this setting means that the majority of individuals who use this service are considered frail.

Within this type of acute inpatient setting, factors such as cognition, social isolation, depression, anxiety and psychological wellbeing are all routinely considered as part of assessment and treatment pathways. These factors are typically considered as part of a

holistic view of a service-user's mental health, and are treated with a view to discharge back to the community as soon as is possible, where further care is provided. Thus, this proof of concept project aimed to use a new therapeutic tool to apply a more direct focus on targeting these factors in this setting, within the context of frailty.

1.2 Tablet Technology

The therapeutic tool used was tablet technology (TT); a recent study found that the negative effects of frailty in older adults are reduced through the use of information and communication technologies (ICTs; van Ingen et al., 2017). Additionally, using ICTs has consistently been shown to be able to improve older adults' quality of life in a number of ways (Vroman, 2015). Using technology is a natural way to provide opportunities for cognitive stimulation (Tsai, 2015), and a number of studies have shown that using ICTs can improve older adults' cognition and delay cognitive decline (e.g. Chan, 2016; d'Orsi et al., 2014; Vaportzis, 2016; Xavier, 2014). Much of this research has shown these benefits in the context of using TT to facilitate cognitive engagement (Anguera et al., 2013). Cognitive engagement focuses on cognitive stimulation provided by activities that are novel to an individual and are broadly demanding of executive function, episodic and reasoning (Park et al., 2007). Both Vaportzis et al. (2016) and Xavier et al. (2014) found that facilitating cognitive engagement through TT can slow down cognitive decline. In line with these findings, another study showed that using ICTs can also decrease the incidence of instrumental ADLs impairment, which often coincides with cognitive decline as it is part of the dementia process itself (d'Orsi et al., 2014). Researchers have concluded that the use of TT may increase brain and cognitive reserve (a depletion of which leads to frailty; Robinson et al., 2016), or lead to utilising more efficient neural networks to delay cognitive decline (Xavier, 2014). Thus, it appears that using TT to facilitate cognitive engagement could be

beneficial to service-users; it is a flexible approach with a potentially broad range of benefits (Park et al., 2014).

Social isolation is also associated with cognitive decline. There is a substantial amount of research evidencing that using ICTs reduces social isolation and increases social support and participation among older adults (see Khosravi et al., 2016 for a review). The majority of these studies show these benefits through using the internet to engage with others (Chopik et al., 2016). There is potential for TT to be used in this way within an acute inpatient setting to facilitate increased communication with family and friends through applications such as Skype. Tsai et al. (2015) found that social support plays an important role when introducing older adults to TT, whilst other researchers have proposed that the clearest way ICT use decreases social isolation is through its ability to keep older adults engaged with life (Rowe & Khan, 2015). This suggests that using TT on inpatient wards can not only decrease social isolation via contact with family and friends, but could reduce isolation within the ward environment by promoting social participation. With regards dementia, there is a wide evidence base for ICT's use in improving social participation (see Chen et al., 2016; Dickens et al., 2016; Pinto-Bruno et al., 2017 for comprehensive reviews). Astell et al. (2010) showed that ICT-based reminiscence activities, compared with non-ICT-based reminiscence activities, elicited higher levels of enjoyment, singing and initiation of conversation. Such findings provide further support for how TT could be used therapeutically within dementia inpatient settings to foster social participation and reduce social isolation.

Of significance, is the usage of ICT in reducing clinical depression in older adults (Anguera et al., 2016; Cotten et al., 2012; 2014; Francis et al., 2016; Ruppell et al., 2016). It is yet unclear as to the mechanism in this outcome, though research has suggested that the relationship is mediated by ICT's ability to reduce social isolation and loneliness (Chopik, 2016; Cotton et al., 2014; Shillair et al., 2015). Regardless of the mechanisms, the well-evidenced

relationship between ICT use and improved psychological wellbeing is notable (Cangelosi et al., 2014; Proyer et al., 2014; Sims et al., 2016). The prospective benefits of reducing depression, increasing -psychological wellbeing and -life satisfaction, reducing -cognitive decline, -social isolation and improving social participation through TT usage could be significant within an acute inpatient setting. However, research has not yet identified whether TT is an effective therapeutic tool, nor whether it can elicit these benefits in older adults experiencing severe and enduring mental health difficulties, nor moderate to severe dementia, and residing in a psychiatric inpatient unit.

The potential benefits of implementing TT within this environment go beyond those already mentioned. The opportunistic and flexible nature of using a mobile resource with access to a wealth of options enables person-centred care as interventions, more so than is currently possible. Faciliating activities using TT would enable staff and service-users to be more flexible in the activities they choose and provide a much greater choice of activities than is currently available. Moreover, the increasing limitations on NHS resources and the need for more cost-effective, high quality methods of care further emphasise the need to investigate this tool's utility within a psychiatric inpatient setting. It is also important to consider that recent statistics demonstrate that ICT use by retired adults in the UK has increased by almost 22 percentage points since 2011 to 61% in 2017 (Office for National Statistics, 2017). Within our ageing population, we are going to experience increasing numbers of older adults who regularly use ICT using our mental health services. Being prepared to offer activities to service-users which they are already familiar will further ensure that we are striving to deliver the highest quality, patient-centred care.

Research to date typically considers ICT usage's benefits in relation to long-term outcomes. Contrastingly, the priorities of acute inpatient services lie in immediate therapeutic gain to promote initial engagement, assist with recovery and enable timely discharge, as opposed to long-term goals. The nature of this service therefore necessitates

that for TT to be therapeutically effective and thus improve quality, it must result in immediate short-term benefits, such as improvements in service-user mood and engagement. Given the well-evidenced long-term benefits of ICT, it seems reasonable to infer that using TT could also have the potential to elicit these immediate outcomes. This assumption is based upon the theory underlying the Cognitive Behavioural Therapy approach, behavioural activation, i.e increasing the occurrence of pleasure will reduce depression in the long term (Ekers et al., 2014). If mental health improves as a result of using TT, the predictors of frailty will thus be targeted.

This quality improvement, proof of concept service evaluation aimed to investigate the therapeutic efficacy of TT interventions across Older Adult Advanced Care and Dementia Inpatient Units. It was hypothesised that there would be a significant improvement in participant mood immediately after using TT, and that participant engagement levels would significantly increase over the data collection period.

2 Method

2.1 Participants

The participant sample consisted of service-users who were staying as an inpatient at one of five Advanced Care or Dementia inpatient wards in Lancashire. For ease of reference, participants diagnosed with dementia are referred to as ‘dementia participants’, and participants who are in hospital due to experiencing a mental health difficulty are referred to as ‘mental health participants’.

Opportunity sampling was utilised; any service-users residing on the ward at the time of data collection could have taken part. This initial participant sample consisted of 95 participants (females, n=49; males, n= 46): 40% (N = 38) were dementia participants; 60% (N = 57) of the participants were mental health participants. A Groningen Frailty Index (GFI; Steverink et al., 2001) was completed for each participant, where a score of 4 or above indicates

moderate frailty[1]. The mean GFI score was 6.51 (*SD* = 1.60; Range 4-11); mean GFI for dementia participants was 6.71 (*SD* = 1.56; Range 4-10); and for mental health participants was 6.37 (*SD* = 1.61, Range 4-11).

A final sample of 63 participants (Males, N=32; females, N=25) took part in at least one tablet activity: 39.7% (*N* = 25) were dementia participants; 60.3% (*N* = 38) were mental health participants. The overall mean GFI Score was 6.41 (*SD* = 1.52; Range 4-10); dementia participants' mean GFI score was 6.72 (*SD* = 1.67; Range 4-10), and mental health participants' was 6.21 (*SD* = 1.41; Range 4-10). All participants were therefore at least 'moderately' frail (Steverink et al., 2001).

There is little demographic difference between the initial potential pool of participants and the actual participant sample. It therefore seems reasonable to infer that the distribution of participants who chose not to engage in tablet activities was relatively even in terms of dementia or mental health diagnosis; gender; and level of frailty.

2.2 Design, Materials and Procedures

This was an LCFT proof of concept quality improvement project. A repeated measures within-subjects design was utilised. This study was recorded on LCFT's service evaluation database, reviewed by the LCFT research and development department and seeking formal ethical approval was confirmed to not be required.

A total of ten Acer Iconia One 10 B3-A20 tablets were purchased. This tablet was chosen as it is affordable (under £100) and has a larger than average screen. The tablets were set up to be as accessible as possible to service-users, i.e. no locks nor passwords, large font, and screen brightness high.

Firstly, service-users, family members, visitors and professionals were asked *'Have you any suggestions about applications or internet resources which would be both helpful*

[1] A full description of the GFI can be found in the method section.

and therapeutic for service-users on the ward?' and *'In what way do you think the tablets could be used therapeutically by staff for service-users on the ward once these applications are on the tablets?'*. An Assistant Clinical Psychologist visited the wards and asked anybody available if they would consent to answering the questions. In total data was collected from: 15 professionals; 11 relatives; 8 service-users; and 3 non-family visitors. This data was then thematically analysed[2] in order to find themes among the data for tablet usage suggestions. Themes that emerged were: Occupation (*e.g. 'News', 'Mental Health information'*); Education (*e.g. 'App for family around dementia awareness'*); Communication (*e.g. 'Skype'*); Reminiscence (*e.g. 'Things from the past', 'House of Memories'*); Sensory (*e.g. 'YouTube', 'Sensory apps for light'*); Cognitive Stimulation (*e.g. 'Quiz apps', 'Information search/Google'*); and Non-tablet related suggestions (*e.g. 'Personal profile for each patient'*).

Next, the themes were considered in relation to predictors of frailty and apps were chosen accordingly, with the service setting in mind. LCFT's ORCHA website (the Organisation for the Review of Care and Health Applications) was firstly used in an attempt to find suitable applications. However, because many of the suggestions received were not specifically health and care related, many of the applications were searched for through Google and Google Play- the tablets' online app store. A number of potential applications were found relating to each theme's content[3] (with the exception of Non-tablet related suggestions). In order to maintain the tablet's affordability and accessibility, only free applications were considered. Many of the suggestions (e.g Quiz apps) had a huge number of 'matching' applications. Thus, through reading around, applications which it appeared may be most suitable to advanced care and dementia inpatients were the chosen applications to include on the list.

[2] See Appendices 2 and 3
[3] See Appendices and 5

The final list of applications to be used was jointly decided upon by a Senior Clinical Psychologist and an Assistant Psychologist, both of who work full-time onto the wards meaning they had a good understanding of the typical service-user population, and therefore of which apps would be most appropriate. Each potential application was downloaded and assessed for its suitability, and where there were a number of potential applications for one suggestion, these were compared to find the most appropriate. Through this process a number of applications were deemed to be unsuitable for a number of reasons; e.g. the number of advertisements. The tablet's memory size also had to be considered when choosing applications. Thus, it was decided that the tablets' home screens would have links to a number of websites where the memory taken up by the website's application would be too much, e.g. BBC News. Applications were also excluded if they were deemed to be unsuitable for a proof of concept project due to them needing a more rigorous review in order to assess their clinical suitability with inpatients (e.g. mindfulness and brain trainer applications). It was decided that such suggestions would be reconsidered in the future. The final applications also aimed to enhance the current ward activities conducted by Occupational Therapy (OT) staff; further enhancing the therapeutic effectiveness of these activities would be beneficial for both service-users and the staff, whom would be beginning this project with at least some familiarity to the new tablet-activities being introduced.

Overall, the final list of applications was decided upon based on those which were deemed to have the highest potential to be used effectively in a therapeutic capacity with service-users. A list of all applications and home screen links loaded onto the tablets is presented in Table 1. Applications with asterisks were added in week 1 of data collection following feedback from staff that the quiz applications originally chosen were not suitable for all service-users taking part, meaning a wider variety of quiz applications was needed.

2.2.1 Table 1

All applications and links loaded onto the tablets

Application / Link	Description	Theme
House of Memories (app)	Reminiscence app aimed at people living with dementia. View objects and share memories. Create a memory tree, box or timeline.	Reminiscence
Short Stories (app)	Short stories app. Stories can either be read by staff member, or played in audio format.	Occupation
Easy Quiz (app)	Easy quiz questions. Choose category.	Cognitive Stimulation
Quiz Time (app)	Medium-Hard quiz. Choose category.	Cognitive Stimulation
Guess The Song (app)*	Guess the song music quiz. Choose category.	Cognitive Stimulation
1960s Music Trivia (app)*	1960s music trivia quiz	Cognitive Stimulation
1960s TV Trivia (app)*	1960s television trivia quiz	Cognitive Stimulation
Amby (app)	Relaxing noises- can be played in background of almost any activity and used during relaxation sessions.	Sensory
YouTube (app)	Can be used to view almost any type of video you want, including music videos, songs with lyrics, old video clips, tutorials.	Sensory / Reminiscence
BBC News (link)	BBC News website to watch and read news stories.	Occupation
Fireworks Touch (app)	Sensory feedback app; touch the screen to view colourful fireworks with sound effects.	Sensory
Google Earth (app)	3D map of the world, can search anywhere in the world and view any distance from satellite image to street level.	Cognitive Stimulation
Skype (app)	Video calling application	Communication

Marks & Spencers (link)	Marks & Spencers website to browse	Occupation
Alzheimer's Society (link)	Alzheimer's Society website	Education
Sky Sports (link)	Sky Sports website	Occupation

Next, initial data was collected. A Groningen Frailty Index (GFI; Steverink et al., 2001)[4] was completed for each participant; a short 15-item screening instrument used to determine a person's level of frailty (K-R 20 = .71). The GFI screens for the loss of functions and resources in 4 domains; physical, cognitive, social, and psychological. The GFI is usually a self-report instrument, however in this study the answers were gained via discussions with staff, care plans and Electronic Care Record notes. Three of the psychosocial questions (10, 11 and 12) could therefore not be reliably answered subjectively, and so were not included. The authors state that, according to a panel of geriatric experts, a score of 4 or higher can be regarded as moderately frail (Steverink et al., 2001).

Data was then collected regarding each participant's engagement levels. The most relevant member(s) of staff for each participant (including Health and Wellbeing Workers, Occupational Therapists, Healthcare Support Workers and Staff Nurses) were asked two questions '*Please rate how likely you feel (participant name) is to engage with you in a 1:1 / Group activity*?'[5] Answers were given on a five point Likert scale, ranging from 'Extremely Likely' to 'Not At All Likely'. The separate answers were averaged to give a third engagement score of 'Overall Engagement'. Additionally, it was recorded whether each participant was in hospital due to experiencing dementia or a different mental health difficulty.

A one week period of staff training then took place. All OT staff attended a one hour group training session on the purpose and use of the tablets. Each member of staff was given

[4] See Appendix 4
[5] See Appendix 5

a tablet 'pack', containing a training manual[6] and all information and resources (e.g. data collection sheets) needed to conduct 1:1 and group activities using the tablet. Throughout the training week, staff spent as much time with the Assistant Psychologist as required to ensure they felt confident in using the tablets. During training week, the range of activities that can be conducted with the tablet in both 1:1 and group formats was emphasised in order to encourage staff to use numerous different activities that meet different service-user's preferences and needs. Together with the Assistant Psychologist, each ward's OT staff members developed a ward activity timetable. Each timetable scheduled in a House of Memories group activity twice weekly, and Reading group (short stories) and Quiz group once weekly to ensure some consistency in the groups being conducted. However, each ward's staff were aware of which activities would be most therapeutically effective for their ward's service-users, and therefore the timetables allowed for flexibility in the activities conducted.

Following this, tablet activities were implemented onto the wards with service-users and the data collection period took place; this lasted 5 weeks. Staff conducted tablet activities daily. Through feedback from staff and service-users, some amendments were made as mentioned earlier (downloaded extra quiz applications). Participants self-reported their mood before and after each tablet activity they engaged in, and their enjoyment of the activity after each session, where able. These were rated using 10 point pictorial scales[7]. Where participants were unable to self-report their mood, staff members subjectively reported this through observation. Participants were also asked whether they had any comments regarding the activity. Responses were recorded on data collection sheets and within Electronic Care Record daily notes[8]. Following the data collection period, service-user

[6] See Appendix 6
[7] See Appendix 7
[8] See Appendices 8 and 9

engagement levels were again collected for each participant from the same staff member asked at the beginning.

3 Results

Data was analysed via descriptive and comparative statistical analysis using SPSS 24.

3.1 Mood and Enjoyment

In total there were 259 recorded tablet activities, 252 mood ratings were provided.

A sign test was used to compare differences in overall pre- and post- activity mood scores. Results showed that of the 252 mood ratings, there was an increase in mood in 177 cases, no change in 74 cases, and a decrease in 1 case. Thus, mood was overall rated as higher following a tablet activity (Mdn = 8) than before (Mdn = 6); a statistically significant median increase of 1.00, z = 13.117 p < .001. Mean enjoyment rating was 7.89 (SD = 1.81). In 17.9% of cases (N = 45) staff members subjectively rated participants' mood and enjoyment via observation where participants were able to communicate this.

3.2 Dementia Mood and Enjoyment Ratings

A sign test with continuity correction was used to compare the differences in dementia participants' mood scores. Of the 120 tablet activities, there was an increase in mood in 94 cases, no change in 25 cases, and a decrease in 1 case. Thus, mood was overall rated as higher following a tablet activity (Mdn = 8) than before (Mdn = 6); a statistically significant median increase of 2.00, z = 9.439 p < .001. Mean enjoyment rating across all dementia participant cases was 8.18 (SD = 1.70). In 21.4% of cases (N = 27), staff members subjectively rated mood and enjoyment.

From male dementia participants, there were 40 recorded tablet activities; 35 mood ratings were provided; 15% (N = 6) were provided by the staff member. There was an improvement in mood in 32 cases, no change in 2 cases, and a decrease in 1 case. A Wilcoxon signed-rank test determined that there was a statistically significant increase in

mood pre-activity (*Mdn* = 6) compared to post-activity (*Mdn* = 8), $z = 4.980$, $p < .001$. The mean enjoyment rating was 7.54 (*SD* = 1.44).

From female dementia participants, there were 86 recorded tablet activities; mood ratings were provided in 85 cases; 24.4% (*N* = 21) were provided by the staff member. A sign test showed that of the 85 tablet activities, there was an increase in mood in 42 cases, no change in mood in 38 cases, and no reported decreases in mood. Thus, mood was overall rated as higher following a tablet activity (*Mdn* = 8) than before a tablet activity (*Mdn* = 6); a statistically significant median increase of 1.00, $z = 6.326$ $p < .001$. The mean enjoyment rating was 8.44 (*SD* = 1.74).

A Mann-Whitney U test was run to determine if there were differences in male and female dementia participants' mood score improvements. Results showed that the difference in males' mood scores was significantly larger (mean rank = 72.63) than female dementia participants' (mean rank = 55.51), $U = 1063$, $z = -2.524$, $p = .012$. A second Mann-Whitney U test, however, showed that female dementia participants' enjoyment ratings (mean rank = 66.69) were statistically significantly higher than male dementia participants' (mean rank = 45.47), $U = 2013.500$, $z = 3.110$, $p = .002$.

3.3 Mental Health Mood and Enjoyment Ratings

There were 133 tablet activities recorded with mental health participants. Mood scores were not provided in 1 case. A sign test with continuity correction showed that of the 132 recorded tablet activities, there was an increase in mood in 83 cases and no change in 49 cases. Thus, mood was overall rated as higher following a tablet activity (*Mdn* = 7) than before (*Mdn* = 5); a statistically significant median increase of 1.00, $z = 9.001$ $p < .001$. Mean enjoyment rating was 7.64 (*SD* = 1.87). In 13.5% of cases (*N* = 18) staff members subjectively rated participants' mood and enjoyment.

From male mental health participants, there were 80 recorded tablet activities; mood ratings were provided for all of these; 16.3% (N = 13) of ratings were provided by the staff member. A sign test showed that of the 80 activities, there was an increase in mood in 62 cases and no change in 23 cases. Thus, mood was overall rated as higher following a tablet activity (Mdn = 7) than before (Mdn = 5); a statistically significant median increase of 1.00, z = 7.747 p < .001. The mean enjoyment rating was 7.51 (SD = 2.01)

From female mental health participants, there were 53 recorded tablet activities, mood ratings were provided for 52 of these; 9.4% (N = 5) of these were provided by the staff member. A sign test showed that of the 52 tablet activities, there was an increase in mood in 41 cases and no change in 11 cases. Thus, mood was overall rated as higher following a tablet activity (Mdn = 7) than before (Mdn = 5); a statistically significant median increase of 1.00, z = 6.247 p < .001. The mean enjoyment rating was 7.83 (SD = 1.63).

Two Mann-Whitney U tests determined that there was no statistically significant difference in mood improvement scores between male (mean rank = 62.31) and female (mean rank = 72.95) mental health participants, U = 2415.500, z = 1.625, p = .104; nor was there a statistically significant difference between male (mean rank = 64.49) and female (mean rank = 69.60) mental health participants' enjoyment ratings, U = 2241, z = .765, p = .445 (distributions of scores were not similar, as assessed by visual inspection).

A Mann-Whitney U test was run to determine if there were differences in mood ratings between dementia and mental health participants. This was done using the difference score; i.e. the difference between pre- and post- activity mood ratings. Distributions of the difference scores were not similar, as assessed by visual inspection. Difference in mood ratings were statistically significantly higher in dementia participants (mean rank = 137.17) than mental health participants (mean rank = 116.80), U = 6639.5, z = -2.282, p = .022.

A second Mann-Whitney U test was run to determine if there were differences in enjoyment ratings between dementia and mental health participants. Distribution of enjoyment ratings was similar as assessed by visual inspection. Due to the median values being the same, both medians and mean ranks are reported to provide further information. Enjoyment scores were statistically significantly higher in dementia participants (*Mdn* = 8.00, mean rank = 137.33) than in mental health participants (*Mdn* = 8.00, mean rank = 116.66), *U* = 6620.5, *z* = -2.293, *p* = .022.

3.4 Engagement

In order to compare differences between pre- and post- overall engagement scores in dementia participants, a Wilcoxin signed-rank test was employed. The scores were symmetrically distributed, as assessed by a histogram. Of the 25 dementia participants, there was an increase in overall engagement in 20 participants, a decrease in 1 participant, and no change in 4 participants. Results determined that there was a statistically significant increase (*Mdn* = 1) in overall engagement scores between pre- (*Mdn* = 3) and post- (*Mdn* = 2) tablet activity period, *z* = -3.946, *p* < .001.

In order to compare differences between pre- and post- overall engagement scores in mental health participants, a sign test with continuity correction was employed. Of the 38 mental health participants, there was an increase in overall engagement in 29 participants, no change in 7 participants, and a decrease in 2 participants. Thus, overall in mental health participants, engagement scores were higher following the tablet activity data collection period (*Mdn* = 1.50) compared to pre-tablet activity period (*Mdn* = 3); a statistically significant median increase of 1.00, *z* = -4.670, *p* < .001.

An independent samples t-test was run to determine if there were differences in dementia participants' and mental health participants' improvement in overall engagement scores. Mental health participants' mean overall engagement improvement score (*M* = 1.26,

SD = 1.25) was higher than dementia participants' (*M* = 1.00, *SD* = 0.82), although this difference was not statistically significant, *M* = 0.26, 95% CI [0.78 to 0.26], *t*(60,999) = -1.013, *p* = .313.

3.4.1 1:1 Engagement

A sign test showed that of the 25 dementia participants, there was an increase in 1:1 engagement in 18 participants and no change in 7 participants. Overall, in dementia participants 1:1 engagement scores were higher following the tablet activity period (*Mdn* = 1) compared to before (*Mdn* = 3); a statistically significant median increase of 1.00, *z* = -4.007, *p* < .001.

In order to compare differences between pre- and post- 1:1 engagement scores in mental health participants, a Wilcoxin signed-rank test was employed. The scores were symmetrically distributed, as assessed by a histogram. Of the 38 mental health participants, there was an increase in 1:1 engagement in 30 participants, no change in 7 participants and a decrease in 1 participant. Results determined that there was a statistically significant increase (*Mdn* = 1) in 1:1 engagement scores between pre- (*Mdn* = 3) and post- (*Mdn* = 1) tablet implementation period, *z* = -4.794, *p* < .001.

A Mann-Whitney U test determined that there was no statistically significant difference in 1:1 engagement improvement scores between mental health (mean rank = 32.22) and dementia (mean rank = 31.66) participants, *U* = 483.500, *z* = .125, *p* = .901.

3.4.2 Group Engagement

In order to compare differences between pre- and post- group engagement scores, two sign tests with continuity correction were used; firstly for dementia participants' scores, and secondly for mental health participants' scores.

Of the 25 dementia participants, there was an increase in group engagement in 14 participants, no change in 10, and a decrease in 1. Overall, in dementia participants, group

engagement scores were higher following the tablet implementation period (*Mdn* = 2) compared to before (*Mdn* = 3), a statistically significant median increase of 1.00, $z = 3.098$, $p = .001$.

Of the 38 mental health participants, there was an increase in group engagement in 21 participants, no change in 14, and a decrease in 3. Overall, in mental health participants, group engagement scores were higher following the tablet implementation period (*Mdn* = 2) compared to before (*Mdn* = 3), a statistically significant median increase of 1.00, $z = -3.470$, $p < .001$.

A Mann-Whitney U test determined that there was no statistically significant difference in group engagement improvement scores between mental health (mean rank = 33.96) and dementia (mean rank = 29.02) participants, $U = 549.500$, $z = 1.089$, $p = .276$.

3.5 Activities

In total, there were 259 recorded tablet activities. The number of times a participant engaged in a tablet activity ranged from 1 to 17 ($M = 7.80$, $SD = 5.11$). The mean number of times a dementia participant engaged in a tablet activity was 8.94 ($SD = 5.25$); for mental health participants the mean was 6.71 ($SD = 4.74$). For male dementia participants, the mean was 4.30 ($SD = 2.02$); for female dementia participants, the mean was 11.09 ($SD = 4.90$). For male mental health participants, the mean was 8.28 ($SD = 5.14$); for female mental health participants, the mean was 4.36 ($SD = 2.76$). No significant difference was found between mental health participants and dementia participants in the number of activities undergone. ($U = 362.5$, $z = -1.611$, $p = .107$).

Two further Mann-Whitney U tests were run to determine if there were significant differences, firstly, in the number of times male and female dementia participants engaged in tablet activities; and secondly, if there were significant differences in the number of times male and female mental health participants engaged in tablet activities. The number of times

female dementia participants engaged in a tablet activity (mean rank = 77.42) was statistically significantly higher than for male dementia participants (mean rank = 33.56), $U = 2917.500$, $z = 6.306$, $p < .001$. In contrast, the number of times a female mental health participant engaged in a tablet activity (mean rank = 48.82) was statistically significantly lower than for male mental health participants (mean rank = 79.04), $U = 1156.5$, $z = -4.460$, $p < .001$.

Table 2 displays the frequency of each activity type; the number of participants the activity was completed with; and each activity's mean mood and enjoyment ratings. Data is provided split by dementia or mental health diagnosis.

3.5.1 Table 2

Descriptive statistics for each activity split by dementia or mental health diagnosis

	Dementia			**Mental Health**	
Activity Type	**Mean Mood Difference Score (± *SD*)**	**Mean Enjoyment Score (± *SD*)**	**Activity Type**	**Mean Mood Difference Score (± *SD*)**	**Mean Enjoyment Score (± *SD*)**
House of Memories (*N* = 19; 10 Ps)	1.22 (*SD* = .98)	8.16 (*SD* = 1.46)	**House of Memories** (*N* = 24; 16 Ps)	1.46 (*SD* = 1.79)	8.00 (*SD* = 1.23)
Quiz (*N* = 16; 8 Ps)	1.69 (*SD* = 1.25)	8.19 (*SD* = 1.50)	**Quiz** (*N* = 48; 22 Ps)	1.32 (*SD* = 1.66)	7.81 (*SD* = 1.79)
Google Earth (*N* = 8; 2 Ps)	2.38 (*SD* = 2.62)	9.75 (*SD* = .71)	**Google Earth** (*N* = 17; 10 Ps)	1.29 (*SD* = 1.06)	8.24 (*SD* = 2.11)
Reading Group (*N* = 3; 3 Ps)	0.33 (*SD* = .58)	4.00 (*SD* = 1.00)	**Reading Group** (*N* = 7; 7 Ps)	0.86 (*SD* = .70)	7.00 (*SD* = 2.08)
Relaxation (*N* = 1; 1 P)	3.00 (*SD* = 3)	8.00 (*SD* = 0)	**Relaxation** (*N* = 10; 8 Ps)	1.15 (*SD* = 1.16)	7.20 (*SD* = 2.25)

Music (*N* = 26; 13 Ps)	2.07 (*SD* = 1.23)	8.77 (*SD* = 1.51)	**Music** (*N* = 6; 4 Ps)	1.33 (*SD* = 0.82)	6.83 (*SD* = 1.84)
Reminiscence (*N* = 16; 10 Ps)	2.00 (*SD* = 1.04)	8.50 (*SD* = 1.35)	**Reminiscence** (*N* = 12; 6 Ps)	1.67 (*SD* = 1.30)	7.00 (*SD* = 2.17)
YouTube (*N* = 2; 2 Ps)	0	7 (*SD* = 0)	**YouTube** (*N* = 4; 4 Ps)	2.75 (*SD* = .96)	8.25 (*SD* = 1.71)
Fireworks (*N* = 8; 7 Ps)	0.75 (*SD* = .89)	7.63 (*SD* = 1.12)	**Fireworks** (*N* = 2; 2 Ps)	0.50 (*SD* = 0.71)	5.50 (*SD* = 2.12)
Shopping (*N* = 2; 2 Ps)	1.00 (*SD* = 1.00)	10.00 (*SD* = 0)	**Shopping**		
Current Affairs (*N* = 15; 10 Ps)	1.00 (*SD* = .88)	6.79 (*SD* = 1.81)	**Current Affairs** (*N* = 1; 1 Ps)	0	8.00 (*SD* = 0)
Amby (*N* = 1; 1 P)	0	5.00 (SD = 0)	**Amby** (*N* = 2; 2 Ps)	0.50 (*SD* = .71)	5.50 (*SD* = 2.12)
Sports (*N* = 3; 2 Ps)	2.66 (*SD* = 1.15)	8.33 (*SD* = .58)	**Sports**		
Translation (*N* = 2; 1 P)	1 (*SD* = 1.41)	10 (*SD* = 0)	**Translation**		
Google Chrome (*N* = 2; 1 P)	3.50 (*SD* = .71)	8.50 (*SD* = .71)	**Google Chrome**		

P: Participant

Table 3 displays the percentage split of 1:1 and group activities among dementia and mental health participants, split also by gender.

3.5.2 Table 3

Number of activities recorded and percentage of these which were 1:1 and Group activities

	Dementia (*N* = 126)	Male Dementia (*N*= 40)	Female Dementia (*N*= 86)	**Mental Health** (*N* = 133)	Male Mental Health (*N*= 80)	Female Mental Health (*N*= 53)
1:1	46.8% (*N* = 58)	47.5% (*N*= 19)	44.2% (*N*= 38)	23.3% (*N* = 31)	15% (*N*= 12)	35.8% (*N*= 19)
Group	53.2% (*N* = 67)	52.5% (*N* = 21)	55.8% (*N* = 48)	76.7% (*N* = 102)	85% (*N* = 68)	64.2% (*N* = 34)

4 Discussion

This evaluation investigated whether TT could be used as a therapeutic tool to improve mood immediately after use and level of engagement in dementia and older adult mental health inpatient settings. Hypotheses were confirmed; across all participants, mood was rated as significantly higher following a tablet activity. To further reiterate the strength of this finding, results showed that when analysed separately, there was a significant increase in mood for mental health participants; dementia participants; male dementia participants; female dementia participants; male mental health participants; and female mental health participants. Participant engagement levels significantly improved across the data collection period for both 1:1 and group activities. Additionally, participants rated a consistently high level of enjoyment from tablet activities.

These results support the literature stating that TT is an effective tool for increasing older adults' quality of life (Vroman, 2015). This conclusion has been drawn on the basis of

a range of evidenced benefits associated with using ICTs (van Ingen et al., 2017), such as: reduced cognitive decline (Chan, 2016); reduced social isolation and increased social participation (Khosravi et al., 2016); reduced depression (Anguera et al., 2016); and increased psychological wellbeing and life satisfaction (Cangelosi et al., 2014; Sims et al., 2016). These previous findings demonstrate positive outcomes in relation to predictors of frailty which are related to mental health; namely, cognitive decline (Robertson et al., 2013); loneliness and social isolation (John, Montgomery & Tyas, 2013; Salem et al., 2013); increased levels of anxiety and depression (Mhaoláin et al., 2012b); and decreased psychological wellbeing (Dent & Hoogendijk, 2014). Consequently, TT was used here as a new therapeutic tool to target these predictors of frailty. However, the previously evidenced benefits of using TT are focused upon long-term outcomes. The nature of an acute psychiatric inpatient setting necessitates focus of therapeutic benefits of using TT be on immediate, short-term outcomes. This is because patients residing in this setting are experiencing severe and enduring mental health difficulties and treatment is acute. Therefore initially improving mood and engagement is a priority, and subsequently necessary to allow for future therapeutic work to focus upon long-term outcomes outside of hospital. It was rationalised that improving patient mood and engagement would improve mental health, so target the predictors of frailty. Thus, the current findings extend the literature by demonstrating that TT is capable of eliciting short-term benefits; by significantly improving mood immediately and significantly improving engagement over a 5 week period. The results therefore support that TT is an appropriate tool to use for immediate therapeutic gain with service users. This benefit of using TT will likely serve to enhance therapeutic outcomes and facilitate more timely discharge back to the community; a key national aim (NICE, 2016).

Throughout the data collection process, the benefit of using a mobile resource was repeatedly highlighted. Using a mobile resource afforded a more opportunistic approach to service user engagement as opposed to scheduled ward activities. This facilitated an increase in person-centred care; TT provides a compre amount of potential activities, and service users were given choice over which activities they would like to engage in. Due to the nature of severe mental illness, many service users have difficulty with maintaining concentration on one activity or topic for very long. Having a mobile resource that could be carried around the ward enabled staff to immediately maximise on opportunities to engage with service users that may have otherwise passed had they needed to collect hard resources required to conduct a usual ward activity. Additionally, using tablets enables the facilitation of activities that follow service user attention and concentration between topics and interests that may change quickly in a short space of time. It seems likely that service user mood and engagement significantly increased largely due to the benefits associated with using an opportunistic, mobile resource.

This evaluation provides a springboard for further exploration of how we might exploit TT within inpatient psychiatric settings to enhance current care and further achieve person centred engagement. Given the need to find more cost effective ways to provide care, without compromising quality, this may be one way in which to enhance interventions and reduce hard resources. Furthermore, choosing affordable TT increases the possibility of families and carers to replicate its utility post discharge sustaining positive impact for the service user. More research is needed to assess the utility of TT in psychiatric inpatients, but results here show promise. Future research that considers the benefits of suggestions that were deemed to be outside the scope of the present research would be useful; for example, mindfulness, CBT and brain trainer apps. Suggestions such as these highlight how wide ranging the potential uses and benefits of implementing TT onto inpatient wards could be.

The tablets used here were not compatible with the pre-existing technology on the wards; investigating how using TT in line with other technologies (e.g. plugging into big screens) would likely highlight further benefits of using TT.

With regards to limitations: as this was a brief proof of concept service evaluation, data was collected over a short period of time. Hence, whilst short-term outcomes were effectively demonstrated, we were not able to investigate whether the previously found long-term benefits of TT apply to an inpatient population, nor did we follow up mood outcomes in the longer term. Due to this being a service evaluation, a control group design was not employed for both ethical and practical reasons. This would have been beneficial as activities were already being facilitated on the wards, albeit without TT, and it is unknown how significantly improved mood was in comparison to usual ward activities. Nevertheless, this does not take away from TT being therapeutically effective on its own, with many additional benefits that are not seen in pre-existing ward activities that utilise hard resources. Another limitation of this research is that validated measures were not used and rather scaled data was collected. This was to ensure data collection methods were simple enough that a broader range of service users could self-report their mood and enjoyment. Also, the nature of the setting and of this being a service evaluation meant that the time required to regularly complete validated measures of mood was not afforded. However, validated mood measures could be considered in future research. Finally, enjoyment is reported to be higher for dementia participants compared to mental health participants, however this may be due to more practitioner report of this scaled measure as opposed to more self-report from mental health participants. Future research could attempt to address this imbalance.

In conclusion, this proof of concept service evaluation has shown some new, promising findings and paved the way for much future research in the area of TT within inpatient settings. TT can now be considered an effective therapeutic tool to be used for

enhancing care for older adult psychiatric inpatients with regards short-term benefits, with potential to also elicit valuable long-term benefits.

5 References

Andrew, M. K., Fisk, J. D., & Rockwood, K. (2012). Psychological well-being in relation to frailty: a frailty identity crisis?. *International Psychogeriatrics*, *24*(08), 1347-1353.

Andrew, M. K., Mitnitski, A. B., & Rockwood, K. (2008). Social vulnerability, frailty and mortality in elderly people. *PLoS One*, *3*(5), e2232.

Anguera, J. A., Boccanfuso, J., Rintoul, J. L., Al-Hashimi, O., Faraji, F., Janowich, J. & Gazzaley, A. (2013). Video game training enhances cognitive control in older adults. *Nature*, *501*(7465), 97-101.

Arts, M. H., Collard, R. M., Comijs, H. C., Zuidersma, M., de Rooij, S. E., Naarding, P., & Voshaar, R. C. O. (2016). Physical frailty and cognitive functioning in depressed older adults: Findings from the NESDO study. *Journal of the American Medical Directors Association*, *17*(1), 36-43.

Astell, A. J., Ellis, M. P., Bernardi, L., Alm, N., Dye, R., Gowans, G., & Campbell, J. (2010). Using a touch screen computer to support relationships between people with dementia and caregivers. *Interacting with Computers*, *22*(4), 267-275.

Bortz, W. M. (2002). A Conceptual Framework of Frailty A Review. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, *57*(5), 283-288.

Cangelosi, P. R., & Sorrell, J. M. (2014). Use of technology to enhance mental health for older adults. *Journal of psychosocial nursing and mental health services*.

Chan, M. Y., Haber, S., Drew, L. M., & Park, D. C. (2016). Training older adults to use tablet computers: does it enhance cognitive function?. *The Gerontologist*, *56*(3), 475-484.

Chen, Y., & Feeley, T. H. (2014). Social support, social strain, loneliness, and well-being among older adults: An analysis of the Health and Retirement Study. *Journal of Social and Personal Relationships*, *31*(2), 141-161.

Chen, Y.-R.R., & Schulz, P.J. (2016). The effect of information communication technology interventions on reducing social isolation in the elderly: A systematic review. *Journal of Medical Internet Research, 18* (1), e18. doi:10.2196/jmir.4596

Chopik, W. J. (2016). The benefits of social technology use among older adults are mediated by reduced loneliness. *Cyberpsychology, Behavior, and Social Networking*, *19*(9), 551-556.

Clegg, A., Young, J., Iliffe, S., Rikkert, M. O., & Rockwood, K. (2013). Frailty in elderly people. *The Lancet*, *381*(9868), 752-762.

Cotten, S. R., Ford, G., Ford, S., & Hale, T. M. (2012). Internet use and depression among older adults. *Computers in human behavior*, *28*(2), 496-499.

Cotten, S. R., Ford, G., Ford, S., & Hale, T. M. (2014). Internet use and depression among retired older adults in the United States: A longitudinal analysis. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *69*(5), 763-771.

Dickens, A.P., Richards, S.H., Greaves, C.J., & Campbell, J.L. (2011). Interventions targeting social isolation in older people: A systematic review. BMC Public Health, 11, 647–647.

d'Orsi, E., Xavier, A. J., Steptoe, A., Oliveira, C., Ramos, L. R., Orrell, M. & Marmot, M. G. (2014). Socioeconomic and lifestyle factors related to instrumental activity of daily living dynamics: results from the English Longitudinal Study of Ageing. *Journal of the American Geriatrics Society*, *62*(9), 1630-1639.

Duarte, M., & Paúl, C. L. (2014). EPA-1479–Mental health indicators as predictor frailty in old age. *European Psychiatry*, *29*, 1.

Ekers, D., Webster, L., Van Straten, A., Cuijpers, P., Richards, D., & Gilbody, S. (2014). Behavioural activation for depression; an update of meta-analysis of effectiveness and sub group analysis. *PloS one*, *9*(6), e100100.

Fillit, H., & Butler, R. N. (2009). The frailty identity crisis. *Journal of the American Geriatrics Society*, *57*(2), 348-352.

Francis, J., Kadylak, T., Cotten, S. R., & Rikard, R. V. (2016). When it comes to depression, ICT use matters: A longitudinal analysis of the effect of ICT use and mattering on depression among older adults. *International Conference on Human-Computer Interaction*, 301-306.

Gale, C. R., Cooper, C., & Aihie Sayer, A. (2015). Prevalence of frailty and disability: findings from the English Longitudinal Study of Ageing. *Age and ageing*, *44*(1), 162-165.

Gale, C. R., Cooper, C., Deary, I. J., & Sayer, A. A. (2014). Psychological well-being and incident frailty in men and women: the English Longitudinal Study of Ageing. *Psychological medicine*, *44*(04), 697-706.

Godin, J., Armstrong, J. J., Rockwood, K., & Andrew, M. K. (2017). Dynamics of Frailty and Cognition After Age 50: Why It Matters that Cognitive Decline is Mostly Seen in Old Age. *Journal of Alzheimer's disease*, (Preprint), 1-12.

Godin, J., Armstrong, J. J., Wallace, L., Rockwood, K., & Andrew, M. K. (2016). The impact of frailty and cognitive decline on quality of life: how does social context matter? *Alzheimer's & Dementia: The Journal of the Alzheimer's Association*, *12*(7), 809.

Holtfreter, K., Reisig, M. D., & Turanovic, J. J. (2017). Depression and infrequent participation in social activities among older adults: the moderating role of high-quality familial ties. *Aging & mental health*, *21*(4), 379-388.

John, P. D. S., Montgomery, P. R., & Tyas, S. L. (2013). Social position and frailty. *Canadian Journal on Aging/La Revue canadienne du vieillissement*, *32*(03), 250-259.

Kulmala, J., Nykänen, I., Mänty, M., & Hartikainen, S. (2014). Association between frailty and dementia: a population-based study. *Gerontology*, *60*(1), 16-21.

Lohman, M. C., Mezuk, B., & Dumenci, L. (2017). Depression and frailty: concurrent risks for adverse health outcomes. *Aging & mental health*, *21*(4), 399-408.

Mezuk, B., Edwards, L., Lohman, M., Choi, M., & Lapane, K. (2012). Depression and frailty in later life: a synthetic review. *International journal of geriatric psychiatry*, *27*(9), 879-892.

Mhaoláin, A. M. N., Gallagher, D., Connell, H. O., Chin, A. V., Bruce, I., Hamilton, F., ... & Walsh, J. B. (2012). Subjective well-being amongst community-dwelling elders: what determines satisfaction with life? Findings from the Dublin Healthy Aging Study. *International psychogeriatrics*, *24*(02), 316-323.

Mhaoláin, A. M. N., Gallagher, D., Crosby, L., Ryan, D., Lacey, L., Coen, R. & Lawlor, B. A. (2011). Correlates of frailty in Alzheimer's disease and mild cognitive impairment. *Age and ageing*, *40*(5), 630-633.

Office for National Statistics (2017, June 1st). *Internet users in the UK: 2017*. Retrieved from https://www.ons.gov.uk/businessindustryandtrade/itandinternetindustry/bulletins/internetusers/2017#recent-internet-use-for-those-aged-65-and-over-is-catching-up-with-younger-age-groups

Park, D. C., Gutchess, A. H., Meade, M. L., & Stine-Morrow, E. A. (2007). Improving cognitive function in older adults: Nontraditional approaches. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *62*(Special Issue 1), 45-52.

Park, D. C., Lodi-Smith, J., Drew, L., Haber, S., Hebrank, A., Bischof, G. N., & Aamodt, W. (2014). The impact of sustained engagement on cognitive function in older adults: the synapse project. *Psychological science*, *25*(1), 103-112.

Peek, M. K., Howrey, B. T., Ternent, R. S., Ray, L. A., & Ottenbacher, K. J. (2012). Social support, stressors, and frailty among older Mexican American adults. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *67*(6), 755-764.

Pinto-Bruno, Á. C., García-Casal, J. A., Csipke, E., Jenaro-Río, C., & Franco-Martín, M. (2017). ICT-based applications to improve social health and social participation in older adults with dementia. A systematic literature review. *Aging & mental health*, *21*(1), 58-65.

Proyer, R. T., Gander, F., Wellenzohn, S., & Ruch, W. (2014). Positive psychology interventions in people aged 50–79 years: long-term effects of placebo-controlled online interventions on well-being and depression. *Aging & Mental Health*, *18*(8), 997-1005.

Robertson, D. A., Savva, G. M., & Kenny, R. A. (2013). Frailty and cognitive impairment—a review of the evidence and causal mechanisms. *Ageing research reviews*, *12*(4), 840-851.

Robinson, T., Gogniat, M., Renzi, L., Hammond, R., & Miller, L. (2016). A-21Does Frailty Moderate the Relationship Between Reserve and Cognitive Function. *Archives of Clinical Neuropsychology*, *31*(6), 591-591.

Rowe, J. W. & Kahn R, L. (2015). Successful aging 2.0: conceptual expansions for the 21st century. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *70*, 593–596.

Salem, B. E., Nyamathi, A. M., Brecht, M. L., Phillips, L. R., Mentes, J. C., Sarkisian, C., & Leake, B. (2013). Correlates of frailty among homeless adults. *Western journal of nursing research*, *35*(9), 1128-1152.

Ruppel, E. K., Blight, M. G., Cherney, M. R., & Fylling, S. Q. (2016). An exploratory investigation of communication technologies to alleviate communicative difficulties and depression in older adults. *Journal of aging and health*, *28*(4), 600-620.

Schuurmans, H., Steverink, N., Lindenberg, S., Frieswijk, N., & Slaets, J. P. (2004). Old or frail: what tells us more?. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, *59*(9), 962-965.

Shillair, R. J., Rikard, R. V., Cotten, S. R., & Tsai, H. Y. (2015). Not so lonely surfers: loneliness, social support, Internet use and life satisfaction in older adults. *iConference 2015 Proceedings*.

Sims, T., Reed, A. E., & Carr, D. C. (2016). Information and Communication Technology Use Is Related to Higher Well-Being Among the Oldest-Old. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, gbw130.

Sourial, N., Bergman, H., Karunananthan, S., Wolfson, C., Guralnik, J., Payette, H., ... & Zhu, B. (2012). Contribution of frailty markers in explaining differences among individuals in five samples of older persons. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, *67*(11), 1197-1204.

Soysal, P., Veronese, N., Thompson, T., Kahl, K. G., Fernandes, B. S., Prina, A. M., ... & Lin, P. Y. (2017). Relationship between depression and frailty in older adults: A systematic review and meta-analysis. *Ageing Research Reviews*, *36*, 78-87

Steverink, N., Westerhof, G. J., Bode, C., & Dittmann-Kohli, F. (2001). The personal experience of aging, individual resources, and subjective well-being. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *56*(6), 364-373.

Theou, O., Brothers, T. D., Rockwood, M. R., Haardt, D., Mitnitski, A., & Rockwood, K. (2013). Exploring the relationship between national economic indicators and relative fitness and frailty in middle-aged and older Europeans. *Age and ageing*, aft010.

Tsai, H. Y. S., Shillair, R., Cotten, S. R., Winstead, V., & Yost, E. (2015). Getting grandma online: Are tablets the answer for increasing digital inclusion for Older Adults in the US?. *Educational gerontology*, *41*(10), 695-709.

van Ingen, E., Rains, S. A., & Wright, K. B. (2016). Does Social Network Site Use Buffer against Well-Being Loss when Older Adults Face Reduced Functional Ability?. *Computers in Human Behavior*.

Vaportzis, E., Martin, M., & Gow, A. J. (2016). A Tablet for Healthy Ageing: the Effect of a Tablet Computer Training Intervention on Cognitive Abilities in Older Adults. *The American Journal of Geriatric Psychiatry*.

Vroman, K. G., Arthanat, S., & Lysack, C. (2015). "Who over 65 is online?" Older adults' dispositions toward information communication technology. *Computers in Human Behavior*, *43*, 156-166.

Woo, J., Goggins, W., Sham, A., & Ho, S. C. (2006). Public health significance of the frailty index. *Disability and rehabilitation*, *28*(8), 515-521.

Woo, J., Goggins, W., Sham, A., & Ho, S. C. (2005). Social determinants of frailty. *Gerontology*, *51*(6), 402-408.

Xavier, A. J., d'Orsi, E., de Oliveira, C. M., Orrell, M., Demakakos, P., Biddulph, J. P., & Marmot, M. G. (2014). English Longitudinal Study of Aging: can Internet/E-mail use reduce cognitive decline?. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, *69*(9), 1117-1121

6 Appendices

Appendix 1: Qualitative data collected off the wards on tablet usage suggestions

Thematic Analysis of Tablet Suggestion Data

Bronte

- Staff 2
- Family 4

Question 1

- Music, Elvis Presley, Old video clips, Dancing, OTS baking and dancing lessons
- Music, Pictures, Books- Kindle, Reminiscence, little simple games like missing objects and trying to find stuff. Card games. Short stories.
- Flashcards for dementia, dollies?
- Speaking books and newspapers
- Special apps for older people, simple ones. Reminiscence.
  Virtual pets, jazz dancing, music, old video clips from 30s/40s
- Keep things as simple as possible, and age-appropriate. Youtube. Beauty and vanity related things, nails, make-up, hair.
- Tactile stuff, physical contract. Consistency and continuity.
- Often dementia patients feel they are at the most productive time of their life, so maybe a working / work-related app.
- App for family around dementia awareness / information for relatives when they come in
- Pictorial app, storyboard.
- Feelings app.

Question 2

- Nostalgia on dementia wards- less clinical. During 1:1 time with patients.
- In groups and to do quizzes and bingo
  To try and use different sorts of apps / pictures and use it on 1:1 to encourage engagement
  Using them to find out what triggers are good for patients. Using them to encourage engagement.
  Use them as a distraction.
  Best to use them primarily individually, on 1:1 basis to encourage engagement during levels.

Wordsworth

- Staff 8
- Family 2

Question 1

- Games. Make notes / lists to remember. News. Books.
- Youtube. Bingo. Games. Google.

- Quiz apps.
  Utilise youtube.
  Music already transferred onto it, Spotify account- think about being able to use it quickly and without the internet.
- Virtual pet app- pet therapy with the ipad. Music app.
- Spotify would be useful as an app to download, picture guessing fames. Scrabble- board games on a tablet. Picture quizzes.
- Chess & draughts & card games e.g. solitaire
  Photo and video apps
  Music apps.
  Ancestry websites.
  Street view apps.
- Things from the past. The way we used to live. Old photographs.
- Music apps, photo album, family tree, colouring, card games, chess, back gammon, scrabble, memory games.
- Games
- Live sport apps (and re-playable sport videos).
  Card games. Board Games.
  Music Apps. Quiz Apps.

Question 2

- In groups.
- Play things in group. Individually.
- 1:1
- 1:1 engagement and activity
  Pet therapy interaction.
  Create individual playlists for patients / groups.
- They would be therapeutic to patients who love music and would help them to relax.
- Use of games service users have enjoyed or might like to try out. Being able to watch classic videos or see old photos. Listen to classic or relaxing music. Being able to view family tree and places service users have lived in the past.
- Reminiscence therapy. Using images to evoke happy memories, i.e. childhood holidays. Xmas in the past.
- Learn about their family, promote engagement. Learn about the cognition and skills. Therapeutic engagement with individuals or groups. Used as an assessment tool.
- May help with memory, agitation, enhancing current mood.
  Visuals might prompt a form of easier communications between staff and service users.
  Everyone has hobbies and being able to watch an activity that they used to do may help with getting them to perform a new activity
  It will enhance 1:1s between staff and service users.

Austen

- Patient 4
- Relative 2

- Unknown 2

Question 1

- Music. Films. Crosswords. Puzzles. Read the news. Relaxation exercises. Positive thinking and positive thoughts instead of negative magazines.
- Not games. Craft. Music / Radio. Photos. I've no idea how to use it.
- Spotify, I want some more music. BBC Radio 4. BBC Iplayer. Youtube. Google and Safari to look at clothes. Being able to look words up.
- Easy crosswords. Online shopping. Games to give confidence to use machine. Quizzes – egghead.
- Solitaire. Boggle. Quizzes. Google chrome to search. Books.
- Album – to keep memorable photographs of families, pets etc.
  Videocalls – to see and speak.
  Music
- 50/60s music. Jenga- simple games. Film. Magic. Old sitcoms- gone with the wind.
  Picures on 1:1 for what interests them.

Question 2

- I wouldn't like it in groups as it's a bit too much. I'd like it 1:1 otherwise I'd tend to follow others.
- 1:1 with staff. In a group would be good as not that interested so if you're in a group it might hold interest a bit more.
- To use individually.
- 1:1 with staff as don't know how to use them.
- Anything that would help with outside living. Emails.
- Showing photographs of family. Listening to music. Games.
- Using the apps. Groups to encourage engagement and involvement. 1:1.

Dickens

- Patient 4
- Staff 3
- Unknown 3
- Relative 3

Question 1

- game to look after virtual pets.
- Reading papers. Word searches as easier on ipad than with pen and paper for dementia patients as you can just press buttons.
  Skype is a really good idea.
  Pictures of families?
- Information- medical knowledge about mental health and conditions.
- Games- card games and board games.
- Information to research things you're interested .
  No games. Listening to music.
- Music. Newspapers. Magazines. Sports updates and results.

- Relatives and family photos. Animals app. Hobbies.
- Films- age appropriate to help with reminiscence/ Musicals black and white, where they'd recognise songs e.g. Grease.
  Brain training apps to keep active.
- Life story. All about me. Holidays and pictures. Personal profile for each patient.
- Music apps to put favourite song on.
  Sensory apps for light- fish tank apps.
  Films. Card games / dominos.
- Family tree.
- Films and era related programmes to reminisce. Simple puzzles.
- Interested in animals and holidays. Maps

Question 2

- use with a member of staff or in a group. It's too hard on own.
- Staff should sit and explain apps / ipads to service users and useful to families to use where they are stuck for conversations etc. Therefore helping social inclusion.
- Would like to be taught how to use one so could use it alone.
- Good for using during levels, main problem here is levels.
- Use as a tool to engage.
- Engagement and interacting with patients. Depends on individual whether they want to use it in a group or independently.
- Interacting 1:1 and helping with engagement.
- Dependent upon service users, groups are no good if the service users are opposites, but if could find common theme could be useful.
- Use individually.
- Help to navigate round tablet and motivate patients to use them.

Appendix 2: Table displaying themes that emerged through thematic analysis of the qualitative data collected off the wards on tablet usage suggestions

Occupation		Education		Communication		Reminiscence		Sensory		Cognitive Stimulation		Not Tablet Related
Something work related	No suitable apps	App for family around dementia awareness/information for relatives	No suitable app, can provide websites which are accessible through chrome	Flashcards for dementia	Flashcards+	Old video clips from 30s/40s	Yesterday USA Old Time Radio YouTube	Age appropriate films / Musicals	YouTube	Simple games	Live Butterflies Talking Tom Cat Pocket Penguins Slots Heaven Tic-Tac-Toe Hangman Color by Numbers (vehicle / flower)	Dancing/Jazz dancing
MH information	No suitable apps- can provide link to website instead.			Feelings app	No suitable app	Pictures Photo apps/photo album	Getty Images Drawing Pad Fingerpaint Magic	Elvis Presley	YouTube	Missing objects / trying to find things	No suitable apps	Kindle
Short stories	Connu			Pictorial/storyboard	No suitable storyboard app	Life Story	No suitable app	Youtube	YouTube	Card Games	Solitaire	Beauty and Vanity related things
Speaking books and newspapers Books Magazines	Audio-books Newspaper and magazine websites accessible			Skype	Skype	Street view apps Maps	Google Maps Google Earth	Music ready to use quickly and easily without	Cajonazo Pandora Radio	Information search/ google	Chrome- already on tablets	Make notes, lists to remember

	through chrome							internet				
News	BBC News							Spotify	Spotify	Bingo	See list of games apps	Pet therapy
Being able to research information	Google Chrome (already on tablet)					Things from the past / the way we used to live / old photographs	House of Memories	Radio / Radio 4	Via Chrome	Quiz apps - eggheads	See list of games apps	Ancestry websites- no suitable apps.
Live Sport Apps / Sports updates and results	Sky Sports							50s / 60s music	Via Chrome / YouTube	Picture guessing games	See list of games apps	Family
Online Shopping	Can access shopping websites through google chrome							Fish Tank App	? find one when uploading tablets	Picture quizzes	See list of games apps	Dominos
Virtual pets	Touch pet dogs Pocket Pond 2							Sensory apps for light	ILoveFire works Kaleidoscope	Chess	See list of games apps	Craft
										Draughts	See list of games apps	Magic
											See list of games apps	All About Me
												Personal profile for each patient

										Puzzles - easy		
										Crosswords		
										Boggle		
										Aid relaxation	Calm Meditation and Mindfulness for Relaxation Relax Melodies Oriental Meditation Relaxing Sounds of Nature	
										Positivity App		
										Word Searches		
										Brain Training apps	Lumosity Brainy App Fits Brains Trainer	

Tablet Data Colour Key:

Bronte Wordsworth Dickens Austen

Appendix 3: Initial list of potential applications

Suggested Apps

Found through Google / GooglePlay

Live Butterflies - Through the 'viewer' (camera) you can see butterflies around you. Touching the screen makes butterflies land on your finger. You can also play a game of catching butterflies.

Talking Tom Cat - It's a pet cat that responds to touch and repeats everything you say with a funny voice. This is one of the top 3 apps rated by care home residents in the University of Worcester study

Kaleidoscope - a simple drawing game with eight kinds of kaleidoscope modes and full of bright colours.

ILoveFireworks - Real looking and sounding firework displays appear just by dragging your fingers across the screen

Drawing Pad - Choose paint brushes, crayons, pens or chalk and create fab art with your fingers

Yesterday USA Old Time Radio - old time radio shoes 1920s-1950s

Pandora Radio- personalise radio song-lists

Cajonazo – music, learn to tap the screen to play flamenco rhythm sounds

Fingerpaint Magic – lets the user paint with a rainbow of colours

Pocket Pond 2 – enjoy feeding the koi and decorating a pond

Pocket Penguins – streaming live video from Calif Academy of Sciences' Penguin Exhibition

Google Earth – like Google Maps except a real camera picture view

Getty Images – 46 million images, searchable by word, e.g. 'sunset'

Calm Meditation and Mindfulness for Relaxation – schedule your perfect calm

Relax Melodies Oriental Meditation – 36 peaceful sounds

Relaxing Sounds of Nature – mix and match sounds, automatic shut off timer

Lumosity – memory and brain performance work outs

Brainy App – brain games for memory and thinking skills

Fit Brains Trainer – concentration, memory and problem-solving app

Tic-Tac-Toe (noughts and crosses)

Backgammon

Color by Numbers – vehicles

Flick Kick Football - a simple football game allowing players to recreate the excitement of scoring goals over and over again.

Word – Search

Sky Sports

Connu

Touch Pet Dogs

Color by Numbers – Flowers

Dominoes

Solitaire

Pro Darts 2014

Four in a Row (Connect 4)

Gin Rummy

Penny Dell Crosswords

QuizUp – free, award winning multiplayer trivia game. Challenge friends and meet new people who share your interests

Spell Mania- word spelling games and boggle trainer

Breathe2Relax- Diaphragmatic breathing has been shown to reduce anxiety and stress while inducing calm. Breathe2Relax is a helpful app for anyone who wants to practice deep breathing but isn't experienced in doing so.

Apps found through ORCHA: Organisation for the Review of Care and Health Applications

Keys to Care

Amby

Relax Meditation Sleep Sounds

Thunder Sounds Sleep Sounds

Relax Lite Stress Relief

Self-Help Anxiety Management

Appendix 4: Groningen Frailty Index (Steverink et al., 2001)

GFI (Groningen Frailty Index)

Circle the appropriate answer and add scores

	YES	NO	
Mobility. Can the patient perform the following tasks without assistance from another person (walking aids such as a can or a wheelchair are allowed)			
1. Grocery shopping	0	1	
2. Walk outside house (around house or to neighbour)	0	1	
3. Getting (un)dressed	0	1	
4. Visiting restroom	0	1	
Vision			
5. Does the patient encounter problems in daily life because of impaired vision?	1	0	
Hearing			
6. Does the patient encounter problems in daily life because of impaired hearing?	1	0	
Nutrition			
7. Has the patient unintentionally lost a lot of weight in the past 6 months (6kg in 6 months or 3kg in 3 months)?	1	0	
Co-morbidity			
8. Does the patient use 4 or more different types of medication?	1	0	
	YES	**NO**	**SOMETIMES**
Cognition			
9. Does the patient have any complaints on his/her memory (or diagnosed with dementia)?	1	0	0
Psychosocial			
10. Does the patient ever experience emptiness around him? *e.g. You feel so sad that you have no interest in your surroundings. Or if someone you love no longer love you, how do you feel?*	1	0	1
11. Does the patient ever miss the presence of other people around him? *Or do you miss anyone you love?*	1	0	1
12. Does the patient ever feel left alone? *e.g. You wish there is someone to go with you for something important.*	1	0	1
13. Has the patient been feeling down or depressed lately?	1	0	1
14. Has the patient felt nervous or anxious lately?	1	0	1
Physical Fitness			
15. How would the patient rate his/her own physical fitness? (0-10 ; 0 is very bad, 10 is very good) 0 – 6 = 1 7 – 10 = 0	1	0	
TOTAL SCORE GFI			

Appendix 6 – PS (Performance Status)

0		Normal activity without restriction.
1		Restricted in physically strenuous activity but ambulatory and able to carry out light work.
2		Ambulatory and capable for all self-care, unable to carry out any work and about >50% of waking hours.
3		Capable only limited self-care, confined to bed or chair and about <50% of waking hours.
4		Completely disabled, cannot carry on any self-care, totally confined to bed or chair.

Appendix 5: Example of table collecting post-data collection period engagement levels

Dickens Ward – Post Engagement Levels

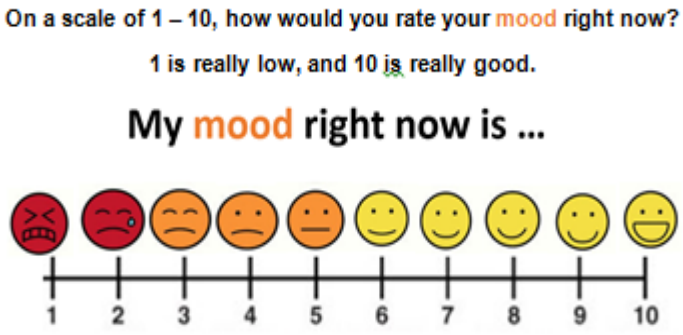
Please rate how likely you feel each service user is to engage with you in a 1:1 or group activity?

1. Extremely Likely
2. Very Likely
3. Somewhat Likely
4. Not Very Likely
5. Not At All Likely

Participant Number	Service User	Overall Engagement Level	1:1 Engagement Level	Group Engagement Level	GIF Score	Diagnosis
1		1.5	1	2	3	Schizophrenia
2		2	2	2	6	Recurrent Depressive Disorder
3		4	3	5	6	Depression
4		1	1	1	6	Recurrent Depressive Disorder
5		2	2	2	7	Schizophrenia
6		4	3	5	11	Severe Depressive Disorder Dementia?
7		1	1	1	4	Alzheimer's Dementia
8		5	5	5	8	Depressive disorder with psychotic symptoms
9		4.5	4	5	10	Schizophrenia Learning Disability
10		1	1	1	4	Bipolar Disorder

Appendix 6: Staff training manual – please see attached document / handout

Appendix 7: Pictorial rating scales

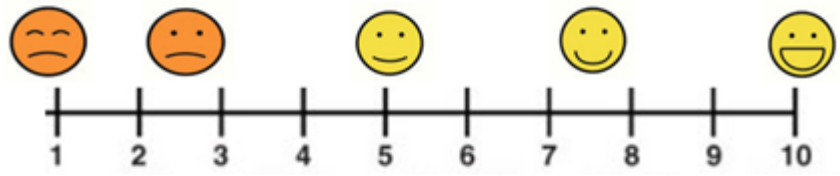


The face scale may help service users who might struggle answering questions. Service users can point to the number / face which best describes their mood. For consistency, please **always** show service users the face scale when asking the mood question.

On a scale of 1 – 10, how much did you enjoy the activity we have just done?

1 is did not enjoy it at all, and 10 is enjoyed it a lot!

Out of 10, I enjoyed this activity…



Again, the face scale may help service users who might struggle answering questions. Service users can point to the number / face which best describes their level of enjoyment. For consistency, please **always** show service users the face scale when asking the enjoyment question.

Appendix 8: Data collection sheets

Name:

On a scale of 1 – 10, how would you rate your mood right now?

1 is really low, and 10 is really good.

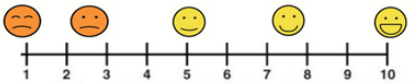
My mood right now is …

Please circle your answer.

On a scale of 1 – 10, how much did you enjoy the activity we have just done?

1 is did not enjoy at all, and 10 is enjoyed it a lot!

Out of 10, I enjoyed this activity…



Please circle your answer.

Name:

On a scale of 1 – 10, how would you rate your mood right now?

1 is really low, and 10 is really good.

My mood right now is …

Please circle your answer.

Appendix 9: Example ECR entry

Last Contact Date/Time. Fri, 24 March 2017 15:50

Recorded By Jane Royle

Notes

Occupational therapy/ therapeutic engagement session using tablet
Health and wellbeing worker Jane Royle
10:00 Quiz trivia
Harold was invited to participate in the quiz, he was reluctant and negative about not being able to answer any of the questions asked. Reassurance was given that we where all in the same predicament and if we did not know the answer we would guess then the tablet would tell us if we where correct or not. Harold did join us. He was quiet and only spoke when asked what he thought the answer was directly not really joining in with the group. He did not use facial expressions and no enjoyment was shown even when he got a question right. Harold remained in the group for the hole session.
Mood rating before 2
Mood rating after 2
Enjoyment Rating 4