

ORIGINAL ARTICLE

The use of digital touch screen technology to deliver reminiscence therapy among people with dementia in Jordanian care homes: a mixed-method feasibility study

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Dementia is a progressive degenerative disease characterised by decreased cognitive abilities and deterioration of behavioural functions.^{1,2} In 2017, the global prevalence of dementia was estimated at 50 million, and it is predicted to be around 141 million by 2050.² Worldwide, the annual cost of treating and caring for dementia patients exceeds

600 billion dollars.³ There are few studies reporting on the prevalence and economic burden of dementia, specifically in Jordan. It is estimated that dementia deaths account for 5.17% of all fatalities in Jordan;⁴ one recent study (n = 31 411) identified a total prevalence of dementia for those over 65 years old at 1.94%.⁵

Abstract

Background: Using technology to deliver psychosocial interventions such as reminiscence therapy (RT) to people with dementia may improve their mental health. Yet, establishing the feasibility of digital interventions in low- to middle-income countries is still in the early stages. This study aimed to: (i) determine the feasibility of using digital touch screen technology to deliver RT among people with dementia living in Jordanian care homes; and (ii) compare study outcomes pre- and post-reminiscence sessions to investigate whether specific outcomes are sensitive to change and explore the acceptability and experiences of the intervention.

Methods: A pragmatic mixed-method study design was implemented. Sixty residents with dementia were recruited from two Jordanian care homes (Site 1: n = 35; Site 2: n = 10). A process evaluation was conducted alongside a single-group pre-post-intervention study. The intervention involved 10 supported RT sessions of up to 1 h each, delivered over 5 weeks. Feasibility was determined by assessing the rate of recruitment, adherence, retention, data completion, implementation fidelity, and adverse events. Qualitative semi-structured interview questions were used to explore experience and acceptability, and data were thematically analysed.

Results: Response rate was 100%; loss to follow up at post-intervention was 25%. Median session attendance for those who received the intervention was 80%. No serious adverse events were reported. A positive, statistically significant and clinically relevant difference was found in all outcome measures before and after reminiscence sessions. Qualitative findings suggest that digital RT intervention is generally well accepted by people with dementia who reported positive changes, including enhanced communication and cognitive abilities.

Conclusion: Using digital touch screen technology to deliver RT is feasible and acceptable among people with dementia in Jordanian care homes. Digital RT intervention is a promising approach to improving mental health and communication for people living with dementia.

Numerous pharmacological and non-pharmacological techniques are used to manage the cognitive and behavioural symptoms associated with dementia.⁶ Pharmacological approaches can be used to lessen the symptoms associated with dementia.⁷ However, they do not always address symptoms, and there are potential risks and side effects. Therefore, people with dementia are usually offered pharmacological treatment combined with non-pharmacological approaches to manage symptoms.⁸ Non-pharmacological techniques are recommended as a first-line treatment to avoid the need for medication for non-cognitive symptoms.⁵ Behaviour therapy,⁸ validation therapy,⁵ and reminiscence therapy (RT)^{9,10} are examples of such approaches.

Reminiscence therapy, the primary intervention in this study, uses accounts of historical events (written, oral, imagery or a combination) to improve psychological well-being in recipients.¹⁰ RT may positively impact quality of life (QOL) and cognitive functioning.^{9,11} The primary goal of RT for those living with dementia is to promote well-being by evoking memories through tangible triggers such as music, objects, photos, and videos.^{11,12} It plays a critical role in preserving a person's sense of self-esteem, identity, problem-solving, communication, and well-being and assisting with death preparation for people with dementia.^{11,13} This therapy can also improve social interaction, mood, cognition, and behaviour;¹³ reduce social isolation; provide a fun and stimulating activity; and foster self-worth.¹⁴ Using technology to impart RT's content affords people with dementia an opportunity to maintain meaningful social interaction and eliminate marginalisation.¹⁵

This study targets people living with dementia in the Hashemite Kingdom of Jordan, Middle East. In general, storytelling is the most common form of reminiscence among Jordanians, evident through their socio-political, cultural, and religious activities.¹⁶ Narrating these stories and experiences embraces strategies of handling losses and disabilities resulting from wars and poverty. Painful memories often include rumination linked to failures, loss of loved ones, regret, and guilt. Conversely, pleasurable memories centre around family life, service in the military, and social events. Jordanians glorify their past and history, which is frequently related to people who have died or are physically not present.¹⁷

To our knowledge, there are no prior studies reporting the use of digital touch screen technology

to deliver RT among people living with dementia in the Middle East. The existing literature in the Middle East examining the effectiveness of RT among people living with dementia is relatively sparse and is limited to studies in Turkey ($n = 3$) and Iran ($n = 2$). Of these, one study utilised technology to deliver reminiscence sessions among Turkish older adults living with dementia, rather than examining the information and communication technology's feasibility in facilitating RT.¹⁵ These studies reported mixed results and used varied methodological approaches. Some studies have concluded that RT is an effective intervention in improving cognitive function,^{15,18,19} depression,^{18–20} QOL,¹⁹ activities of daily living,¹⁸ and apathy¹⁵ in patients living with dementia. A study from Turkey¹⁵ found that patients in the intervention group who received group RT combined with internet-based videos reported improvements in cognitive function and apathy levels.

Digital technologies are becoming increasingly available and are developing at an accelerated pace,²¹ and there is a growing interest in using digital touch screen technology to deliver interventions in dementia care. Studies have shown that digital touch-screen technology can be a useful platform for delivering psychosocial interventions in high-income countries and areas of the world where healthcare is more advanced, and that people with dementia in such settings will engage with the technology.²²

Several researchers have used advanced technologies to enhance the accessibility and usability of RT, such as digital RT.²³ Digital RT is a practical technique to deliver RT using dynamic and convenient memory stimuli. Although digital RT helps facilitate reminiscences for people with dementia, the use of digital technology in health care is still in the early stages in low- to middle-income countries such as Jordan. It is unknown whether this approach is acceptable, feasible or effective in Jordanian people with dementia and their caregivers. Furthermore, in Jordan, specialised centres for the assessment and treatment of dementia are minimal. Family plays a vital role in Jordanian society, and people with dementia gain high status within the family structure; offering dementia care within the family is a key feature within the culture and religious parameters of the Jordanian community.⁵ Therefore, studies conducted elsewhere may not be generalisable to the Jordanian context. The current study contributes to the international literature on reminiscence

in the context of dementia care. Our study aims to explore the feasibility and acceptability of a digital intervention to deliver RT to people with dementia living in care homes in Jordan. The study will also determine which outcome measures are most appropriate for evaluating digital RT delivery to people with dementia in Jordan, which can be used in a subsequent definitive trial.

METHODS

Design

This is a pragmatic mixed-method research study involving a 5-week single-group feasibility trial with process evaluation. The study reporting adheres to the Consolidated Standard of Reporting Trials (CONSORT) statement²⁴ and the intervention is reported in line with the Template for Intervention Description and Replication checklist and guide (TiDiR).²⁵ The trial was registered on clinicaltrials.gov (identifier: NCT03429686).

Intervention

Resident participants were invited to undertake an individual digital RT program at the care home they were resident within. The intervention comprised of 10 guided digital RT sessions undertaken twice per week, for 5 weeks, for up to an hour at a time. Session length depended on the participant's ability and willingness to participate. The digital RT sessions were delivered one-to-one and face-to-face. They were structured sessions based on the key stages in the life most people had experienced.

The researchers adapted the RT sessions originally developed by Schweitzer and Bruce²⁶ (see Table 1). This consists of a series of sessions that help to engage personal and communal 'positive memories' using various media types, including photographic images, videos, and audio. The Agile software development²⁷ approach was used to create a functional prototype early in the development life-cycle, usability testing, and refinement throughout the process. The digital application was developed in the Arabic language with components designed in line with Socioemotional Selectivity Theory (SST)²⁸ and the Technology Acceptance Model.²⁹ The digital RT intervention content was developed by the

research team prior to the feasibility study and was informed by Patient and Public Involvement and Engagement in Research (PPIE) consultation activities, expert peer review, and service user testing to support a rigorous development process. The technical development was led by the principal researcher and software developers. The principal researcher was responsible for the conceptual design of the theory-based RT, supported by the wider research team. The multimedia developers provided technical expertise in building the program. The process adopted participatory design methods³⁰ which involved stakeholders at all stages of the development process. Here, consultation work was undertaken with health and care professionals working with people who have dementia, as well as dementia caregivers. Feedback from these activities indicated value in the use of generic memories of photographs, audios, and videos associated with the specific geographical area where the research was conducted (e.g., Amman, Jordan) rather than national or international materials, to enhance parity of experience and reduce risk of inequality impacting on engagement with the materials. As a result, all the included generic content were obtained without copyright infringement from the internet.

The digital RT application was developed to provide a broad range of stimuli to prompt reminiscing among patients with dementia, that could be used in a one-to-one session. Engagement of the public and professionals in the development of content and the interface increased the likelihood of the materials being suitable for the target audience. For example, to increase accessibility and reduce the cognitive burden for participants, the interface included hypermedia features (various multimedia elements which are linked with each other non-linearly).

Participants

A formal sample size estimation is not required for a feasibility study. However, the number of patients with dementia in Jordanian care homes is relatively low. Therefore, it was intended to recruit every eligible patient with dementia in both care homes during a 12-week recruitment period. In total, 60 patients with dementia were recruited, with 15 participants lost to follow up. Follow-up data are therefore available for 45 participants. Figure 1 shows the participants' flow through the study. The inclusion criteria

Table 1 Intervention content (RT[†] sessions adapted from Schweitzer and Bruce, 2008)

Week	Session	Themes	Program content
1	1	Warm up	1. Introduction of program and rules. 2. Introduction to the principal researcher.
	2	Childhood and family life	Watching generic photos (20 min) and considering structured questions: <ul style="list-style-type: none"> • Sharing memories about parents and brothers
2	3	Schooldays	Watching an edited film (20 min). With structured questions, they might consider: <ul style="list-style-type: none"> • Sharing dreams about the future • Sharing successes and frustrations
	4	Working lives	Listening to three Arabic songs about success and achievement during working lives (20 min). With structured questions, they might consider: <ul style="list-style-type: none"> • Sharing memories and feelings about success and frustration.
3	5	Going out and having fun	Watching generic photos (20 min). With structured questions, they might consider: <ul style="list-style-type: none"> • Sharing feelings about recalling past pleasures, common experiences, hobbies, interest, and travel.
	6	Wedding	Watching edited film and generic photos and Arabic songs for wedding (20 min). With structured questions, they might consider: <ul style="list-style-type: none"> • Sharing feelings about partner when they first met • Sharing wedding day
4	7	The next generation, babies and children	Watching an edited film (20 min). With structured questions, they might consider: <ul style="list-style-type: none"> • Sharing the birth of the first baby
	8	Food and cooking	Watching generic photos (20 min) and sharing structured questions: <ul style="list-style-type: none"> • Sharing good feelings associated with food and eating.
5	9	New understanding about parents and recognition of value about oneself - Having pride about solving problem	Watching an edited film (20 min). With structured questions, they might consider: <ul style="list-style-type: none"> • Sharing the experiences of pleasure and difficulty in the process of rearing of children • Sharing the most difficult experiences • Sharing the successful experiences
	10	Stage of senescence: successful agedness and positive recognition about proceed of agedness	Watching generic photos (20 min). With structured questions, they might consider: <ul style="list-style-type: none"> • Sharing personal experiences of grandparents in childhood • Sharing opinions about successful ageing.

[†] Reminiscence therapy.

were as follows: (i) care home residents who were clinically diagnosed with any type of dementia defined by a psychiatrist; and (ii) care home residents who could understand and consent to participate in the study, including those who could consent at the moment, or had a consultee who could be approached for their assent if the participant was not able to consent at the moment but met the eligibility criteria. Residents were excluded if they were considered unable to take part in the study as determined by care home staff and/or had a diagnosis of an additional psychiatric disorder other than those identified in the inclusion criteria as determined by psychiatrists.

In phase 1, a convenience sample of residents was recruited over 3 months. Residents were

screened by care home staff to determine their eligibility. The care home managers and staff verified that the resident/or their consultee was willing to participate. The primary researcher gained informed consent from all eligible participants before baseline data were collected. If there were any residents without the capacity to consent, the primary researcher approached the next of kin as a consultee on the resident's behalf. The consultee was asked to provide assent on behalf of the potential participants.

In phase 2, purposive sampling was used to select eligible residents and care home staff from each care home, who were then interviewed using semi-structured interviews. The audiotaped interviews took place after measuring the post-intervention quantitative outcomes, and each interview took approximately

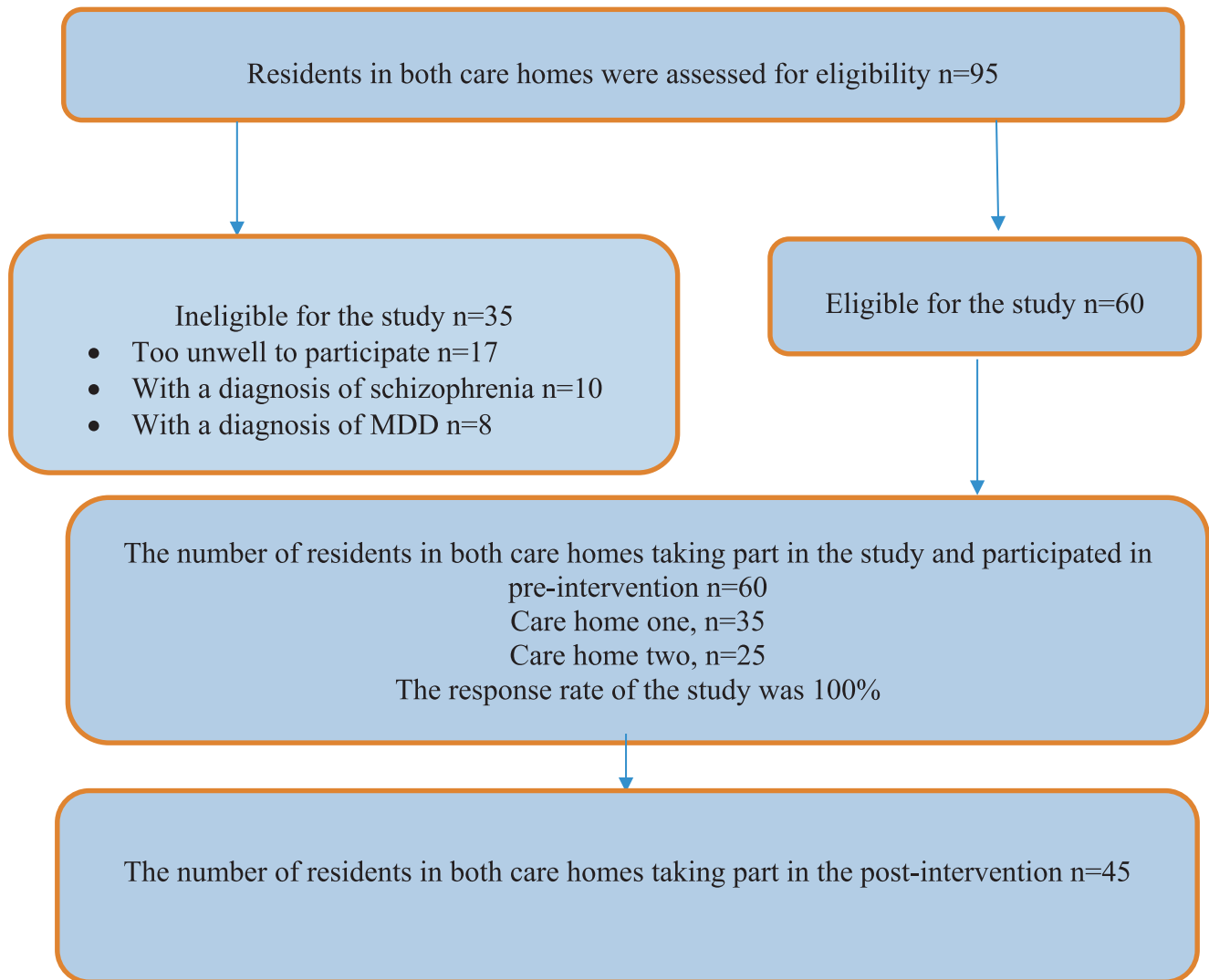


Figure 1 Flow chart of recruitment participants through the study. MDD, major depressive disorder

30 to 60 min. Qualitative interviews were conducted with 21 participants from the two care homes in Jordan, comprising seven care home staff who provide direct care for those residents and 14 care home residents with mild to moderate dementia, as assessed by the Mini-Mental State Examination (MMSE) post-intervention (as determined by a consultant psychiatrist and care home staff).

Outcomes to assess feasibility and acceptability

The study process evaluation was guided by Reelick and colleagues³¹ standardised framework. This framework provides comprehensive and systematic

instructions for process evaluations at the development and feasibility evaluation stages. Feasibility data included the rate of recruitment, adherence to the intervention, retention, data completion, and adverse events. Outcome data were collected via questionnaires to compare cognitive function, QOL, anxiety, depression, and communication outcomes before and after delivery of the intervention, to explore whether specific outcomes are sensitive to change. Data were collected on the rate of recruitment, adherence to the intervention, retention, and data completion. Quantitative data were evaluated concurrently with qualitative data to better understand the feasibility of using digital touch screen technology and potential future applications in this

mixed-methods analysis. The following data were collected to determine feasibility and acceptability:

Recruitment rate

This was calculated as: the number of eligible residents who enrolled in the study after being referred to the research team by care home managers and staff or by filling out an expression of interest form. If consent was obtained from $\geq 40\%$ of participants, the feasibility criterion was met.³²

Retention rate

The number of participants who completed post-intervention assessments compared to the number who started the intervention was used to determine retention. The feasibility criterion was met with a $\geq 65\%$ retention rate.³³

Intervention adherence

Adherence represented the number of resident participants using each intervention component, including attendance at digital RT sessions. Adherence³⁴ to each session was determined as attending at least eight of the 10 sessions of reminiscence intervention. Adherence was monitored using self-report logs completed by the primary researcher, including time spent of each session, the performed activities, non-attendance reasons, feedback from participants, and any emotional distress experienced by participants. The adherence rate was calculated based on the adherence rate (%) of the participants in the sessions in the 5 weeks, which is derived from the percentage of days they have completed the sessions.

Implementation fidelity

Implementation fidelity refers to the extent to which the intervention was delivered according to the registered research protocol.

Adverse events

Adverse events that occurred because of participating in the study were assessed. Any severe negative health effects observed that were due to digital RT participation were defined as serious adverse events.

Data completion

The frequency of missing items during the data collection indicated the feasibility of data completion. If

less than 10% of items on each questionnaire were missing, the feasibility criterion was satisfied.

Data collection

The researchers obtained ethics approval for the study prior to the recruitment process from the Faculty of Medicine and Health Sciences Research Ethics Committee at the University of Nottingham (FMHS 110-1709). Following the consent and recruitment procedures, baseline data collection was undertaken with all resident participants by independent researchers who were not involved in the intervention delivery or data analysis. Resident participants who completed the intervention were then asked to complete the same outcome measures immediately post-intervention. The baseline and follow-up data were in the form of a self-report questionnaire that consisted of the following outcome measures:

Participant characteristics

Data were collected on age and gender of resident, type of care home setting, the severity of dementia, level of education, and marital status.

Arabic version of Saint Louis University Mental Status (Arabic SLUMS)

The Arabic version of SLUMS measures cognitive function in people with dementia.³⁵ Tariq and colleagues³⁶ first created the Arabic SLUMS, and it has been tested and used extensively among people with mild cognitive impairment and dementia, worldwide. It consists of an 11-item questionnaire with scores ranging from 0 to 30. It is a one-page screening test administered in 10 min to identify older adults with cognitive impairment through measuring orientation, memory, attention, and executive functions. The score interpretation depends on education level. High school education: Normal, 27–30; Mild neurocognitive disorder, 21–26; Dementia: 1–20. Less than high school education: Normal, 25–30; Mild neurocognitive disorder, 20–24; Dementia, 1–19.³⁵

The Arabic SLUMS has been tested for its reliability and validity in 90 older adults. It has been found that there is a statistically significant agreement between the SLUMS examination and the MMSE (Kappa 0.826, $P < 0.001$) (61). The Arabic SLUMS examination was found to be reliable by test-retest (McNemar $P > 0.05$, Kappa 0.806 $P < 0.001$), with

high sensitivity (94%, 31/33) and specificity (96%, 55/57). The internal consistency of the Arabic SLUMS examination on the main items of cognitive function showed a Cronbach's alpha of 0.723 with a significant item-to-item and item-to-total correlation.³⁵

Older People's Quality of Life questionnaire (OPQOL-brief-13)

Quality of life in older people was measured using the OPQOL-brief-13.³⁷ It has been tested and used extensively among older people. The scale consists of 13 items where participants are required to rate the extent to which they agree with each item by choosing one of five possible options ('strongly disagree', 'disagree', 'neither agree nor disagree', 'agree' and 'strongly agree', each with a score of 1–5). Higher scores represent higher QOL. The total score ranges from 13 (worst possible QOL) to 65 (best possible QOL). The 13 items of OPQOL-brief take approximately 5 min to complete. The OPQOL-brief was found to be highly reliable (Cronbach's alpha = 0.856).³⁷

In the current study, OPQoL-Brief-13 translated version (Arabic) was highly reliable and valid. The Arabic translation of the OPQoL-Brief-13 scale showed a high level of internal consistency (0.80), comparable to the original version. In addition, the internal consistencies and test-retest reliability (after 2 to 9 days) of the entire Arabic scale revealed high internal consistency levels with reporting a split-half coefficient of 0.89 and intraclass correlation coefficient (ICC) of 0.90.

Arabic version of Hospital Anxiety and Depression Scale (Arabic HADS)

Depression and anxiety in people with dementia were measured using the Arabic HADS.³⁸ It contains seven self-report items related to anxiety, as well as seven self-report items related to depression. This can take around 2–5 min to complete. On a Likert-type scale that ranges from 0 to 3, participants rate anxiety and depression symptoms by signifying how often they have experienced each symptom in the past week. Scores for each subscale (anxiety and depression) range from 0 to 21, with scores categorised as follows: normal 0–7, mild 8–10, moderate 11–14, and severe 15–21.³⁸

Arabic HADS has high reliability and validity, with good internal consistency (Cronbach's alpha was 0.73 and 0.77 for anxiety and depression, respectively). Also, it was found to be a valid tool by obtaining a two-factor in accordance with HADS subscales (anxiety and depression) using factor analysis; the result was a statistically significant correlation ($r = 0.57$; $P < 0.0001$) between the two subscales.³⁸

Holden Communication Scale for persons with dementia (HCS)

Communication was measured using the HCS³⁹ after translation, back translation to Arabic (Arabic HCS). It comprises 12 items assessing conversation, awareness and knowledge, and communication and takes around 2–5 min to complete. Each Arabic HCS item is assigned a score on a Likert-type scale from 0 to 4. Scores for the entire scale of all 12 items rate difficulties with communication from 0–48, with a higher rating indicating a greater degree of communication difficulty. HCS was found to be highly reliable and valid (65). The internal consistency (Cronbach's $\alpha = 0.94$), test-retest reliability was $r = 0.71$, and the corrected item-total correlation ranged from 0.63 to 0.79.³⁹

The translated version of the HCS was highly reliable and valid in this pilot study. The translation of the HCS presented a high level of internal consistency of the scale (0.89), comparable to the original version. High levels of internal consistency were evident in most subscales, with Cronbach's alpha values of 0.94, 0.95, and 0.96 for conversation, awareness, knowledge, and communication, respectively. In addition, the internal consistencies and test-retest reliability of the Arabic HCS showed high levels of internal consistency, reporting a split-half coefficient of 0.94 and ICC of 0.97.

All questionnaires were double-checked to ensure their accuracy, and the causes for missing data were investigated. For all questionnaire outcome measures, frequency counts of missing items were conducted during all data collection periods. Missing data were checked on all returned questionnaires.

Data analysis

Quantitative data were analysed using IBM SPSS Statistics for Windows, Version 25.0. (Armonk, NY, USA: IBM Corp). Descriptive statistics describe

Table 2 Baseline characteristics of participants

Characteristic	Value	Differences between care homes (<i>P</i> value)
Age, years, mean (SD), range	66.9 (7.4), 55–85	0.320
Gender		0.275
Male, n (%)	29 (48.3%)	
Female, n (%)	31 (51.7%)	
Severity of dementia		0.731
Mild, n (%)	28 (46.7%)	
Moderate, n (%)	20 (33.3%)	
Severe, n (%)	12 (20.0%)	
Level of education		0.124
Less than high school education, n (%)	38 (63.3%)	
High school education and more, n (%)	22 (36.7%)	
Care home (CH)		
CH1, n (%)	35 (58.3%)	
CH2, n (%)	25 (41.7%)	

sample characteristics, recruitment rates, retention rates, rates of completion, attendance, and adherence rates (frequencies, percentages, means and SDs as appropriate). For each outcome measure, the distribution of the data was assessed for normality required for parametric statistical analyses. All data were checked for extreme values and boxplots were scanned for outliers. Non-parametric analyses were used if data were deemed to depart from normality as assessed by using a visual review of histograms.

The two care home settings were compared, and *P*-values were calculated to indicate whether there was a statistically significant difference regarding participant demographics and characteristics. The sample characteristics of participants in the two care homes were compared using Chi-squared tests. The Reliable Change Index (RCI)⁴⁰ was used to ascertain whether each participant's post-therapy change ended at a statistically significant level. An RCI larger than 1.96 is regarded as statistically significant at a two-tailed 5% alpha level. An RCI value of $-1.96 < RCI < 1.96$ indicates that the patient's condition has remained unchanged or deteriorated, respectively. Paired *t*-test was conducted to compare the differences between baseline scores and post-intervention scores of cognitive functions, QOL, anxiety, depression, and communication to achieve this study's quantitative objective. The significance level was set at $P < 0.05$.

The qualitative data were analysed using a thematic analysis approach⁴¹ to identify key themes.

NVivo was used to organise and code the data. All interviews in this study were conducted in Arabic language, audio recordings were transcribed verbatim in Arabic and then translated into the English language and then back-translated to check for quality after the analysis in order to preserve cultural nuances in the data during analysis.⁴² The following Appendix S1 link shows the semi-structured interview questions with residents and staff in Jordanian care homes: Appendix S1.docx.

RESULTS

Sample characteristics

Baseline data were collected from all eligible 45 participants, as shown in Table 2. Study participants had a mean age of 66.9 years (SD = 7.4 years and range = 55–85 years). Gender distribution was approximately equal (51.7% female). The sample included participants with dementia of varying degrees of severity (46.7% mild, 33.3% moderate and 20% severe). The education level for almost two-thirds of the study participants in both care homes was below high school education (63.3%). There were no statistically significant differences in any of the demographic characteristics between residents in either care home.

Retention rate

In total, 15 people were lost from the study at follow up (25%). The retention rate was, therefore, 75%. The attrition rate was due to co-morbidity and mortality (i.e., death, transferred to other care homes, and emotional distress). There were no differences in baseline measures of demographics between those who stayed in the study and those who were lost to follow up.

Completeness of data collection

At pre-intervention, a single item in one case was missing from one of the measures (OPQOL); in this case, the mean of the responses was inserted.⁴³

Feasibility of outcome measures to detect changes

There were statistically significant and clinically relevant improvements in cognition, QOL, anxiety, depression, and communication from pre- to post-

intervention. Within this feasibility study, a statistically significant increase in mean by 3.7 (SD = 2.4; $t(45) = 10.43$; $P = 0.000$) for cognitive function and 6.2 (SD = 4.8; $t(45) = 8.6$; $P = 0.000$) for QOL was observed. Additionally, a statistically significant and clinically relevant decrease in mean scores of 6.2 (SD = 4.2; $t(45) = -9.9$, $P = 0.000$), 4.4 (SD = 2.9; $t(45) = -10.1$, $P = 0.000$) and 3.7 (SD = 2.6; $t(45) = -9.6$; $P = 0.000$) was observed for communication and anxiety/depression respectively. These changes in means suggest pre- to post-improvements in cognitive function, QOL, anxiety/depression, and communication. The RCI analysis showed statistically significant changes in outcome measures. RCI results are presented in Appendix S2.

Implementation fidelity

The digital RT intervention was delivered as per protocol – all resident participants were offered the intervention as planned. No breaches of the study protocol were reported during the conduct of the study. In line with the participatory design approach,

participants were actively engaged in the design of the intervention and research processes. Fidelity monitoring was carried out by an independent researcher who is a psychiatric and mental health nurse.

Adherence to the intervention

Session attendance was used as a measure of intervention adherence. The median session attendance for those who received the intervention was 80%, demonstrating an acceptable level of intervention adherence. For those participants with low attendance, staff suggested this was dependent on their ‘health condition’ and ‘getting to grips with unfamiliar digital touch screen technology’. There were no reports of non-attendance being related to the intervention content (RT).

Adverse events

No significant adverse events were observed during the study, although care home residents reported emotional distress on five occasions. These residents

Table 3 Overview of themes, sub-themes and supporting quotations

Themes	Sub-themes	Supporting quotation
Easy to use	Flexibility of the intervention delivery	<i>‘I really liked the fact that I could zoom in and widen the screen size so that I could see things because I cannot see unless I zoom. I do not have good eyesight so I used it in all the sessions.’</i>
	Simple format	<i>‘To me, the sessions were very easy and straightforward and I could take part without any problems... I do not need anything needs to be changed about the sessions.’</i>
Facilitative environment	Influence of distractions	<i>‘There was a lovely atmosphere and it was great to take part in the session.’</i>
	Getting to grips with digital touch screen technology	<i>‘I think we [residents] need a lot more concentration, it [using digital touch screen technology in the sessions] makes me feel quite tired.’</i>
	Availability of guidance	<i>‘It was very easy to understand and use all of the app information. When I had a question or did not understand something, I could ask you directly.’</i>
Interesting content	Structure of the content	<i>‘The sessions were organised around their [resident participants] life and the experiences they have had. This was what they went through in all the sessions... I really liked them [the sessions]’</i>
	Variety in format	<i>‘It [the delivery of content] was lovely to look at because of all the pictures.’</i>
	Familiarity of the generic content	<i>‘I really prefer well-known everyday pictures and music because I am so familiar with them, it’s easy to fall back to them.’</i>
Positive impact on QOL [†]	Enhancing communication and cognitive abilities	<i>‘Now, when I am sitting with someone, I’m different; I’m more talkative. I want to talk with people here.’</i>
	Enhancing relationships	<i>‘Really, I felt so much better because I could remember things I did well in life.’</i>
	Positive changes in psychological and emotional aspects	<i>‘I think that the application gave them [resident participants] the chance to...reduce anxious and depressed feelings that they have. It improves their quality of life so we will definitely use it again in our routine care for them’</i>

[†] Quality of Life.

were referred to care home staff as per protocol and subsequently withdrew from the study.

Experience of patients and staff

Thematic analysis revealed four themes relating to the features of the digital RT application that were valued by people with dementia: (i) easy to use; (ii) facilitative environment; (iii) interesting content; and (iv) positive impact on QOL. A summary of themes and example quotations is provided in Table 3. Thematic analyses show that digital RT improved memory and cognition of people with dementia.

DISCUSSION

This study sought to determine the feasibility of using digital touch screen technology to deliver RT among people with dementia living in Jordanian care homes. It was found that a digital RT intervention was feasible and acceptable to people with dementia living in care homes in Jordan.

Feasibility of research processes

Overall, this study demonstrates that it is possible to recruit people with dementia to a digital RT intervention in Jordan. The face-to-face recruitment approach has previously been identified as a beneficial recruitment strategy for intervention with people with dementia.⁴³ As all the resident participants who were approached to participate in the study agreed to participate in the study, the response rate was 100%. While many clinical trials report challenges with recruitment,⁴⁴ this was not the case in our study. However, this is broadly in line with recruitment rates in a study in the United Kingdom (UK) using mobile technology to deliver RT to people with dementia, in which a high response rate was also reported (96.6%).⁴⁵ This indicates that digital approaches to RT may be universally acceptable, although this needs further exploration.

The sample size was sufficient for this feasibility study, comparable with similar research in this field^{45,46} and addressed the feasibility aims in line with the National Institute for Health (NIHR) Research Evaluation, Trials and Studies Coordinating Centre (NETSCC) glossary. Although the findings are limited to the study sample, these data indicate that people

with dementia are interested and willing to participate in this type of study.

Intervention acceptability

The digital RT program was delivered in accordance with the research protocol with no breaches to protocol. All resident participants received the digital RT sessions as planned. The intervention was well-received by the resident participants.

The digital RT sessions were well-attended (80%, median = 8, interquartile range = 4). No previous study reported the rates of adherence in using digital RT intervention for people with dementia, so it is impossible to make a direct comparison. However, this attendance rate is comparable to adherence rates in technology-based exercise interventions in older adults in which the median attendance has been shown to be around 90%.⁴⁷

Feasibility of outcomes to change

This secondary objective of this study was to determine the likelihood of changes in outcome measures and identify the most appropriate outcome measures to evaluate digital RT delivery to people with dementia in Jordanian care homes to be used in a subsequent definitive trial. This study provides preliminary evidence suggesting that digital RT intervention positively impacted overall cognitive functions, QOL, anxiety, depression, and communication at post-intervention, although this needs to be tested in a definitive randomised controlled trial. Our findings are congruent with the findings of an earlier study by Subramaniam and Woods,⁴⁶ who used the Autobiographical Memory Interview scale to measure cognitive function and found an increase at post-delivery of digital RT. Our findings are comparable with previous studies, which suggest that the practice of using past memories will make it easier for people with dementia to recall them as the more memory is used, the easier it is to remember things.⁴⁸ Therefore, this suggests that people with dementia are likely to have the ability to fully participate in a full-scale RT program.

This study provides evidence on how digital RT intervention appears to impact overall communication at post-intervention in this study. Previous studies investigating the effect of digital RT on communication in people with dementia have reported mixed results.⁴⁶ Our findings align with

those of Astell and Ellis,⁴⁹ who suggested that communication is sensitive to change after using digital RT sessions ($z(9) = 2.19, P < 0.05; t(10) = 2.191, P < 0.05$, respectively), although they did not report which tool was used to assess communication. Conversely, no change in communication pattern was found at 2 weeks or 3 months follow up using the Minimum Data Set Activities of Daily Living scale ($z(6) = 0.85, 0.73; P = 0.40, 0.46$).⁵⁰

Previous studies have reported that using digital RT is more likely to yield communication improvements for people with mild to moderate severity of dementia.⁵¹ Our sample included only people with mild or moderate dementia, and we found positive effects in this group. These findings concur with suggestions that RT can be used for teach-inform purposes (the formal sharing of memories with others to impart life experiences). Older people may want to leave their mark on the world and ingrain their essential values and ideas.⁹ Jordanian older adults might use social reminiscence (i.e., teach-inform) to optimise opportunities to experience positive emotions in social settings. They may attempt to consolidate a sense of self and gain an insight into meaning in the life they have lived. It can provide opportunities for the bond between the elderly and the younger to be strengthened,¹² and give the younger something to build on in the future.⁵² Therefore, the reminiscence for teach-inform functions can positively affect the social adaptation of older adults.^{9,14} RT can also be used for conversation purposes, which is associated with socialisation by either reconnecting with old friends or fostering new friendships.⁵³

We found evidence that digital RT reduces anxiety – no other studies have measured change in anxiety after delivery of RT intervention. However, previous studies have used the HADS scale to measure anxiety and depression in people with dementia who live in care homes.⁵⁴

The results of this study support the RT function for teach-inform purposes that suggests that it could be associated with positive emotions within a social context that convey an image of older people self-enhanced, wise, and experienced.⁵² This could lead to an elevated mood and an increased sense of respect and admiration from others. Moreover, this links with the use of RT for conversation purposes, which could be used to convey an image of older people as a communicative, pleasant, and entertaining person in a

social environment. This could positively affect older people's mental health and emotions, especially in social situations.

Regarding depression, this study affords evidence suggesting that digital RT intervention impacts overall depression at post-intervention. Only one previous study suggests that depression is sensitive to change after using digital RT sessions.⁴⁶ Subramaniam and Woods⁴⁶ used the Geriatric Depression Scale (Residential) (GDS-12R) and showed a reduction in depression using this tool. This finding is consistent with SST theory, which implies that depressed older adults can benefit from the positivity impact by constructing idealised positive memories and selectively coping with painful memories to escape from these memories, thereby enhancing their mood.⁵⁵

Finally, our findings offer evidence suggesting that a digital RT intervention appears to impact overall QOL at post-intervention. The conceptualisations of QOL in dementia vary with the progression of the disease.⁵⁶ For example, while in the early stages of dementia, enjoyment of activities is relevant; however, it becomes less relevant in severe dementia. For this study, aspects of QOL included cognitive function, mood, interpersonal relationships, and the ability to participate in meaningful activities.

Only two previous studies have looked at QOL outcomes following digital RT.^{45,46} Subramaniam and Woods⁴⁶ used the same OPQOL-brief-13 scale to measure QOL and found improvements post-intervention. Laird *et al.*⁴⁵ used the World Health Organization–Five Well-Being Index (WHO-5) to measure QOL and reported increased QOL scores post-intervention. This finding aligns with SST theory, which suggests that the RT that induced positive emotions could be helpful and positively affect mood, memory, well-being, and support the maintenance of social and emotional bonds.⁵⁷ Moreover, SST suggests that people with dementia search for positive experiences, evade the painful ones, and spend a great time with close ones in smaller social networks due to the positivity effect that enhances their QOL.⁵⁸

In line with other qualitative studies, qualitative analyses in several developmental projects have demonstrated that digital RT improved memory and cognition of people with dementia.^{46,58,59} This is certainly links with other studies which suggest that the practice of using past recalls during positivity effect

will render it easier for people with dementia to recall them as the more memory is used, the better at remembering things people become.^{42,51} Like our study, some research reports that using digital RT is more likely to yield communication improvements for people with mild to moderate severity of dementia.⁵¹ Therefore, the reminiscence for teach-inform functions can positively affect older adults' social adaptation.¹⁴ Moreover, this supports the RT for conversation purposes associated with socialisation by either reconnecting with old friends or fostering new friendships.⁵³ People with dementia incline to select an emotionally close social partner due to a positive effect that enhances their communication and interactions with others.⁵⁸

Digital RT sessions were considered acceptable and feasible by residents and staff participants as found in previous studies.⁵⁴ However, these sessions require supervised caregivers to deliver.⁵⁵ The format and structure of the digital RT sessions were considered simple, easy to use and understand, using many properties in technology to counteract the effects of physical impairments occurring in dementia, and flexible in rescheduling missed sessions. The content of the sessions was considered interesting, relevant, useful, structured, and used various familiar and novel formats.^{46,52} However, some participants suggested using personal memories and decreasing the time duration and frequency of sessions per week to be more attractive and tolerable. Therefore, these issues were notably essential issues contributing to having a usable and acceptable digital RT session.

Using generic memories followed the previous digital RT, which was designed with a generic focus.⁴⁹ Nevertheless, the strategy was opposed to some studies that applied personalised materials.^{45,60} Most resident and staff participants preferred the person-to-person approach. This is undoubtedly linked with SST, which suggests that older people gain a sense of well-being and high QOL due to the positivity effect in which they are selectively biased toward personal memories with positive emotions.²⁷

Overall, this study shows that it is feasible to use digital technology to deliver RT for people with dementia, and this is consistent with previous feasibility and developmental studies in low- to middle-income countries where people from different cultures were included.^{45,61} This digital RT intervention was well accepted by resident and staff participants in

Jordanian care homes, and this is consistent with previous feasibility and developmental studies.⁴⁵

Study strengths and limitations

The strength of the study lies in using digital touch screen technology to deliver RT among people with dementia in Jordanian care homes, which may be used to shape the design of a future clinical trial. This study is one of the first in this research area using a theory-driven intervention to include elements associated with health outcomes and QOL improvements and explain how the intervention brings about change. A further strength was the exceptionally high response rate from the resident participants (100%) and adherence to the intervention. The intervention development process was rigorous and involved an expert panel, peer reviewers and contributions from people with dementia regarding the intervention development and research design. Finally, using a purposive sample for process evaluation interviews reduced the risk of selection bias because the sample was refined to meet the study aims.

Some limitations should be considered when analysing and interpreting the results presented throughout this study. This study has a small sample size ($n = 45$), due to constraints of time and funding. Since this was a single-group study, the feasibility of randomisation and acceptability of this remains unknown. The efficacy of the intervention needs to be tested in a randomised controlled trial design; however, such a trial should include an internal pilot study to test randomisation procedures and acceptability.

All interviews were conducted in the Arabic language, and the analysis was conducted in the English language. There is a possibility that some meanings may have been lost in translation, so this data needed to be repeatedly re-translated. The reliability of the Arabic OPQOL-Brief-13 scale and HCS scale were tested in a small sample of participants and so the psychometric properties of the translated versions need to be tested in a larger sample.

Implications for a future trial

The results indicated that digital RT could be delivered in a formal evaluation in a future definitive randomised controlled trial across several care homes. The key stakeholders who could directly benefit from this study are people with dementia residing in care

homes and staff. Consideration should be given to the potential negative impact on resident participants during the delivery of sessions.^{62,63} Therefore, plans should be to implement and minimise this effect, such as using personal (rather than generic) memories, decreasing the number of digital RT sessions to one session per week, decreasing the duration time of each digital RT session, delivering the intervention in quiet rooms and minimising distraction, and using step-by-step instruction cards to the resident participants, or needing to be delivered with the support of a care worker, informal caregiver or nurse. A future trial should continue to draw on the strengths of mixed-methods study designs and qualitative evaluations.

In this study, the researchers did not interview participants with severe dementia. Therefore, a prospective trial should consider widening the scope of qualitative data collection in order to increase the impact these data have on our understanding of digital RT intervention used for people with severe dementia.⁶¹ Overall, the duration of research should consider the necessity of involving resident and staff participants to become involved in the research design. Timescales of the study should be sufficient to allow people with dementia to be fully involved with the development of the intervention and trial processes. The data gathered and critically discussed here can be used to improve the quality of the interventions developed and potentially utilised within a future study.

Implications for practice

This study is relevant to dementia care practice as it explores a novel approach to supporting RT with people with dementia in the care home setting. Using digital touch screen technology to deliver RT content has shown that digital touch screen technology can improve such interventions, making them less arduous for the staff and potentially more beneficial for people with dementia. This, in turn, can improve the QOL of people with dementia. Therefore, it is of value to consider the types of guidance and support required to enable uptake and access to such digital touch screen technology resources to ensure that access and benefits of the intervention are upheld. While digital touch screen technology did show benefits for the RT process, there were some associated risks with its delivery which need to be considered in

implementation of digital interventions in the future. The reliability of digital touch screen technology in the care home and the prioritisation of technology may help meet the needs of both staff and residents in the home. Digital RT should be easy to use and provide efficient, personalised, and structured content for RT, leading to successful reminiscence outcomes.

In conclusion, using digital touch screen technology to deliver RT is feasible and acceptable among people with dementia in care homes, in Jordan. The statistically significant changes in outcome measures demonstrate that digital RT may be useful for improving the cognition, QOL, anxiety, depression, and communication of patients with dementia in nursing homes. The digital RT and research processes are feasible in their current form, although there are some considerations to the RT design that may further enhance effectiveness. A definitive trial is required to evaluate the intervention effectiveness and long-term outcomes for people with dementia.

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SUPPORTING INFORMATION

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Appendix S1 Semi-structured interview questions with residents and staff in Jordanian care homes

Appendix S2 The pre-post patients’ reports were analysed using clinically significant and Reliable Change Index (RCI) calculations.