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A Single Case Experimental Design Study to Explore the use of Simulated Presence Therapy as a Formulation Based Intervention for Patients with Dementia Who are Presenting in Distress.

Danyal Ansari, BA (Hons), MSc

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Institute of Health and Wellbeing

College of Medical, Veterinary and Life Sciences

University of Glasgow

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Foreword

This foreword elucidates the impact of the Covid-19 pandemic on Chapter Two (the Major Research Project) of this thesis. In terms of variations to the thesis, option 1 was selected. This stipulates that the trainee has collected some usable data for the project, but the nature or amount of the data differs from what was planned in the proposal (e.g. mode of assessment has changed or sample size is smaller than planned).

Although there were no major changes in terms of the study design, there were two key issues that occurred as a direct result of the Covid-19 pandemic. Firstly, the project was extended from April 2022 to October 2022 via a minor ethics amendment due to recruitment issues and operational delays that can be attributed to the pandemic. Secondly, there were concerns regarding missing data across participants, most of which can be attributed to the pandemic. The extent of this is further discussed in Chapter Two, and methods to address this, via missing data analysis methods, were conducted. There was also a more minor concern regarding the alteration of some data collection timescales that occurred due to the pandemic; however, this was relatively negligible and accounted for in the original proposal as the possibility of slight timescale alterations was anticipated as part of routine, non-Covid related organisational issues.

Acknowledgements

The author offers thanks and appreciation to all those that were involved, both directly and indirectly, in the culmination of the present research project.

Chapter 1

A systematic review of the acceptability and use of technologies with touchscreen interfaces by persons with dementia and their caregivers across studies with varied methodologies.

Danyal Ansari[1][2][3]

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[1] Institute of Health and Wellbeing, University of Glasgow, Glasgow, Scotland, United Kingdom.

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[3] Orcid Link: https://orcid.org/0000-0002-2437-0909

Abstract

Background and Aims

The aim of the present systematic review was to investigate the barriers and facilitators to the use of Technologies with Touchscreen Interfaces (TTI) employed as part of an intervention to reduce the impact of dementia for Persons with Dementia (PwD) and/or their caregivers across studies of varying design types.

Methods

Six databases were searched in parallel using EBSCOhost, comprising of CINAHL, Health Source: Nursing/Academic Edition, MEDLINE, APA PsycArticles, APA PsycInfo, and Psychology and Behavioural Sciences Collection. Qualitative,, quantitative and mixed methods studies that investigated TTI as part of an intervention and generated outcomes regarding their perceived acceptability, adoption and/or general usability were included. Ten studies were ultimately included. The methodological quality of the studies was rated using the Mixed Methods Appraisal Tool (MMAT) and a narrative synthesis of the findings was presented.

Results

Four of the studies met 75% of the MMAT criterion, three met 50%, one met 25%, and two were unable to be rated. All of the studies utilized TTI as regards to improving quality of life outcomes across a range of domains. Across studies, three key themes regarding the adoption, usability and acceptability of TTI was found: (1) personal attributes of the user; (2) the ergonomics of the device; and (3) external factors.

Conclusions

The conclusions of the present review should be considered in the context of its limitations, including small sample sizes and lack of quantitative data analysis in the included papers. Suggestions for future research are elucidated, including the need for large scale longitudinal and cross-sectional studies.

Keywords: *dementia, technology, touchscreen, distress, use*

Introduction

Dementia is a psychiatric condition marked by a decline in at least two domains of cognitive functioning that are not entirely attributable to ageing, and significantly interferes with daily living (World Health Organization, 2018). Persons with Dementia (PwD) may also present with signs of disturbed perceptions, thoughts, mood and behaviors, commonly referred to as the Behavioral and Psychological Symptoms of Dementia (BPSD; International Psychogeriatric Association, 2010). The symptoms of dementia are associated with a range of consequences, including increased caregiver burden and stress, increased risk for placement in inpatient hospitals, and significant cost to the healthcare system (Tible et al., 2017). Thus, efforts to reduce the personal and societal impact of dementia are needed.

In recent years, a surge in interest regarding the applicability of innovative technologies to address the impact of dementia has occurred (Astell et al., 2019). Technologies with Touchscreen Interfaces (TTI) are one such innovation, used for assessment and intervention purposes for PwD as well as their caregivers (Hitch et al., 2017). The majority of interventions using TTIs focus on improving day-to-day functioning and compensating for the cognitive decline associated with dementia (e.g. prompting or reminding applications). Literature reviews have shown the effectiveness of interventions delivered with TTI in improving psychosocial (Hung et al., 2020; Tyack & Camic, 2017) and day-to-day functioning (Thordardottir et al., 2019) outcomes in PwD, whilst concurrently reducing perceived caring burdens of both formal and informal caregivers of PwD (Tyack & Camic, 2017).

In terms of engagement, research highlights that positive experiences of technology are a prerequisite for technology use, particularly for older persons (Alvseike & Brønnick, 2012; Kobayashi et al., 2011; Parker et al., 2013). For TTI specifically, their benefit relates to usability, with studies highlighting that older people find them easier to use than personal computers (Findlater et al., 2013; Murata & Iwase, 2005). Considering the benefits of TTI in dementia care, studies investigating the specific factors that may serve as facilitators and barriers to acceptability and use of touchscreen deceives by PwD and their caregivers is needed.

Rationale

Thus far, no known systematic reviews of the barriers and facilitators to acceptability and use of TTI have been conducted. A previous review exploring the acceptability of interventions delivered through assistive technologies for PwD and/or their caregivers did so for all types of technologies, rather than exclusively those with touchscreen interfaces and so therefore did not cover the specifics of TTI in detail (Thordardottir et al., 2019). Moreover, reviews that have commented upon the usability and acceptability of TTI have done so as an aside, rather than as a primary or secondary feature of the review question; instead, focusing primarily on the effectiveness of the interventions in ameliorating symptoms (Hung et al., 2020; Tyack & Camic, 2017). Consequently, owing to the more generalized nature of these reviews, key search terms, such as 'touchscreen' and 'smartphone' were not utilized, likely missing studies employing TTI.

In addition, previous reviews did not focus on ongoing interaction with TTIs (or other technologies), meaning that, for instance, if a device is setup to automatically provide a particular function with no ongoing manipulation by the PwD or caregiver, there may be a difference in experience from being a passive recipient of the TTI rather than actively manipulating it. Considering the increasing use of novel technologies within dementia care and the need to understand the developments required to facilitate adoption and use of various technologies within the healthcare system, it is vital that reviews focusing on the uptake of specific technologies discretely are conducted to support this process (Astell et al., 2019). Moreover, including designs of varying study types is important in order to capture the broadest amount of literature in this area owing to the likelihood that user-experience type studies will likely utilize a variety of research methods. Hence, the present review addresses this by investigating the barriers and facilitators to the use of TTI employed as part of an intervention to ameliorate the impact of dementia for PwD and/or their caregivers.

Objective

The present review explores the following research question:

1. What facilitators and barriers are related to acceptance and use of TTI delivering interventions amongst older persons with dementia, and/or their formal and/or informal caregivers.

Methodology

The review included published articles with quantitative, qualitative and combined or mixed designs that reported on interventions employed with TTI, used by PwD and/or their caregivers. Hong et al., (2017) highlight that the most common checklist for designing systematic reviews, the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA; Moher et al., 2009), does not provide guidance for the reporting of reviews that include studies of varied designs. Hong et al., (2017) provide their own four key recommendations: (1) indicating that the review includes studies of varied designs in the title; (2) providing clear justification of why a review combining multiple research methods is required; (3) identification and description of synthesis methods; and (4) discussion of the data integrated into the review and insight gained from the data. However, the criticisms levied against the PRISMA checklist by Hong et al. (2017) extend only to the 2009 version and not the more recent 2020 version (Page et al., 2021), which is more generalized than its predecessor. Hence, a combination approach was taken, whereby the design and reporting of the present review was structured in line with Hong et al., (2017) recommendations, in concert with the applicable elements of the PRISMA 2020 checklist.

In addition, the present systematic review was registered on Prospero (https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=283105). The Prospero registration serves as a protocol of the review, although a formal protocol document was not drafted.

Eligibility criteria

The inclusion criteria were as follows:

- Studies recruiting people over the age of 65 with a diagnosis of dementia and/or their formal and/or informal caregivers;
- Studies that assess interventions delivered by TTI that address the cognitive, day-to-day functioning and/or the behavioral and psychological symptoms of dementia, and where regular, ongoing interaction with these touchscreens is required by PwD and/or their caregivers; and
- Studies primarily or secondarily investigating acceptance, adoption, attitude, perception and overall usability of TTI.
- Only those papers that report on primary research studies.

Studies were excluded where: they did not describe a specific research methodology; did not describe some form of an intervention; use TTI for other purposes (e.g. assessment only); were conference papers; and were not in English.

Information sources and search strategy

The electronic databases CINAHL, Health Source: Nursing/Academic Edition, MEDLINE, APA PsycArticles, APA PsycInfo, and Psychology and Behavioural Sciences Collection were accessed using EBSCOhost. In terms of search strategy, a variety of terms were utilized, including Alzheimer, dementia, various terms for TTI and their use, with truncated terms used to account for plurals. The search terms employed are detailed in table 1. A full account of the search strategy can be found in Appendix 1.1.

Table 1. *Search Terms*

Component 1		**Component 2**		**Component 3**
dementia OR Alzheimer	AND	iPad* OR Android OR touchscreen OR touch screen OR smartphone	AND	perception* OR adopt OR acceptability OR attitude OR usage OR use

Data synthesis and appraisal

The methodological quality of included papers was evaluated using the revised version of the Mixed Methods Appraisal Tool (MMAT; Pluye et al., 2011). The tool is publicly accessible, free to use, and is designed for implementation in systematic reviews, having been used effectively in similar papers to evaluate methodological quality and enable comparisons between diverse study designs (e.g. Thordardottir et al., 2019; Tyack & Camic, 2017). The MMAT enables concomitant evaluation of five study types: mixed-methods; qualitative; quantitative (randomized-controlled); quantitative (non-randomized); and quantitative (descriptive). It consists of two screening questions for all study types, which ask the rater to consider whether the study has clear objectives and whether the data collected addresses the research question. If one or both questions is answered in the negative or the answer is unclear, then further appraisal may be unfeasible. In the context of the present paper, where the answer is negative or ambiguous to one or both screening questions, the papers were not appraised by the MMAT.

As regards the rating structure of the MMAT, once the study design is identified then papers are rated as 0%, 25% (*), 50% (**), 75% (***) or 100% (****), where '*' represents achievement of a quality criterion. Thus, achievement of one quality criterion (*) is equivalent to 25% of the criterion being met whilst achievement of two quality criterion (**) is equivalent to 50% of the criterion being met and so on. For qualitative and quantitative papers, there are four quality criteria and papers may achieve a score of between 0% to 100% (****). For mixed-method papers, there are three quality criteria, although it is not possible to achieve a score of 0%, with possible ratings being between 25% to 100% (***). The criterion for each type of study design may vary on the specifics, but generally, across study designs, criterion focus on the characteristics of the sample and sampling methods, use of appropriate instruments and data analysis methods, and the quality and completeness of data collected. There is also a guidance document provided that assists the rater in considering what characteristics within the study would indicate the achievement of the various quality criterion.

Additionally, data synthesis involved the generation of a summary of findings table designed according to the aims of the studies, as well as a narrative synthesis of the findings overall[4]. It should be noted that, whether the studies are able to be rated on the MMAT or not, so long as they satisfy the inclusion and exclusion criteria, they will be included in the synthesis of the results as failing to pass the screening still provides an indicator of study quality, and being able to be rated on the MMAT is not an essential criterion for inclusion.

The narrative synthesis encompassed undertaking a thematic analysis, similar to thematic analysis methods employed in previous reviews that aimed to synthesis data from qualitative and quantitative study designs (Lucas et al., 2007). Within the context of the current paper, this involved three stages. The first stage involved writing down, verbatim, the conclusions of the papers as concerns the use of TTI. The second stage encompassed linking common conclusions, which tended to be specified as either a barrier, facilitator, or some combination of the two concerning TTI use, to develop possible provisional themes. Finally, provisional themes were clustered together to identify overarching themes that best categorised the common conclusion.

Results of the Search

Figure 1 shows that of the 314 papers identified, 102 duplicates were removed, leaving 212 to be screened by title and abstract. A second rater reviewed the titles and abstracts of approximately 10% of the papers found in the initial search, with duplicates removed, to confirm the inclusion/exclusion criteria. There was 81.25% agreement between the first and second rater regarding included/excluded articles. As agreement between the raters was high and discrepancies were easily resolved without consultation of a third rater for resolution, modification of the

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[4] The narrative synthesis employed within the present systematic review aimed to identify common themes across research articles in relation to factors that influence acceptance and/or use of TTI in PwD and/or their caregivers. Hence, no apriori factors were considered prior to the undertaking of the systematic search and narrative synthesis.

selection approach was considered unnecessary. Ten studies were found to be eligible for inclusion in the present review.

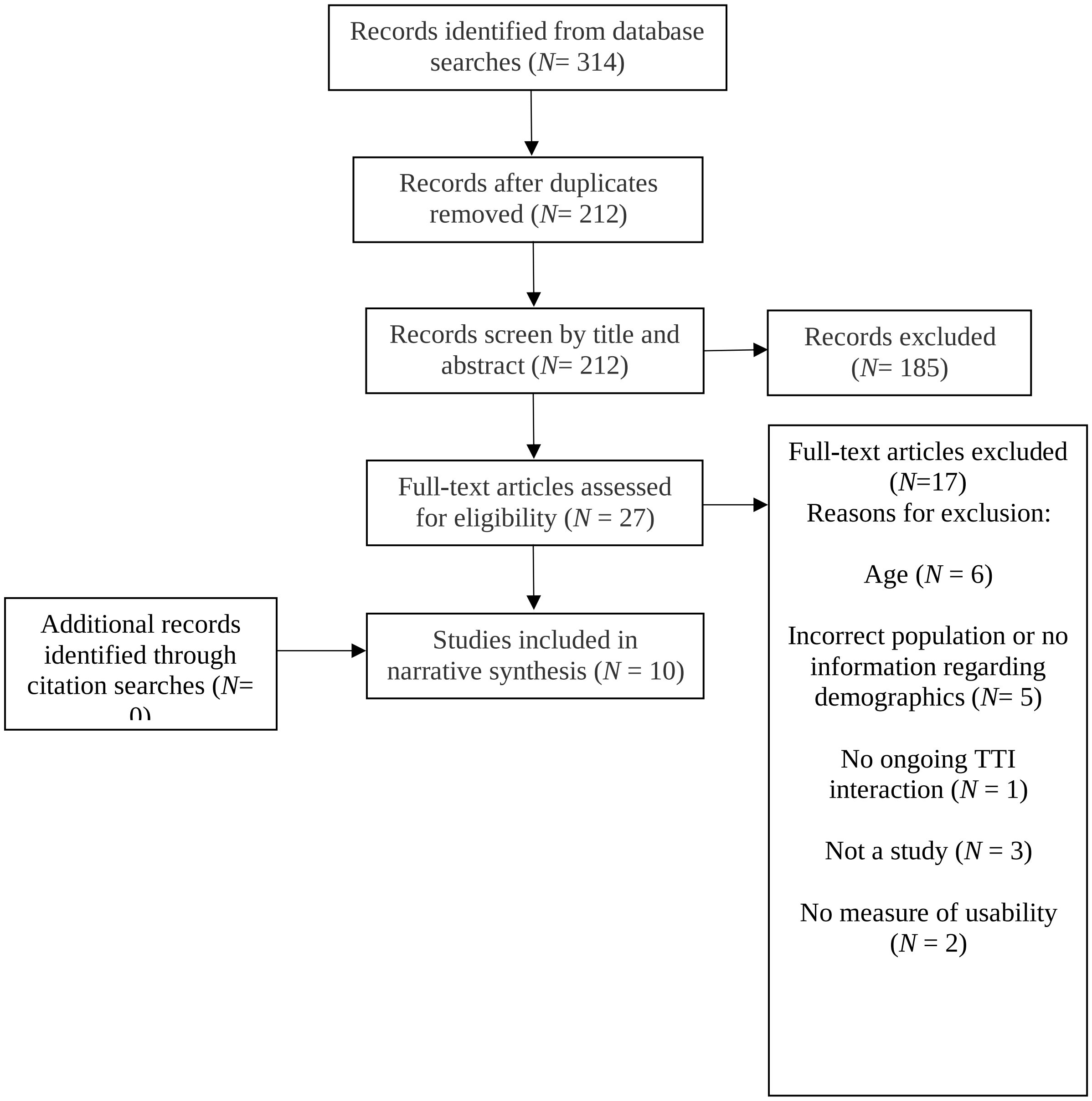

Figure 1. Diagrammatic summary of systematic search outcomes

Results

The characteristics of the ten studies and their methodological quality, as rated on MMAT, are summarized below.

Study Characteristics

Table 2 includes a summary of study characteristics and key information relevant to the systematic review question. Five of the studies were conducted in Europe and the remaining five in North America. A variety of study designs were employed, with qualitative designs being most common (*N*=5), followed by mixed method (*N*=3) and quantitative (*N*=2). All the included studies reported on sample sizes and ages. One study failed to report on gender (Evans et al., 2021) whilst only two reported on ethnicity (Hung et al., 2018; Rai et al., 2021). Two of studies also reported on education levels (De Vito et al., 2020; Harris et al., 2021). Generally, most participants across the studies were female, white/Caucasian and had at least a high school level of education.

Table 2. *Study Characteristics and relevant findings.*

First Author, Year and Location	**Study Design and Sample**	**Key Aim(s)**	**Touchscreen Technology and Intervention**	**Measures and Dependent Variable(s)**	**Relevant Results**
Astell et al., 2016 UK	**Study Design:** Quantitative **(**Randomized trial) **Sample:** *N* = 30 (25f and 5m). *Mdn* age = 86 (*range* 78-100; *SD* = 5.43).	1. Are people living with dementia able to play games on an iPad independently (without a researcher or caregiver on hand)? 2. Do people living with dementia enjoy playing games on the iPad independently?	**Technology:** An Apple iPad (fourth generation) running iOS7 used for data collection and game playing. **Intervention:** Participants played one of two games which were deemed familiar or familiar: Solitaire (group 1; unfamiliar) and Bubble Xplode (group 2; unfamiliar). Bubble Xplode was a game that involved pressing bubbles that appear in formation together of varying colours. By pressing buttons of the same color adjacent to the one that was popped, the others of the same color pop.	Non-validated/observational measures: 1. Independently initiating gameplay. 2. Independently advancing through game 3. Gameplay Length 4. Gameplay enjoyment as measured on a modified GEQ.	Prior familiarity of gameplay or technology use was not considered important for continued use or ease of use but was important for learning to use the TTI and better game performance. This study suggests that novelty may facilitate greater use or engagement with TTI.
Bejan et al., 2018 Germany	**Study Design:** Qualitative (Phenomenological study) **Sample:** All PwD. S1 *N* = 16 (15f and 1m); age *range* 76-95. S2 *N* = 5 (all female); age *range* 90-94.	1. Study S1: can a multimedia natural user interface (NUI) program facilitate enjoyment as an added value, further evoking reminiscence and activating PwD? 2. Study S2: Will personalized multi-media content add value to and be adopted/accepted as a meaningful asset by care personnel as well as the	**Technology S1 and S2:** 40” surface computer with active touchscreen interaction. **Technology S3:** 9.7” tablet and 32” TV and involved passively watching **Intervention:** S1 virtual mixed reality and consisted of 15 sessions. This was a virtual fish aquarium and required PwD to feed and manipulate the fish. S2 encompassed a digital photobook with an average of 29 sessions involving active interaction. Finally, S3 involved passively watching	1. S1: Self provided observation form filled out by author whilst carer prompted PwD about technology, was used to measure reactions and interactions. 2. S2: Self provided observation form which was evaluated using qualitative data analysis and interpreted with a corresponding	Familiarity and stimulation were linked with TTI adoption and engagement. Ergonomics were an important facilitator for interaction. Active interaction facilitates engagement more than passive interaction.

	S3 *N* = 12 (6f and 6m); age *range* 75-97.	PwD in a dementia special care home? 3. Study S3: are non-personalized YouTube (YT) movies (in contrast to self-filmed movies) presented on tablet PCs or TVs suitable to evoke reminiscence and activate PwD and if so, which option is more effective regarding the whole process?	movies on the devices over 50 sessions. All interventions were related to reminisce experience.	hermeneutical approach. 3. S3: Outcomes consistent or participant observation and self-provided observation form to for verbal and non-verbal statements.	
De Vito et al., 2020 USA	**Study Design:** Mixed Method **(**Triangulation design). **Sample:** PwD *N* = 18 (9f and 9m) with all being Caucasian. Age of PwD *M* = 84.5 (*SD* = 7.12). Education of PwD *M* = 16.53 (*SD* = 2.70). Caregivers *N* = 6. Of the 18 participants initially recruited, 11 remain enrolled in the study.	To examine the acceptability and feasibility of a multicomponent telehealth intervention in individuals with moderate to severe dementia who live in a long- term memory care facility.	**Technology:** An Apple iPad (6th generation) and FitBit Activity Monitor. **Intervention:** Once monthly telehealth visits with a neuropsychologist to assess for and manage neuropsychiatric symptoms and develop wellness plans once monthly over the iPad.	1. Activity/HR monitoring via FitBit. 2. Goal Completion - BADLS, NPI-Q, QoL-AD, and QUALIDEM. 3. Semi-structured caregiver/staff interviews.	Increased use of technology is associated with type of goal, motivation, positive attitudes towards technology and more accessible ergonomics.
Evans et al., 2021	**Study Design:** Grounded Theory	Semi- structured interviews with Pwd and	**Technology:** Touchscreen Tablet utilizing a prompting application (but no model or name of TTI provided).	Semi-structured interview with caregivers and PwD.	Level of interest and perceived skill requirement associated with use. Seamless lifestyle

UK	**Sample:** 26 dyads of PwD and their caregiver (*N*= 52) with most caregivers being spouses and some siblings or children. Total sample *M* age = 80, *range* 67-94.	carers about using a prompter.	**Intervention:** Use of a prompting app to set up a series of step-by step prompts from caregivers, using a combination of text, audio and pictures, through which the PwD can be prompted to complete a task of their choosing.		integration and attitudes are factors that mediate engagement and use of TTI.
Goodridge et al., 2021 Canada	**Study Design:** Mixed method (Embedded Design) **Sample:** Participants were caregivers for PwD (*N* = 77). Overall, the persons using the intervention were *N* = 53 (48f and 5m). *M* age = 58, (*SD* = 13.6). PwD were mixture of spouses, friends, or relatives (*M* age = 77.6, *SD* = 12.0).	The overall objectives of this project are: (1) explore the feasibility of a 12-week mobile support program, and (2), conduct an initial efficacy evaluation of changes in perceived caregiver burden, coping styles, and emotional well-being of caregivers before and after the program.	**Technology:** Smartphones (make and model not specified). **Intervention:** A 12-week programme consisting of a mindfulness-based application delivered via an in-house programme called the 'Ethica system' or Ethica smartphone application.	1. Caregiver Burden as measured on the BFSC 2. Caregiver coping style and emotional wellbeing as measured on the Brief COPE and WHO-5. 3. Informal qualitative interviews.	Convenience or portability, increasing familiarity, decreased anxiety, improved learning, and prompting were associated with facilitating TTI use. key barrier concerned inaccessible ergonomics and readability.
Harris et al., (2021) UK	**Study Design:** Quantitative (Pre and posttest). **Sample:** Pairs of participants (Pwd and primary caregivers). 14 dyads	The objectives of this study were to provide preliminary evidence relating to four key questions: 1. Were participants able to use the	A prompting toolkit (touchscreen tablet with pre-loaded software and an instruction manual) was provided without setting it up or showing how to use it for an ‘out-of-the-box’ experience. Use the toolkit over four weeks to choose an activity, break it down into a series of steps, load the steps onto the tablet and	*Cognitive functioning* – ACE-III, CVLT-II and trail making component of D-KEFS), and BADLS (carer completed).	Majority were able to successfully utilize the prompter. Older PwD were more successful at using the prompter, and greater use associated with more positive outcomes.

	with three dropouts. 11 Dyads in final. PwD (*Mdn* Age = 81, *SD* = 5.87, Age *range* = 72-94; f = 8 m = 6). ACE-III *M* = 67.86, *SD* = 9.98). All white, British, and reviewed in NHS clinic. 8 out of 14 had more than 12 years of education, with two not known. Relationships mostly consisting of spouse followed by child dyads, and one sibling.	prompter successfully? 2. Were couples able to achieve the goals they set? 3. Were any background factors associated with use of the prompter? 4. Was use of the prompter associated with outcomes?	carry out the activity. Dyads received weekly research phone calls and were offered a helpline for questions.	*Care knowledge and attitudes* – Caregivers completed ADKS, SCQ. *Prompter use* – Recorded on log automatically every occasion in which component of steps of the task was edited or task was run using in built software. *Goal attainment* (DV) – Modified GAS that omitted any requirement to weight importance of goals. *Ratings of success* – At the end of the four-week trial, carers asked to make two ratings of success (1) whether they were able to access and use the prompt screen to load the steps and (2) whether PwD has been able to complete at least one step on their own.	
Hung et al., 2018 Canada	**Study Design:** Qualitative (Grounded Theory).	To explore the use of SPT with hospitalized older people with dementia.	**Technology:** Apple iPad Pro 12.9". **Intervention:** SPT. This involved family members self-recording a personalized	1. Observational video records of PwD's interaction with iPad.	Bespoke intervention associated with greater TTI engagement. Training also important for to facilitate

	Sample: PwD *N* = 4 (3f, 1m). Age *range* 69-80 with varying dementia types. Backgrounds of PwD were Asian and Caucasian. Staff members also recruited to complete interviews (*N*= 2). These were full-time Nurses.		one-minute video, to be played by the two-nursing staff to PwD during manifestation of agitated or resistant behaviors.	2. Semi-structured interview with the two staff members.	engagement by caregivers and PwD.
Maze et al., 2018 USA	**Study Design:** Qualitative (Case study) **Sample:** *N* = 1, 70-year-old male with mild dementia.	Exploring the use of a smartphone for outdoor safety in a male PwD.	**Technology:** A smartphone designed for OA (but no make or model provided). **Intervention:** The smartphone was used when walking outdoors for the purposes of safety. For instance, pressing a red button when the participant was lost or in danger.	Qualitative account of participant's experience using the smartphone	Memory impairment, inaccessible ergonomics served as barrier for engagement, whilst external support served as a facilitator.
Olexsovich 2016 USA	**Study Design:** Mixed Method (Embedded Design) **Sample:** *N* = 5 PwD who displayed agitated behavior (e.g. verbal agitation and changes in mood). Age *range* 70-92 with various forms of dementia.	1. Goal: OA with cognitive impairments who have agitation and completed the program will not display challenging behaviors 50% of the time after 2 months. 2. Goal: Family members of OA with cognitive impairments will be able to independently find information concerning dementia utilizing at least 2 resources in 5 months.	The Interpersonal APProach to Dementia program consisted of two components: (1) decreasing agitation and (2) caregiver education. Four apps, Classic Melody, White Noise, Recolor, and Flower Garden, that focus on sensory stimulation and structured activities were utilized during one-to-one sessions to decrease agitation in OA. At program completion, the apps were downloaded to a iPad. Caregiver education was delivered through meetings, home visits or email with the researchers to educate family members about dementia. Education materials were saved in the Google Docs^{tm} app on the	1. Agitation as measured on the ABS. 2. A checklist of the observation of nonverbal satisfaction (e.g. smiling, laughing, nodding head and interacting with application). 3. Level of dementia knowledge as measured on the Learning About Dementia: Test Questions Revised	Most found applications and devices easy to use and learn. TTI training for caregivers associated with greater likelihood for engagement and use.

	N = 8 caregivers (but data collected from only 6) with relationship combinations of children/children-in-law, and grandchildren.	3. Goal: Apps that are shown to decrease agitation levels will be incorporated by 50% of the staff who work directly with OA with cognitive impairments and measured via self-report in 1 year.	iPads. These materials contain general information about dementia so that the content was applicable to a variety of caregivers. Appropriate resources that are accessible to the caregivers were also included in the app so that they can find answers to any future questions. Further details about the specifics of these components are detailed in the article. Overall, the apps were used to reduce agitation by improving sensory stimulation and providing structured activities. PwD participated for 15-30 minutes per day, five days per week. Each app was used over a 2-week period. For caregivers, the educational materials use was flexible, but ranged from approximately 30 minutes to 1 hour and lasted indefinitely.	4. Likert scale questions and open-ended (qualitative) questions about strengths and weaknesses of program on the Family Education Questionnaire.	
Rai et al., 2021 UK	**Study Design:** Qualitative (Grounded Theory). **Sample:** *N* = 13 PwD and *N* = 13 carers who were placed in a focus group or individual interviews. Additional *N* = 18 PwD and *N* = 16 cares completed a short usability and acceptability questionnaire. Focus Group: *N* = 8 PwD (3f and 5m).	Trial iCST application with people with dementia and carers to refine application and improve usability.	**Technology:** Touchscreen devices, including tablets, computers, and smartphones. **Intervention:** A prototype iCST application which is intended to be delivered with an informal carer in the home environment.	1. Observational data: Whilst participants using the application for 20 minutes together (i.e. PwD and carer together), the researcher recorded observed responses to the application. 2. Semi-structured interviews: In the individual group, this involved interview of 20-50 minutes in length with PwD and caregiver separately. Focus groups involved group interviews.	Main factors mediating use were attitudes, ergonomics, perceived benefit, enjoyment, social interaction whilst using the TTI.

	M age = 75.5, (*range* 69-86, *SD* = 7.76). *N* = 5 PwD in focus groups (*M* age = 70.37, *range* 54-82, *SD* = 7.89; 5f, 3m). *N* = 8 carers in focus groups (*M* age = 75.5, *range* 69-86, *SD* = 7.76; 3f, 5m). *N* = 5 carers in focus groups (*M* age = 67.2, *range* 49-82, *SD* = 11.99; 4f, 1m). All participants predominately white. Caregivers encompassed a combination of spouses and children.				

Note. Summary of abbreviations used in table below.
ABS = Agitation Behavior Scale; ACE-III = Addenbrooke's Cognitive Examination-III; ADKS = Alzheimer's Disease Knowledge Scale; BADLS = Bristol Activities of Daily Living Scale; BFSC = Burden Scale for Family Caregiving ; CDR = Clinical Dementia Rating; COPE = Coping Orientation to Problems Experienced Inventory; CST = Cognitive Stimulation Therapy; CVLT-II = California Verbal Learning Test - Second Edition; D-KEFS = Delis-Kaplan Executive Function System; GAS = Goal Attainment Scale; GEQ =Game Experience Questionnaire; iCST = Internet Cognitive Stimulation Therapy; ICT =Information Communication Technologies; MMSE = Mini Mental State Examination; MoCA =Montreal Cognitive Assessment; NPI-Q =Neuropsychiatric Inventory Questionnaire; OA = OA; PwD = Person(s) with Dementia; QoL = Quality of Life; QoL-AD = Quality of Life in Alzheimer's Disease Scale; SCQ = Social Communication Questionnaire; SPT = Simulated Presence Therapy; TTI = Technologies with Touchscreen Interfaces; UK = United Kingdom; USA = United States of America; and WHO-5 = The World Health Organization- Five Well-Being Index.

Quality of Papers

Each of the included studies were analyzed and appraised by the primary researcher using the MMAT. A secondary researcher then co-rated five of the included papers to examine reliability of the ratings. It was noted that there was a 75% agreement regarding quality of papers and 50% agreement in terms of methodology as described in the MMAT. Disparities were discussed and raters were able to resolve differences in terms of methodological design and quality ratings. Generally, disagreements concerning study design arose due to misleading descriptors of study types by the research authors, which, when discussed in the context of the papers as a whole in comparison to the MMAT criteria were easily resolved without need for consultation of a third researcher. As regards quality of papers, once disparities between study designs were resolved the quality criteria was confirmed through a discussion between both raters without issue. The MMAT ratings and design selected for each individual paper are detailed in table 3.

Table 3. *MMAT Ratings*

First author and year	**MMAT Design Selected**	**MMAT screening passed?**	**Quality Appraisal (Quality Criterion)**
Astell et al., 2016	Quantitative Descriptive	Yes	50% (**)
Bejan et al., 2018	Qualitative	No	N/A
De Vito et al., 2020	Mixed Methods	Yes	75% (**)
Evans et al., 2021	Qualitative	Yes	75% (***)
Goodridge et al., 2021	Mixed Methods	Yes	25%
Harris et al., 2021	Quantitative Descriptive	Yes	50% (**)
Hung et al., 2018	Qualitative	Yes	75% (***)
Maze et al., 2018	Qualitative	No	N/A
Olexsovich 2016	Mixed Methods	Yes	75% (**)
Rai et al., 2021	Qualitative	Yes	50% (**)

A combination of research designs were employed as defined by the MMAT criterion, with the most common being qualitative or mixed methods. Of the ten papers included, two papers did not pass the initial MMAT screening criteria and therefore could not be rated (Bejan et al., 2018; Maze & Hunt, 2018). Of the remaining papers, four met 75% of the criteria, three met 50% of the criteria and one met only 25% of the criteria.

Outcomes regarding barriers and facilitators to TTI

Several key themes and principles are shared across the included research papers in relation to barriers and facilitators concerning the engagement, use, adoption or acceptability of TTI. These will be summarized below.

Personal Attributes and Factors

The most common theme consistently reported relates to personal attributes. Indeed, of the included articles, six made explicit a theme related to personal attributes and use of TTI (De Vito et al., 2020; Evans et al., 2021; Harris et al., 2021; Hung et al., 2018; Maze & Hunt, 2018; Rai et al., 2021). For instance, the studies indicated that factors such as attitudes towards the technology, the perceived costs and benefits of their use, personal skill level and degree of confidence or anxiety in using TTI were factors that may increase or decrease the likelihood of engagement with TTI. This is in keeping with previous studies, which found similar themes, such as exposure to previous experience of technology use as a prerequisite for future engagement and use of TTI (e.g. (Alvseike & Brønnick, 2012; Kobayashi et al., 2011; Parker et al., 2013). Interestingly, familiarity with TTI may not in itself impact the adoption of TTI directly, although may lessen anxiety and bolster learning. Lowered anxiety and better learning may increase ease of use, but reduce novelty thereby decreasing overall engagement as a reduction in novelty has been found to decrease engagement with TTIs (Astell et al., 2016). Conversely, one study did note that although concerns were raised regarding use of TTI, the majority of participants were able to utilize the devices indicating that lowered confidence may not always correspond with lowered use (Harris et al., 2021).

Ergonomics

A second factor related to the ergonomics of TTI, which was a theme in four of the included studies (Bejan et al., 2018; Goodridge et al., 2021; Maze & Hunt, 2018; Rai et al., 2021). Specific ergonomic components that were identified included readability, portability, and straightforward design or programming. Indeed, feedback reported in the study by Rai et al., (2021) explicitly requested cross-platform support for their internet Cognitive Stimulation Therapy (iCST) programme beyond the smartphones that were employed in order to improve readability. Frustration was expressed by the PwD in the Maze and Hunt (2018) study in terms of readability on smartphones being poor and becoming confused by the overwhelming number of other features available on the TTI. Thus, taken in concert with results from another study disabling superfluous features on the smartphone and receiving positive feedback in terms of ease of use (Rai et al., 2021) there is reinforcement for the notion of favoring a simple design language when employing TTI. Finally, the emphasis regarding the quality and size of displays in TTI is important but should be interpreted with caution since it is difficult to conclude whether the readability issues are a result of the size of the device screen or the quality of the application, with only one study evaluating these components separately (Olexsovich, 2016).

External Factors

An important final theme concerns external or social cues, which can mediate the use of and engagement with TTI. In particular, the option of utilizing such technology with others, such as family members or healthcare professionals, was a theme found to increase engagement and use of TTI across at least four studies (Bejan et al., 2018; Cooper et al., 2020; Evans et al., 2021; Hung et al., 2018) . Other factors that might serve as a barrier to engagement include the perceived stigma about the use of TTI for assistive functions, and prompting by other persons was a factor that increased use and adoption of TTI (e.g. Maze et al., 2018; Hung et al, 2018). In the Maze et al. (2018) study specifically, concerns related to ensuring the device was fully charged and accidently misplacing it were raised, indicating that a lack of external cues for use and upkeep are barriers for engagement with such technologies by PwD. For caregivers, requirement of training or guidance was an important priority in terms of increasing the likelihood of the adoption and use of the TTI.

Discussion

The purpose of this review was to investigate the barriers and facilitators for the use, engagement, or adoption of TTI for PwD and their caregivers. Ten studies were ultimately identified, the outcomes of which will be summarized below.

Outcomes related to engagement, use and adoption of TTI

Concerning the primary aim of this systematic review, across included papers, three main outcomes or themes were identified in terms of factors that facilitate engagement with TTI. These were: (1) personal attributes; (2) ergonomics; and (3) external factors. Specific factors relate to the prior use, confidence regarding the use of TTI, the characteristics of the design language, readability, utility and reinforced use by others in the environment. These findings appear largely in-keeping with similar research undertaken with older adults without dementia, which has found prior use, confidence, utility and ergonomics to be associated with use and engagement with TTI (Alvseike & Brønnick, 2012; Findlater et al., 2013; Kobayashi et al., 2011; Parker et al., 2013). A factor that was not explicitly mentioned within the studies for PwD that was noted to decrease use or engagement with TTI in persons without dementia was cognitive ability (Alvseike & Brønnick, 2012). It is intuitive that cognitive decline may reduce use of TTI owing to decreased function or forgetfulness, and is therefore a discrete factor that consistently reduces TTI use within PwD that is not necessarily found in those older persons without dementia.

For caregivers, a key facilitator related to training and experience in their use with more training and experience associated with greater engagement with TTI. The most common and consistent theme concerned familiarity with TTI which enables ease of use, although this did not necessarily result in an increase in adoption. This suggests that the theme of use and adoption differs from ease of use and engagement, and the relationship between these variables is complex. Moreover, something that was noted across the studies was the lack of differentiating between the TTI and the software built into it, which was only explored in one study (Olexsovich, 2016) meaning that it is difficult to delineate the extent to which the outcomes regarding use, adoption and engagement are a result of the device or the application delivered via the device. Regardless, the consistent results regarding good engagement and adoption of the TTI by PwD and their caregivers augurs well for the implementation of such devices across older adult care settings.

Methodological Quality of the Included Studies

In aggregate, the methodological quality of the studies was satisfactory, with the majority achieving ratings between 50% to 75% on the MMAT. There does not appear to be a link between the quality of the studies and outcomes found, with even those papers that achieved few of the MMAT criterion (Goodridge et al., 2021) or did not meet the minimum criteria to be rated (Bejan et al., 2018; Maze et al., 2018) reaching similar conclusions to those studies meeting more of the criterion. Despite this, it is important to acknowledge that, due to the MMATs ability to assess multiple types of studies, it is less sensitive to detect the quality of specific factors related to a particular type of study; instead, evaluating multiple types of study designs in a general fashion. For instance, whilst the MMAT ratings may be favorable, the small sample sizes, lack of quantitative data analysis, and general absence of psychometrically sound outcome measures across studies, limits the applicability and reliability of the findings. Despite this, a notable strength across the studies related to ecological validity and appropriate sample types, which were recruited from relevant clinical settings.

Strengths and Limitations of this review

The strengths and limitations of this review must be considered when interpreting the findings. The validity of any systematic review is based on the rigor of the search and whilst every effort was made to identify all studies, there is always an inherent risk of overlooking research (Moher et al., 2015). Indeed, whilst databases were extensively searched and reference lists from previous reviews consulted, there were no hand-searching of journals, forward and backward searching for articles, contacting of experts in the areas for knowledge of further papers, and no review of sources specifically within the grey literature, likely resulting in missed articles.

Interestingly, all the included studies were published in between 2016 to 2021, although no date parameters were applied within the search. This can likely be attributed to the iPad only becoming available in 2010 and the use of terms such as smartphone and touchscreen becoming more common in recent years. Regardless, future reviews would benefit from a more comprehensive search strategy.

In addition, nine of the papers included in this review were published in peer reviewed journals, introducing the potential of publication bias. Conversely, as the studies have been scrutinized by independent researchers, this also means that they may be of higher quality than those that come from non-peer reviewed sources. It should be noted that a systematic appraisal of bias was not conducted owing to the inclusion of varying study design types. Hence, whilst an appraisal of methodological quality has been provided and potential for publication bias discussed, the extent to which bias is present across the included studies and impact of this upon the conclusions drawn is unknown, serving as another limitation of the present review.

A key strength of this review relates to the inclusion of a co-rater at every stage of the search strategy and rating of a portion of the included studies, in an attempt to minimize researcher bias. Furthermore, the inclusion of a diverse range of studies provides a richness of information, that may be lost in design specific reviews with a considerably more restricted scope. Finally, the use of a rating tool that affords simultaneous evaluation of a range of study designs enables comparison of multiple studies and can provide a summary of the quality of all research within a particular field, thus enabling a more holistic approach in identifying gaps in the literature and where improvements are required.

Recommendations for future research

The outcomes of this review illuminate several avenues for further research. The included papers highlight three key factors in mediating TTI adoption and engagement and therefore larger scale studies are needed to reinforce these conclusions and confirm the degree of influence these factors have upon TTI engagement, adoption and use over time. Moreover, studies that undertake component analysis separating TTI from the applications or software being delivered via such technology are also needed to confirm the factors mediating the use, adoption and engagement with TTI that are universal across varying applications. These recommendations may be achieved through the undertaking of large scale cross-sectional or longitudinal research designs. For instance, cross-sectional research methodologies utilizing predictive modelling analysis (e.g. regression analysis) may be undertaken to investigate the predicative validity of personal attributes, ergonomics and external factors discreetly upon TTI hardware and software engagement or use. Such studies will no doubt facilitate the generation of guidelines in the use of TTI within dementia care.

Additionally, the papers appear to elucidate familiarity as a key feature in the adoption and use of TTI; hence, further research into this factor and its relation to learning and novelty effects are needed. This may be done, for instance, via randomized between-group methodologies, whereby participants are randomly allocated to two groups, with one group allowed time to use the TTI following training to increase familiarity and reduce novelty prior to data collection and another where data collection begins immediately post-training.

Conclusion(s)

In aggregate, current research seems to portend a positive view of the adoption and use of TTI as a means of improving quality of life. Barriers and facilitators to engagement and use relate to personal attributes, ergonomics and external factors, and these components should be considered in the implementation of TTI. However, interpretation of these findings should be tempered with caution, owing to the methodological weaknesses of the included studies, such as the small sample sizes and lack of quantitative data analysis. Large scale and component analysis-oriented studies are needed in order to validate the results from these smaller studies as well as to draw inferences regarding the relationships between the various components that facilitate the adoption, use and engagement of TTI within PwD and their caregivers.

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Chapter 2

A Single Case Experimental Design Study to Explore the use of Simulated Presence Therapy as a Formulation Based Intervention for Patients with Dementia Who are Presenting in Distress.

Danyal Ansari[5][6][7]

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[5] Institute of Health and Wellbeing, University of Glasgow, Glasgow, Scotland, United Kingdom.

[6] No conflicts of interest to disclose.

[7] Orcid Link: https://orcid.org/0000-0002-2437-0909

Plain Language Summary

Title: A Single Case Experimental Design Study to Explore the use of Simulated Presence Therapy (SPT) as a Formulation Based Intervention for Patients with Dementia Who are Presenting in Distress.

Background: Persons with dementia **(**PwD) can experience distress, sometimes due to a physical or mental health need that that is unmet (James, 2011). Distress is expressed in many ways in PwD, but some common occurrences include physical or verbal aggression, tearfulness, upset, confusion and asking repetitive questions. Consequently, it is important to find methods to lessen this distress.

SPT involves playing a video/audio recording of a loved one to PwD to reduce distress, although research evidence relating to its helpfulness is mixed (Abraha et al., 2017). One reason for this may be because decisions to use SPT have been based on just the presence of distress rather than a more detailed understanding of the factors that are causing distress. Formulation is an approach to healthcare that considers the views of an individual and the systems they operate within, as well as psychological theory and research evidence, to conceptualise their difficulties (James, 2011).

Aims and Questions: This study aims to determine if SPT use, based on a psychological formulation, reduces distress in patients with a diagnosis of dementia presenting with distressed behaviours. This study will also examine how user-friendly and helpful SPT was viewed by healthcare professionals.

Methods: Five participants with moderate to severe dementia who presented with distress were initially recruited from older people's hospital wards, which are operated by NHS Greater Glasgow & Clyde and/or a surrounding Health and Social Care Partnership. As participants with dementia did not have the ability to provide their informed consent, these were obtained from a participant's legal guardian or next of kin. SPT recordings were generated by those persons who knew the participants, to be played at times when they presented in distress. The frequency of the distressed behaviours was tallied by healthcare professionals before and after the introduction of SPT for each participant over a pre-determined period of time. One participant dropped out prior to data collection. Another participant's data was not collected during the delivery of SPT and so they were unable to be included in the analysis. Thus, three patient participants were included in the final analysis. At the end of the study, five healthcare professionals who used SPT with the patient participants were also recruited and completed a questionnaire about their experiences using SPT.

Main Findings and Conclusions: The results were mixed across the three participants, with SPT temporarily increasing distress for one participant, lowering distress for another and not having any effect for the remaining participant. In terms of the experience of healthcare professionals using SPT, this was generally favorable, with all recruited professionals indicating they found it easy to use and helpful. Possible explanations for the results are discussed, such as the relationship style of the patient participants impacting their engagement, the nature of the SPT recordings and the impact of covid on the study. Recommendations for future study are provided.

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Abstract

Background

Simulated Presence Therapy (SPT) involves playing an audio and/or visual recording of a caregiver to persons with dementia (PwD) to ameliorate Stressed and Distressed Behaviors (SDB).

Aims

This study aimed to determine if SPT, when employed as part of a formulation-driven approach, can ameliorate SDB in PwD. In addition, this study also investigated the usability and acceptability of SPT by healthcare staff.

Methods

A multiple baseline across participants single case experimental design was employed. Participants were in the moderate to severe stages of cognitive decline, residing in residential or hospital settings. Participant attachment style data was also gathered. Data was gathered through recordings of the frequency of daily SDB before and after the introduction of SPT and analyzed using visual inspection and Baseline Corrected (BC) Tau**.** 21 people participated in the study, consisting of patient participants (*N*= 5), informants (*N*=4) SPT video recorders (*N*=7) and professionals (*N*=5). Three patient participants, all identified as being securely attached, ultimately completed the study. The five professionals completed the user experience questionnaire.

Results

Tau-U analysis revealed that one participant demonstrated a significant increase (Tau = 0.588, $p < .001$) in daily SDB based upon the method utilized to handle missing data, whilst another demonstrated a significant decrease (Tau = 0.377, $p = 0.046$). No other significant results were shown. The median score on the user experience questionnaire across participants was 45 out of a possible 55, indicating positive views of the technology-based intervention by healthcare staff.

Conclusions

The mixed efficacy of SPT used as part of a formulation-based approach indicates that it may be a useful intervention in certain circumstances. Staff responses to the user experience questionnaire indicated that SPT was a usable, acceptable, and helpful intervention. Recommendations for further research are provided.

Keywords: *dementia, formulation, attachment, simulated presence therapy, distress*

Introduction

In the United Kingdom (UK), approximately 7.1 per cent of individuals over the age of 65 have a diagnosis of dementia, with the most common being Alzheimer’s disease (Prince et al., 2014). In addition to cognitive impairment, persons with dementia (PwD) often present with a cluster of symptoms of distorted perceptions, thoughts, mood and behaviors, referred to as the Behavioral and Psychological Symptoms of Dementia (BPSD; Tible et al., 2017). It has been argued that it is important to understand these psychological and behavioural experiences not just in terms of an underlying biological pathology, but as arising from the complex interaction of the disease process and the person's psychosocial environment (James & Moniz-Cook, 2018).

Formulation-based approaches to Dementia Care

Psychosocial conceptualizations posit that BPSD manifest as a result of distress arising from an unmet need (Cohen-Mansfield, 2001); thus, the term ‘Stressed and Distressed Behaviors’ (SDB) may more accurately represent the etiology of these symptoms. These concepts have been aggregated into the Newcastle model (James, 2011), emphasizing a formulation-based approach to dementia care. The core components of the Newcastle model are detailed in figure 2 below.

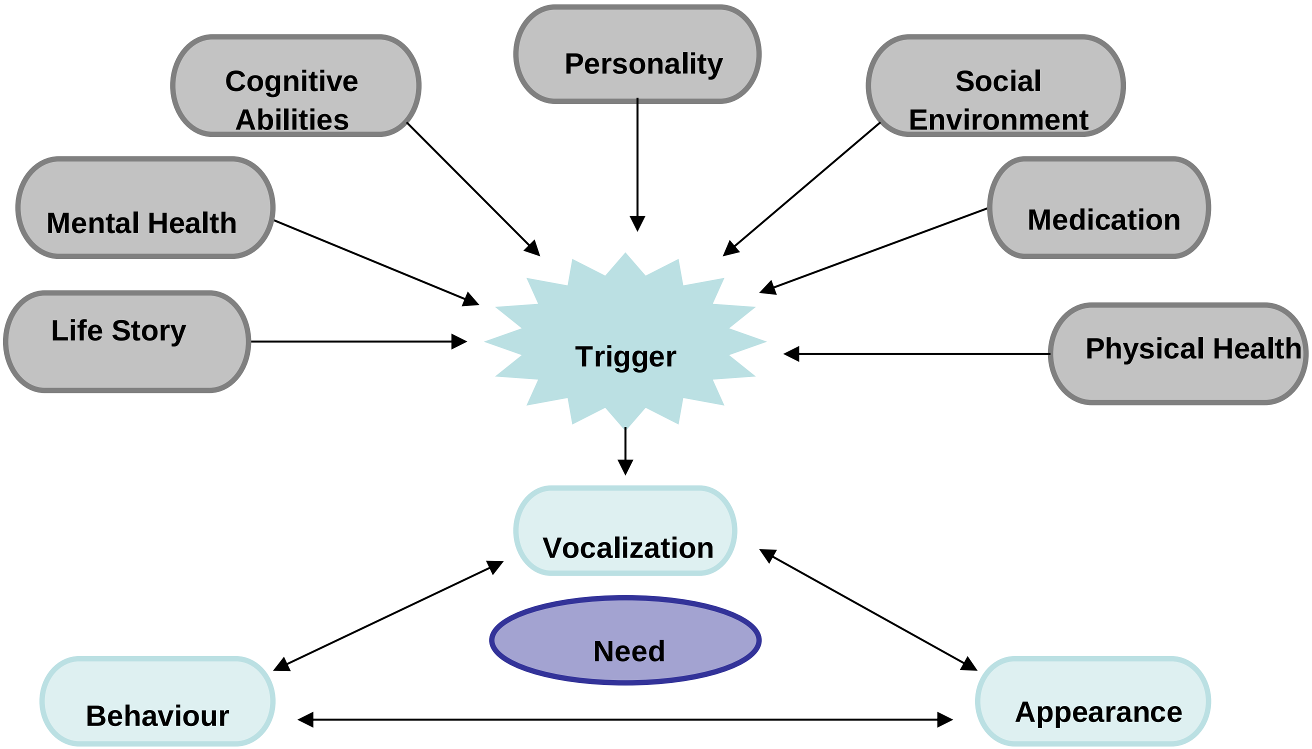

Figure 2. The Newcastle model

Psychological formulation involves collaboratively developing a hypothesis regarding an individual's difficulties by incorporating psychological theory and evidence (James, 2011). In an integrative review of formulation-led interventions in dementia care, Holle et al. (2017) noted that formulations: (1) reduce SDB in comparison to usual care; (2) slightly alleviate caregiver burdens; and (3) improve multi-disciplinary care decision-making processes. Thus, a formulation-based approach in applying interventions appears to provide a myriad of benefits over traditional symptom-led care, although the conclusions of this review should be interpreted with caution as all included studies were conducted in nursing homes, and most outcome measures emphasized physical health needs. One intervention, that has not been investigated in this manner, is Simulated Presence Therapy (SPT).

Simulated Presence Therapy

SPT is an intervention that involves playing a video or audio recording of a loved one to PwD when they present with SDB (Abraha et al., 2017). The content of the recordings can vary, with some focused-on recollecting shared past experiences whilst others are present focused and relate to the PwD current environment. Regardless of content, the aim of the intervention is to reduce SDB and improve quality of life within PwD (Peak & Cheston, 2002). The theoretical underpinnings underlying its putative efficacy vary, with some proposing that SPT activates preserved long-term memory storages which contain experiences associated with positive affect thus reducing SDB (Camberg et al., 1999).Others indicate that the presence of an adult attachment figure may help to reduce separation anxiety and confusion to improve emotion regulation (Cheston et al., 2007; Peak & Cheston 2002).

In terms of the application of SPT within a formulation-based approach utilizing the Newcastle model, the primary aim would be to utilize SPT for those PwD where there is an underlying unmet need that results in SDB (James, 2011). As highlighted previously, whist the theoretical mechanisms which underlie the efficacy of SPT are unclear and contended, the similarities between differing viewpoints are that that SPT may compensate for the diminished ability of PwD to effectively manage their own emotional or behavioral experiences. This occurs by drawing upon important individuals with whom they share positive experiences and connections with. Thus, in the present context, SPT may be selected as the intervention of choice where there is SDB caused due to a lack of familiarity, reduction in meaningful interpersonal exchanges and/or emotional dysregulation due to a dearth in meaningful connections to attachment figures.

As regards current evidence, studies examining the efficacy of SPT are sparse; however, what little research that has been conducted has suggested it may be effective in some instances (Abraha et al., 2017) with high usability and acceptability reported by healthcare staff (Hung et al., 2018). Having a secure attachment style may be indicative of benefitting from SPT (Peak & Cheston, 2002), although this finding has not been consistently replicated (Cheston et al., 2007). Additionally, SPT has been found to be more effective in those PwD who are more cognitively impaired (Bayles et al., 2006; Werner et al., 2000). Finally, whether the content of the recordings pertains to past events or is present-focused, response to the recordings are most effective when they are loving, supportive and in a style that is idiosyncratic to the relationship of the caregiver with the patient (Werner et al., 2000).

Thus far, studies have not explored SPT when it has been identified as a way of addressing an unmet need through a formulation-driven assessment process. Instead, it has been applied to participants within specific care settings with a symptom rather than formulation-based approach. Only utilizing SPT where distress symptoms are present without consideration of the underlying causes for such distress may mean that it has been applied inappropriately. Hence, the present study explored the efficacy of SPT as part of a formulation-driven approach, grounded in the Newcastle model. Additionally, as attachment styles may be a factor that influences efficacy of SPT, participant attachment style was assessed through a similar method employed in a previous study of SPT (Cheston et al., 2007). The acceptability and usability of SPT by healthcare staff who used it was evaluated using a questionnaire based on the Unified Theory of Acceptance and Use of Technology (UTAT; Venkatesh et al., 2003). The UTAT informed questionnaire can be found in appendix 2.3.

Aims and Objectives

The present study investigated the efficacy of SPT for SDB in PwD when it was specifically identified via a Newcastle formulation as the preferred intervention.

Primary objective

1. It was proposed that the introduction of SPT as an intervention would significantly reduce the frequency of SDB in patients during day-to-day activities, encompassing activities related to hygiene, receipt of care (e.g.

accepting medications), interaction with others, and pleasurable or relaxing activities done individually or with others, when compared to the frequency of SDB during the baseline phase prior to the introduction of SPT..

Secondary objective

2. To examine the acceptability and usability of SPT amongst healthcare professionals who administer it.

Methods

Design

The present study employed a randomized Single Case Experimental Design (SCED) of two phases with multiple baselines. This involved randomly allocating participants using a randomizer (http://www.randomizer.org) to a 14, 17 or 21-day baseline period (Phase 'A'), where the frequency of dSDB were collected per participant. This was followed immediately by the SPT intervention phase (Phase 'B'), which may last indefinitely, although the data collected matched the length of the corresponding baseline. To ensure methodological rigor, the present study was developed with reference to the recommendations of the Risk of Bias in N of 1 Trials (RoBiN-T; Tate et al., 2013), which is a tool used to evaluate the methodological quality of SCEDs.

Ethics

Management approval was provided by National Health Service (NHS) Greater Glasgow and Clyde (GGC) who also acted as study sponsor (GN21MH088). Ethical approval was granted by the Scotland A Research Ethics Committee (21/SS/0055) (Appendix 2.4). The study was also registered on clinicaltrials.gov (https://clinicaltrials.gov/ct2/show/NCT04876911). A non-substantial amendment to extend the recruitment period for the study until October 2022 was approved by the sponsor (GN21MH088 NSA01). A substantial amendment to clarify number of SPT video recorders was approved by the Scotland A Research Ethics Committee (21/SS/0055 AM02) and the sponsor (GN21MH088 SA01 Cat A).

Inclusion and Exclusion Criteria

To be included in the present study, patient participants were required to be aged ≥ 65 years and resident within a care home or hospital ward setting. Furthermore, the first language of all participants was required to be English as SPT recordings were required to be in English to allow staff to understand their content as part of quality control. All patient participants had a diagnosis of dementia (any form) within the moderate to severe stages and presented with SDB as confirmed by a Newcastle formulation. A score of at least 19 on the Dementia Severity Rating Scale (DSRS; Clark & Ewbank, 1996) was required, reflecting dementia severity of at least a moderate level. Finally, the formulation needed to identify patient participants as having retained the relevant cognitive faculties required to engage with audio-video technologies, including attention, recognition and communication (Bayles et al., 2006).

The exclusion criteria were:

- No relative/friend/caregiver available to be recorded.
- Significant vision and/or hearing impairments that cannot be corrected.
- Pre-existing neurological or severe psychiatric disorder (e.g. psychosis, bi-polar disorder).
- Diagnosed or suspected intellectual and developmental disability.

Participants

Patient participants resided within residential or hospital care settings managed by NHSGGC or jointly by NHSGGC and a GGC Health and Social Care Partnership (HSCP). Other recruited participants encompassed the loved ones of patient participants and healthcare professionals employed within the aforementioned healthcare settings. The DSRS was used by a member of the research and/or healthcare team to confirm that potential patients were in the moderate-severe range of cognitive impairment. Attachment styles were determined via the adaption of two attachment-based questionnaires: The Measure of Attachment Measure (MOA; see appendix 2.1) and the Measure of Attachment Qualities Adapted (MAQ; see appendix 2.2).

A total of 21 participants were initially recruited, comprising of patient participants (*N* = 5), informants (*N* = 4) SPT video recorders (*N* = 7) and healthcare professionals (*N* =5). One patient participant dropped out prior to commencement of data collection. Participant 1 began Phase A with some data collection, but due to covid outbreaks in the ward, dSDB were not tallied during the full baseline period. Moreover, the SPT recording, which had been obtained just prior to the outbreak, was inconsistently delivered on at least two occasions during the outbreak but again dSDB was again was not tallied. This was attributed to the outbreak limiting staff resource and the ability to appropriately cascade information. Consequently, Participant 1 did not complete the study. In sum, 19 participants completed the study.

As regards the three patient participants that did complete the study, data was successfully collected from Phases A and B for Participants 2 and 3, although significant disruption due to covid outbreaks across NHSGGC operated hospital wards resulted in missing data. For Participant 4, data was collected during Phases A and B, although there was substantial missing data owing partially to covid related disruptions but more general organizational concerns. SDB was conceptualized for each patient participant based on a Newcastle formulation completed by a clinical psychologist. Full details regarding the use of the Newcastle formulation within the healthcare environment and research can be found in the study protocol (see appendix 2.5). A summary of the patient participant characteristics of those who commenced the study are provided in table 4.

Table 4. *Patient participant clinical and demographic variables*

Participant	Age	Sex	Dementia Type	DSRS	Attachment style MOA	MAQ	SDB[1]
Participant 1[2]	76	M	Lewy Body Dementia (moderate)	19	Anxious/Ambivalent	Avoidant	Physical and verbal aggression, confusion, and tearfulness.
Participant 2	86	M	Vascular Dementia (severe)	42	Secure	Secure	Repetitive shouting and confusion.
Participant 3	73	F	Alzheimer's (severe)	38	Secure	Secure	Tearfulness, reassurance seeking, and confusion.
Participant 4	69	M	Alzheimer's (moderate)	26	Secure	Secure	Reassurance seeking and excessive apologizing.

[1] The SDB reported represents the main behaviors expressed by the patient participants and were the behaviors tallied on the frequency charts. It may be the case that other SDB behaviors are also expressed but these were either infrequent or not considered amenable to change by SPT.

[2] Participant 1 did not complete the study.

Four informants (2 female and 2 male) were recruited to complete the MOA and MAQ questionnaires for each participant

Seven recorders (4 female and 3 male) were also recruited to generate SPT video tapes for the patient participants. Finally, a total of five healthcare professionals who were members of staff within the wards completed the SPT user experience questionnaire.

Materials

Measures used within the present study and psychometric properties, are summarized below in table 5.

Table 5. *Measures employed*

Measure	Information

DSRS	The DSRS is a 12-item, informant report questionnaire that assesses a variety of functional and cognitive abilities across a Likert scale, enabling allocation to ‘mild’, ‘moderate’ or ‘severe’ level of dementia impairment for an individual. The DSRS has been psychometrically validated across varying dementia types, with predictive validity for detecting dementia via ROC being 0.66, sensitivity being 0.41 and specificity being 0.79, (McCulloch et al., 2014). A minimum score of 19 is required for inclusion in the present study.
MOA	This is an informant report questionnaire that consists of three interpersonal statements (A, B and C), of which, one is selected in order to identify the attachment style of the PwD. The questionnaire can be completed by persons who knew the participant before and/or after their diagnosis of dementia. As the questionnaire has been modified for the present study, its psychometric properties ae unknown.
MAQ	This is a 14-item informant report questionnaire that evaluates interpersonal and social functioning across varied scenarios in order to identify an attachment style. The items correspond to four attachment style domains. Achieving an average scaled score of 2.5 or above on an attachment domain indicates a likelihood to present with the traits of this attachment style, although the attachment style domain with the highest score is reported. The questionnaire can be completed by persons who knew the participant before and/or after their diagnosis of dementia. As the questionnaire has been modified for the present study, its psychometric properties are unknown.
UTAT	This is an 11-item, self-report questionnaire that evaluates staff experience of using SPT. There is no cut off score although a greater score indicates a greater perception of usefulness, helpfulness and overall usability of SPT. As the questionnaire has been modified for the present study, its psychometric properties are unknown.
Frequency Chart	This is a frequency chart that is routinely used in the service. Any care team member supporting a patient participant can record on it, and the total number of tallies per day should be documented. The chart records begin and concludes ‘one day’ from 5am. It is not possible to establish the psychometric properties of this measure.

Laptop or tablet devices were used to record the SPT messages. These were then transferred to NHSGGC and/or GGCHSCP owned tablet devices (i.e. 9.7” iPads) for storing and displaying the videos to the participants. For participant randomization, an online randomization program available at https://www.randomizer.org/ was used for allocation. All participants were within their care home or hospital ward setting during the delivery of SPT.

Procedure

Participants were recruited by members of the research team from identified care homes and hospital wards within NHSGGC and/or GGC HSCP. At time of recruitment, a fully or partially completed Newcastle formulation had been undertaken to confirm suitability for SPT and the research project. As all PwD did not have the capacity to consent, the relevant welfare guardian or next of kin for the participant was approached to obtain informed consent. Informed consent for recorders, informants, and healthcare professionals was also obtained. Accordingly, there were five versions of the information sheets and consent forms for each of these persons (see appendix 2.5). Full details regarding the consent procedures are detailed in the study protocol.

Following recruitment, patient participants were randomly allocated to a 14, 17 or 21-day baseline as part of the staggered approach using an online randomizer. It should be noted that, owing to covid related organizational issues and consequent delays in arranging SPT recordings, an increase to baseline periods for some of the included participants were observed due to delays in arranging SPT recordings. The possibility of an adaption to data collection periods was noted in the proposal, and the changes in timeframe in this context did not impact the integrity of the data set. A summary of the allocated versus actual baseline and intervention length can be found in the figure 3.

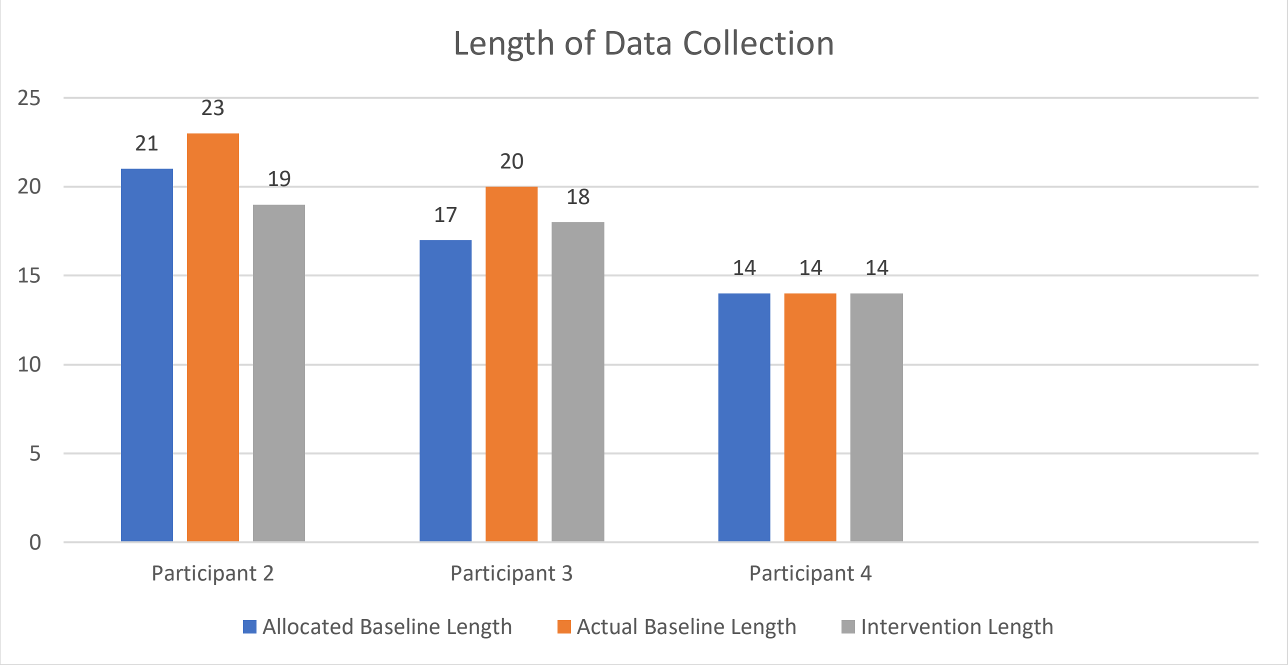

Figure 3. Actual and allocated baseline and intervention length

During the baseline stage, the frequency of SDB per day were documented on the recording sheet (appendix 2.6) and totaled together to generate the dSDB number. Thus, dSDB represents the total amount of SDB displayed in one single day (i.e one point of data) by a patient participant. The SDBs were operationalized within the Newcastle formulation and were coded by the occurrence of a specific type or types of behavior that was considered suitable to be addressed by SPT. Following the baseline phase, the intervention stage immediately commenced, whereby SPT was introduced.

In terms of the nature and content of the SPT videos, the common components encompassed speaking about present and past life events shared with the patient participant and recorder and encouraging and reassuring the patient participant that they are in a safe environment. All recorders were instructed to introduce themselves and who they were in a personable manner in order to help focus the patient participants attention on the event of confusion and to end the video with a message indicating that they would speak with or see the patient participant very soon. Each video was approximately two to three minutes in length.

As regards the delivery of SPT, where a patient participant presented with the identified SDB, or where there were clear behavioral indications that the SDB was beginning to manifest, a healthcare professional would retrieve the iPad tablet device and play the recording to the patient participant, encouraging them to engage with the recording via verbal prompting. Where their distress did not change, or there was an escalation of distress or the patient participant did not engage with the recording despite staff prompting, the recording was terminated after approximately 30 seconds. Staff recorded the frequency of SDB in the intervention phase, whereby SDB was recorded immediately after the delivery of SPT should the SDB continue to remain present after the video has been played. Intervention plans were reviewed regularly as part of the Newcastle Model approach; consequently, the efficacy of SPT for participants was consistently monitored and assessed by the research and/or healthcare team during the study period, and by the healthcare team during and after the study as part of routine care. Patient participants were able to continue to use SPT after the active study period ended if it was considered beneficial for them.

Following the conclusion of the intervention stage the UTAT questionnaire was disseminated by members of the research team for completion by those professionals who delivered SPT and consented to take part in the study. There were no expectations regarding minimum number of professionals to recruit as it was anticipated that this would vary based on the number of staff who used SPT with a patient participant, although it was anticipated that at least one professional would be recruited. Five professionals were ultimately recruited and completed the UTAT questionnaire.

Method of Analysis

Data analysis for evaluating intervention effects in SCEDs encompasses visual inspection and statistical analysis (Tate et al., 2013). In the context of the present study, the visual analysis methods recommended by Lane and Gast (2014) were employed. Statistical analysis involved calculation of Tarlow's (2017) Baseline Corrected Tau (BC-Tau) to measure data non-overlap between the two phases (A and B). Non-overlapping data as an indicator of performance difference between phases is included in standards for evaluating SCEDs (Tate et al., 2013). Additionally, BC-Tau is useful in aggregating data across phases to produce an overall effect size. Therefore, the efficacy of SPT would be demonstrated by a significant reduction of dSDB when the intervention is introduced. To calculate BC-Tau, a web-based calculator developed by Tarlow (2016) (http://www.ktarlow.com/stats/tau) was used.

Evaluation of the secondary objective encompassed calculating the median score across participants on the UTAT informed questionnaire, with a higher score indicative of greater acceptability.

Results

Data were collected between September 2021 and July 2022. Table 6 shows the results of the attachment questionnaires and who completed them for each participant.

Table 6. *Attachment measures*

Participant	**Informant**[1]	**MOA**	**MAQ**
Participant 1	Child	C	Security = 3 Avoidance = 3.6 Ambivalence-worry = 3.3 Ambivalence-merger = 1.3
Participant 2	Child	B	Security = 3.67 Avoidance = 2.4 Ambivalence-worry = 1 Ambivalence-merger = 1.67
Participant 3	Spouse	B	Security = 2.67 Avoidance = 2.6 Ambivalence-worry = 1.67 Ambivalence-merger = 1
Participant 4	Spouse	B	Security = 3 Avoidance = 1 Ambivalence-worry = 1 Ambivalence-merger = 1

[1] All informants knew the patient participant very well, being either their child who knew the participant throughout their entire lifetime or a spouse with a relationship of at least 30 years.

Participant 1's outcome data was lost to follow up, partially owing to covid related disruptions. Consequently, it was not possible to provide data analysis for him. For Participants 2 and 3, although data collection was completed, there were significant missing data due to covid outbreaks across NHSGGC hospital wards. For Participant 2, a covid outbreak occurring during phase A, meant that data could not be collected for a period of approximately eight weeks. When the facility returned to normal following the outbreak, it was possible to collect further baseline data and five data points were amassed prior to the inception of phase B. Concerning Participant 3, it was noted that a covid outbreak occurred during phase B for an extended period, meaning that data collection was ceased prior to the agreed ending period in phase B. Data was also collected for Participant 4, and there was no outbreak during data collection, yet a substantial amount of data was missing during both phases. It was reported by ward staff that Participant 4 become more withdrawn during the data collection stage, and due to this, staff indicated that the presentation of his SDB decreased. It therefore appears that in the absence of SDB staff did not record the frequency of such behaviors.

As regards the handling of missing data in SCED studies, various methods exist to manage these (Peng & Chen, 2021). These methods make different prerequisite assumptions about the nature of the missing data in order to produce valid results under particular conditions. Specifically, each of these methods makes either one or more of the following assumptions about the data: (1) the data is Missing Completely At Random (MCAR); (2) the data is Missing At Random (MAR); (3) the data Missing Not At Random (MNAR); and/or (4) lost data is between 5-30% per phase (Peng & Chen, 2021). MCAR refers to probability of data being missing as being the same for all cases, that is, that the cause of missing data being unrelated to the data collected, whilst MAR indicates that the probability of data being missing is the same within groups defined by the observed data (i.e. missing data is likely unrelated to data collected, but may be predicted by other information not collected within the research). MNAR assumes that the probability of being missing varies for unknown reasons but is likely related to the data collected.

Owing to variability on the amount of missing data between patient participants and the differing reasons for this between Participants 2 and 3, and Participant 4, the Available Data (AD) method was chosen for use across all participants. The AD approach makes the fewest assumptions regarding the nature of missing data by treating missing scores as non-existent and only analyzing available scores. Additionally, for Participant 2, the Minimum-Maximum (MM) approach was also applied. The MM approach is considerably more conservative and assumes that data is MAR and lost data is between 5-30%. Data is treated by replacing a missing baseline score with the 'best' score in the baseline phase (i.e. lowest dSDB score in Phase A) and replacing a missing intervention score with the 'worst' score in the intervention phase (i.e. highest dSDB score in Phase B). When utilizing the MM approach for Participant 2, only the five most recent data points during Phase A were utilized as these were taken after the covid gap, whilst the entirety of the data was used for the AD approach.

Data analysis of dSDB

Graphs were generated for Participants 2, 3 and 4 to visually inspect level, trend, variability, immediacy of effect, overlap, and consistency of data patterns (Lane & Gast, 2014). These can be viewed below in figure 4. Data highlighted with a yellow diamond in figure 5 for Participant 2 represents baseline data collected after the covid outbreak. An additional, separate graph was generated for Participant 2, which represents their dSDB corrected with the MM approach, with data marked with a grey square in figure 5 representing this imputed data. The mean, median and other descriptive values for each phase across all participants were also calculated to assist the interpretation of visual data. These are presented in table 7.

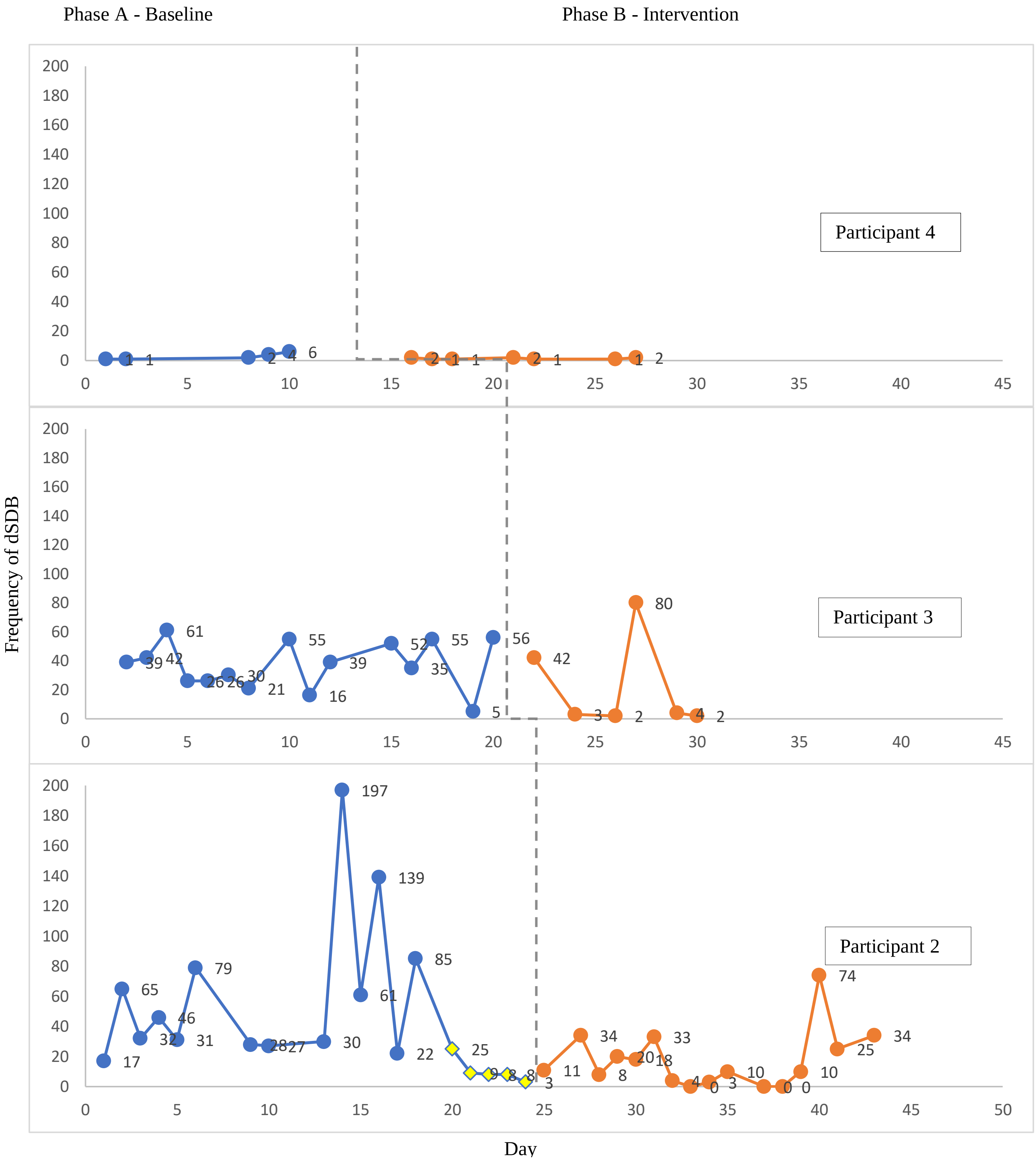

Figure 4. Participants 2,3 and 4's dSDB across conditions presented in ascending order of baseline length

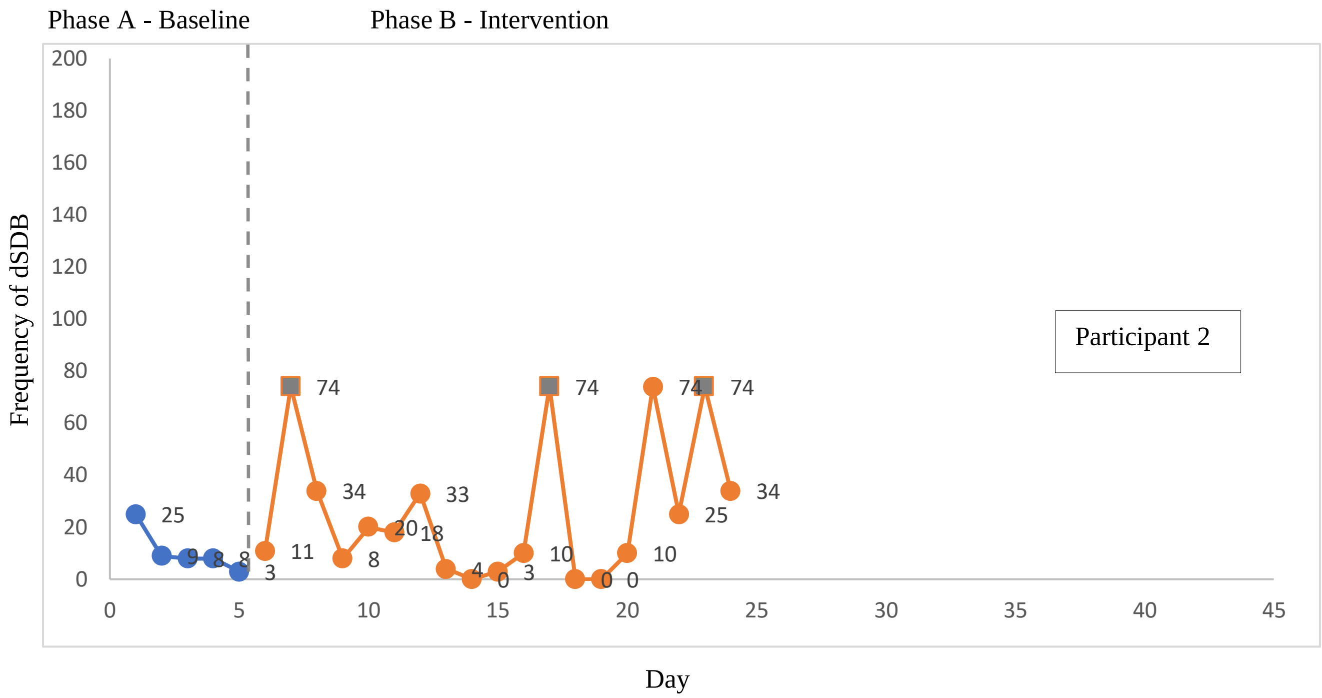

Figure 5. Participant 2’s dSDB when removing pre-covid baseline data and utilising the MM approach

Table 7. *Mean and median dSDB scores of patient participants across phases.*

Participant	Phase A - Baseline		Phase B - Intervention	
	M (*SD*)	*Mdn* (*Range*)	*M* (*SD*)	*Mdn* (*Range*)
Participant 2	48 (49.38)	30 (3-197)	17.75 (19.31)	10.5 (0-74)
Participant 2 (MM)	10.6 (8.38)	8 (3-25)	26.63 (27.47)	18 (0-74)
Participant 3	37.2 (16.60)	39 (5-61)	22.17 (32.40)	3.5 (2-80)
Participant 4	2.8 (2.17)	2 (1-6)	1.43 (0.53)	1 (1-2)

Participant 2

In terms of visual analysis for Participant 2's data (using all available data), estimation of trend within conditions using the split-middle method indicated a variable, decelerating trend in a therapeutic direction in Phase A, whereby, upon introduction of SPT (Phase B), there was a variable, accelerating trend in contra therapeutic direction. In terms of immediacy of effects between conditions, an improving relative level change (*Mdn* relative change $_{A \rightarrow B}$= -2) was observed, whilst a deteriorating absolute level change (*Mdn* absolute change $_{A \rightarrow B}$= 8) was noted from Phase A to B. For the MM data, a variable, decelerating trend in a therapeutic direction was observed in Phase A, whereby, upon introduction of SPT (Phase B), there was a variable accelerating trend in contra therapeutic direction. In terms of immediacy of effects, both a deteriorating relative level change (*Mdn* relative change $_{A \rightarrow B}$= 12.5) and a deteriorating absolute level change (*Mdn* absolute change $_{A \rightarrow B}$= 8) was observed from Phase A to B.

As regards statistical analysis, analysis of AD dSDB monotonic baseline trend was estimated using Kendall's Tau rank correlation coefficient, which indicated a significant baseline trend, Tau = -0.352, p = 0.039; hence, BC Tau was reported. Analysis of dSDB between Phase A and B revealed a statistically non-significant change in dSDB, BC Tau = 0.278, p = 0.053 (SE_{Tau} = 0.230). Analysis of MM dSDB monotonic baseline trend was estimated using Kendall's Tau rank correlation coefficient, which indicated a significant baseline trend, Tau = -0.949, p = 0.043; hence, BC Tau was reported. Analysis of dSDB between Phase A and B revealed a statistically significant change in dSDB, BC Tau = 0.588, $p < .001$ (SE_{Tau} = 0.234).

Participant 3

In terms of visual analysis for Participant 3, estimation of trend within-conditions using the split-middle method indicated a variable, accelerating trend in a contra therapeutic direction in Phase A, whereby, upon introduction of SPT (Phase B), there was a variable, accelerating trend in contra therapeutic direction. In terms of immediacy of effects between conditions, both an improving relative level change (*Mdn* relative change $_{A\rightarrow B}$= -36) and improving absolute level change (*Mdn* absolute change $_{A\rightarrow B}$= -14) was observed from Phase A to B.

As regards statistical analysis, analysis of dSDB monotonic baseline trend was estimated using Kendall's Tau rank correlation coefficient, which indicated a non-significant baseline trend, Tau = 0.019, p = 0.960; hence, non-BC Tau was reported. Analysis of dSDB between Phase A and B revealed a statistically non-significant change, Tau = -0.302, p = 0.119 (SE_{Tau} = 0.294).

Participant 4

In terms of visual analysis for Participant 4, levels of SDB were low in both baseline and intervention phases compared to the other two participants. Nevertheless, estimation of trend within-conditions using the split-middle method indicated a variable, accelerating trend in a contra therapeutic direction in Phase A, whereby, upon introduction of SPT (Phase B), there was a variable, static trend. In terms of immediacy of effects between conditions, both an improving relative level change (*Mdn* relative change $_{A\rightarrow B}$= -4) and improving absolute level change (*Mdn* absolute change $_{A\rightarrow B}$= -4) was observed from Phase A to B. It is notable that four of seven data points in Phase B are lower than any data point in Phase A.

As regards statistical analysis, analysis of dSDB monotonic baseline trend was estimated using Kendall's Tau rank correlation coefficient, which indicated a significant baseline trend, Tau = 0.949, p = 0.043; hence, BC Tau was reported. Analysis of dSDB between Phase A and B revealed a statistically significant decrease in dSDB, BC Tau = -0.728, p = 0.006 (SE_{Tau} = 0.280).

UTAT-informed questionnaire responses

As regards the results of the UTAT-informed questionnaire, a median score of 45 (*Range* = 30-55; *N* = 5) was noted across recruited participants. As the maximum possible score on the UTAT is 55, the median score appears to indicate a high degree of acceptability, usability and/or helpfulness of SPT for the healthcare professionals that delivered the intervention. A summary of each healthcare professional's individual UTAT questionnaire score can be found in table 8 and an overview of response medians across the UTAT items can be seen in figure 6. It should be noted that whilst a greater value across each individual UTAT item indicates a greater degree of agreement towards the item, items 4, 6, 9 and 10 on the UTAT are reverse coded. Consequently, the greater the value of the median reported within figure 6 for these four items, the more in disagreement the professionals were with that item.

Table 8. *Professionals Individual UTAT Scores*

Participant	**UTAT Questionnaire Score**
Professional 1	45
Professional 2	55
Professional 3	45
Professional 4	55
Professional 5[1]	30[1]

[1] Professional 5 did not provide a response to item five.

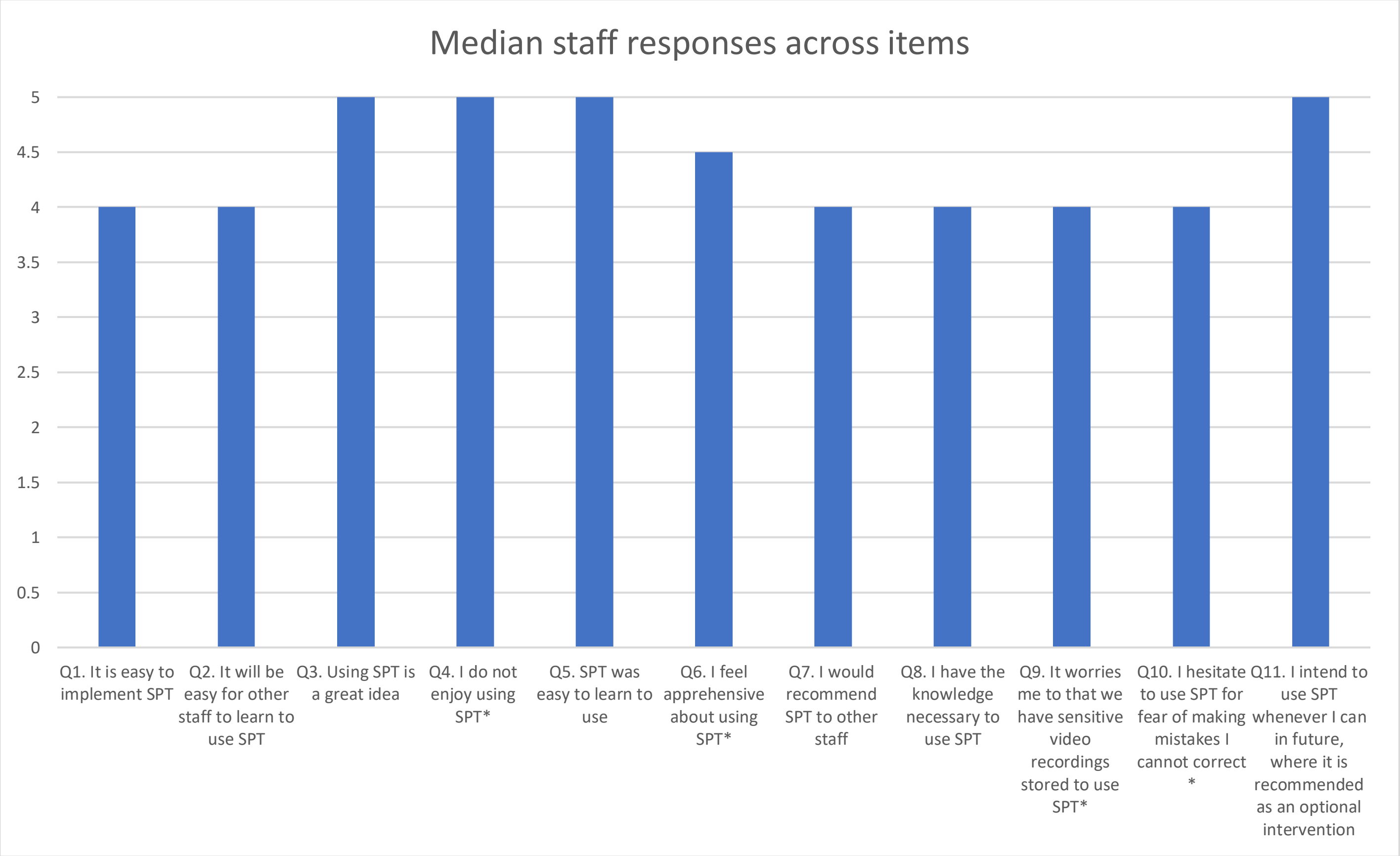

Figure 6. Healthcare professional's responses across individual UTAT items.[8]
*Item is reverse coded

In reviewing the responses of the five healthcare professionals across the UTAT items, it is notable that the highest median score is reflected on items 3, 4, 5 and 11. In terms of the lowest ratings, these were across items 1, 2, 7, 8 , 9 and 10. These response patterns appear to indicate that staff members are confident in utilizing SPT and

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[8] Reverse coding items 4, 6, 9 and 10 by rephrasing questions with a negation or antonymic expression to indicate an inverse opinion from the other items (i.e. a negative or more critical opinion) helps to reduce response or acquiescence bias and improves the validity of responses from the questionnaire.

find it easy to use, enjoyable and would recommend the interventions use in future; however, feel that implementing SPT within the healthcare environment is challenging and believe that they do not have the knowledge necessary to use SPT appropriately. Regardless, the perception of SPT use, adoption and helpfulness are generally positive.

Discussion

The present study aimed to identify whether SPT, when used as part of a formulation-based approach to care, would lead to a significant decrease in SDB in PwD in the moderate to severe range. A secondary aim concerned the user experience of healthcare professionals who implemented SPT with PwD within the healthcare environment.

SPT Efficacy

Concerning the effectiveness of SPT, the results varied across participants. As highlighted in table 4, when using only the available data, the dSDB scores were higher in Phase A in comparison to Phase B, indicating a reduction of SDB for participants during the intervention phase. For all participants, the pattern of data within Phases A and B was variable, with two of the three participants demonstrating an accelerating trend (i.e. worsening of dSDB) within Phase B. Two out of the three participants demonstrated an accelerating trend in Phase A. In terms of the immediacy of effects between Phases A and B, for two out of the three participants, there was an improvement (i.e. reduction of dSDB) upon introduction of SPT. In terms of statistical analysis between conditions, Participant 4, yielded a small, significant decrease in dSDB from Phase A to B (*Mdn* difference $_{A \rightarrow B}$= -1) indicating a short-term decrease in distress. Participant 4’s baseline data was generally very low, which may explain the reasons for the small observed effects. Whilst no other significant results were noted when analyzing only the available data, Participant 2 achieved a borderline significant result (p = 0.053) in a therapeutic direction (*Mdn* difference $_{A \rightarrow B}$= -19.5). This is particularly noteworthy considering that Participant 2’s last five baseline data points were lower compared to the rest of the baseline data that was collected prior to the 8-week gap. Thus, it may be the case that had data collection during baseline not been interrupted for 8 weeks, and the pattern of dSDB remained consistent in Phase A, that a significant result in a therapeutic direction may have been achieved.

Participant 2 demonstrated a large, statistically significant increase in dSDB from Phase A to B when analyzing data corrected with the MM method, indicating a short-term increase in distress when SPT is employed (*Mdn* difference $_{A \rightarrow B}$= 10). This is reinforced through review of the elevated Phase B scores presented in table 4 and the decelerating trend of Phase A data changing to an accelerating trend of Phase B data. Interpretation of this finding should be done so with great caution owing to the considerably fewer baseline data points when compared to the intervention data points. Moreover, the MM method is highly sensitive to outliers, owing to the use of the most extreme scores within each phase as a means of addressing missing data. It is evident through inspection of the data points for Participant 2, provided in figures 3 and 4, that an outlier score was selected to correct the data for analysis. Reviewing the analyses collectively across all participants, it is axiomatic that disruptions in care processes and variability in expressions of distress across participants impacted data collection, and therefore the extent to which the tallied dSDB for each patient participant signifying a true representation of distress expressed is unclear. In aggregate, these findings further contribute to the mixed nature of the literature regarding the efficacy of SPT as an intervention for PwD (Abraha et al., 2017).

One explanation that has been posited for the varied results in the literature concerns differences in attachment style between PwD (Peak & Cheston, 2002). Specifically, it has been inferred that a secure attachment style may lead to better outcomes with SPT in comparison to those with other attachment styles. In the context of present study, Participants 2, 3 and 4 were classed as being ‘securely’ attached, yet the response between them to the intervention varied. The adapted MAQ recognizes that a scaled score of 2.5 or higher across items corresponding to an attachment domain indicates a general tendency to agree more with items corresponding to the scale rather than disagree, although the attachment style corresponding to the highest scaled score is reported. Regardless, it is possible that where participants score above 2.5 on multiple attachment domains, there may be a chance that they possess traits associated with more than one attachment style. In reviewing the MAQ scores of participants individually, Participant 3’s mean scores on the MAQ were almost equivalent on the secure and avoidant attachment scales (2.67 and 2.6, respectively). For Participant 2, and 4, the secure attachment scale score exceeded that of any other domain, with no other scaled score exceeding 2.5. It may be the case that Participant 3’s avoidant attachment traits may have prevented her from being able to meaningfully engage with the SPT intervention. Equally, Participant 4’s secure attachment may have served as a significant facilitator regarding their engagement and benefit from SPT; however, an increase in distress observed for Participant 2 when employing the MM approach to handle missing data, who has a secure attachment style, seems to indicate an inverse relationship. These mixed findings indicate that the relationship between SPT engagement and attachment style are inconsistent and complex, although a lack of diverse attachment styles across participants and concerns regarding the quality of data collected, particularly for Participant 2 across both analyses, reduces the robustness of any conclusions, with the impact of other attachment styles on SPT engagement and SDB remaining unclear.

Another plausible explanation for the results, that is also referenced in previous research, concerns the operationalization of SDB between patient participants. It is recognized that the variability in the nature of SDBs may result in certain types of SDBs being more susceptible to amelioration when SPT is employed (Abraha et al., 2017). It is noteworthy that Participant 4 was in the moderate stages of cognitive decline, whilst Participants 2 and 3 were in the severe stages. Moreover, in terms of the nature of SDBs, Participant 4 did not appear to have significant bouts of confusion whilst Participants 2 and 3 did. It is also acknowledged that there is a tendency within ward environments to address SDB that are overt, aggressive and/or impede upon care processes in some way. For those persons who present with more covert or non-aggressive SDB, such as Participant 4, there may be a tendency to not appropriately recognize or record SDBs, particularly where staff resource is limited. Thus, although staff members did record scores of ‘0’ for participants where no dSDB were observed, it may be the case that missing data represents no observed dSDB rather than a failure a note them, regardless of whether there was objectively no SDB or that staff members failed to recognize a behavior as representing underlying distress.

Concerning the delivery of SPT, the frequency with which SPT is employed by members of staff may contribute to the efficacy of the intervention (Camberg et al., 1999). Participant 3 had multiple SPT recordings from various persons, whilst Participants 2 and 4 had one recording from one person each. It appears intuitive that those persons with multiple SPT recordings would receive the intervention more frequently, although within the formulation-driven nature of the present study, priority is placed to implementing SPT in a targeted manner, rather than maximizing the frequency of its delivery. Consequently, a greater number of recordings may not necessarily increase the use of SPT, although it is feasible. In the context of the results, where Participants 2 and 3 did not benefit whilst Participant 4 did, it may be concluded that the presence of confusion impacts the benefit received from SPT, whilst the frequency with which SPT is delivered may not. It is acknowledged that these discussions are largely speculative, as the frequency of SPT delivery was not measured, and the impact of frequency upon SPT efficacy was not formally investigated, therefore, the relationship between these variables remains ambiguous.

In addition, the present study explored whether SPT, when used as part of a formulation-driven approach, may provide a marked amelioration of SDB consistently across participants, particularly in comparison to the symptoms focused approaches employed within previous research. Owing to the mixed findings within the present study, which is consistent with previous, symptoms-led literature (Abraha et al., 2017), this hypothesis appears to be unsupported. It is important to recognize that formulations are not an exact science, and whilst they provide an evidenced and theory driven approach to care, ultimately, recommendations regarding an intervention based on a formulation will not always lead to benefit. Moreover, formulations do not necessarily serve to solely alleviate SDB within dementia care, but can also positively impact other processes of care (Holle et al., 2017). It is therefore possible that the formulation-based approach may have provided benefits that have not been captured in the context of the present study. Regardless, at face value, employing a formulation-based approach to SPT delivery for PwD does not appear to yield a superior or more consistent result when compared with previous, symptoms-led approaches (Abraha et al., 2017).

Usability

It is axiomatic that technology that is easy to use, accessible and helpful will likely be utilized more often within healthcare environments. Thus, it is important to ensure that usability concerns regarding a technology-based intervention are evaluated. In the context of the present study, the user experience of healthcare professionals who employed SPT was ascertained through completion of the adapted UTAT informed questionnaire. Generally, median scores were high across participants on the UTAT, indicating that healthcare professionals found SPT delivered in its current format (i.e. on an iPad tablet device) to be easily usable, acceptable and helpful in their day-to-day working. Anecdotally, healthcare professionals indicated that participants engaged with the SPT recordings, although at times distress could increase as participants understood that the recorder was not present physically and may begin searching for them. Staff also reported that the recordings were generally helpful as a means of distraction in order to reduce resistance to care processes for each patient participant. These positive experiences appear to be consistent with previous literature which explored the usability of SPT by healthcare professionals (Hung et al., 2018). Interpretation of these findings however should be tempered with caution owing to the small sample size of the recruited professionals (*N*=5).

Strengths and Limitations

The rigor of the aforementioned outcomes are dependent on the methodological strengths and limitations of the present study. As regards strengths, a key strength of the present study concerns the high ecological validity of the procedures employed. This study measured the efficacy of SPT as part of routine care processes with minimal alterations to the delivery of the intervention and other care processes. Hence, the findings of the present study would generalize well to similar healthcare settings and contexts, where SPT is employed as part of a formulation-based approach. Moreover, randomization of participant to baseline lengths helped to minimize likelihood of biases across the participants. Finally, regarding appropriate sample size, Tate et al. (2013) recommend a minimum of three repetitions of a treatment (i.e. recruitment of at least three participants) in order to establish a reliable effect, which was met within the context of the present study.

In terms of limitations, several are notable. Firstly, all patient participants were required to have a first language of English, with all recruited patient participants being of Scottish descent, meaning that results are likely biased towards shared cultural factors. Secondly, it was not possible to blind participants or clinicians to the study conditions as these persons were informed of the two phases (i.e. baseline and intervention), and the practicalities of delivering SPT are overt and unable to be masked. The lack of blinding of the experimenter may have introduced bias as members of the research team, owing to their involvement in patient care, may have also delivered the intervention and collected data. Furthermore, whilst monitoring of the intervention was done by members of the research team via supervision, the inability to assess fidelity by direct observations or recordings meant that it was not possible to ascertain whether SPT was being delivered consistently and appropriately.

In addition, the aforementioned disruptions caused by the covid pandemic significantly impacted the methodological rigor of the present study in several direct and indirect ways. Indirectly, it was anecdotally reported that changes in covid levels and responses across the wards meant that there could be staffing shortages or employment of bank staff, who may not have been appropriately trained or advised in SPT use. These changes in protocols also meant that the initially proposed baseline periods had to be slightly modified on an ad hoc basis because of alterations to visiting times for friends and loved ones across the wards. More directly, during periods of covid outbreak that occurred across the wards, ‘essential to life’ care was prioritized; consequently, non-essential interventions, such as SPT, may not have been routinely employed and behavioral data not collected. Indeed, the significant data gaps for Participants 2 and 3, and the lack of available data for Participant 1 can be directly attributed to the covid pandemic. Therefore, it can be inferred that covid related factors influenced the consistency with which staff members noted SDBs, if at all, resulting in missing or incomplete data, thereby impacting the robustness of the results.

Finally, concerning outcomes related to user experience, the questionnaire was adapted by the research team and, whilst the UTAT is informed by a theoretical framework and has been used extensively, the extent to which its theoretical components are applicable within the context of this study remain unclear. Another concerns the delivery of SPT, which is largely non-volitional within the present study as the professionals who completed the UTAT are employees who are required to provide SPT as part of their occupation. It is likely that utilizing SPT, and any other technology, in this way will influence the user experience of persons using technology. Further, it was not possible to conduct analysis to confirm the psychometric properties of the adapted UTAT instrument owing to the small sample size of professionals who completed the questionnaires. Consequently, apart from the criteria of face validity, the questionnaire's non-validated psychometric properties limit the reliability of the findings regarding user experience of SPT. Finally, it is recognized that the questionnaire does not delineate the usability of SPT itself and the device which it is played on, meaning that a cumulative evaluation has been done rather than attempting to evaluate these components discreetly. Thus, the extent to which the usability and acceptability of SPT as an intervention can be attributed to the intervention itself or the device it is delivered through remains unknown.

Clinical Applications

It is notable that SPT appears to be useful in certain circumstances, and the utilization of a formulation-based approach may be appropriate in planning and co-ordinating various elements of care, with SPT included as one component of this. The formulation-based approach can also be continually revised. Thus, where initial hypothesis or the application of interventions, such as SPT, are not useful, these can be updated to reflect such outcomes and lessons learned.

Concerning SPT specifically, members of staff that implemented this reported that it was useful in terms of reducing SDB in instances where staff members were implementing elements of care. Consequently, SPT may be useful as an intervention where there is frequent resistance to care. Finally, staff members find SPT useful, helpful and would generally recommend the intervention. Implementation of the intervention appears to be non-complex, requiring minimal formal training and something that staff members would draw upon. Equally, where SPT is applied, regardless of whether this is through a formalised approach or not, it should be done so with caution and continuously monitored to ensure its ongoing efficacy for patients.

Future studies

The outcomes of the present study illuminate several avenues for future research. Firstly, this study, in concert with most of the previous literature on SPT, consists of a small-scale research design (Abraha et al., 2017); hence, undertaking of large-scale randomized controlled trials is needed to further investigate the efficacy of SPT for use with PwD. Secondly, investigation of factors that mediate engagement with SPT, such as attachment, is also required through the undertaking of large-scale cross-sectional research. The outcomes of such studies would be bolstered through the use of validated questionnaires and outcome measures as well as consideration of adherence/fidelity monitoring.

The present study also represents the first of its kind to evaluate SPT used as part of a formulation driven approach to care; however, the implication of using a formulation was not measured in a direct way, relying solely on the outcomes related to frequency of SDB to provide any indication regarding the impact of a formulation. As discussed previously, amelioration of patient difficulties is merely one aspect of a formulation-based approach to care, with other elements including an improvement in care processes and empowerment of patients and their families within healthcare decision-making (James, 2011). Hence, future studies that explore SPT, or any other intervention, employed within a formulation-based approach should use methodologies that can also capture the efficacy of a formulation across various care processes. This may be done, for instance, via a mixed qualitative-quantitative approach which interviews professionals, patients, and their families about their experience of formulation-based care, whilst also quantitively evaluating clinic outcomes, enabling a more wholistic approach in evaluating the utility of a formulation-driven approach to healthcare.

Conclusion(s)

The findings of this study suggest that SPT may be beneficial in certain circumstances; however, the inconsistent results indicate that the overall efficacy of SPT for PwD remains ambiguous. Despite this, the perceived usability, acceptability and helpfulness of SPT is high amongst healthcare professionals who deliver it. It should be noted that the methodological and organizational issues within the research, including missing data and covid related disruptions, limits the applicability of the findings. However, the high ecological validity of the present study demonstrated by minimal alteration of routine care processes greatly bolster the generalizability of the findings across similar contexts. Larger scale studies investigating SPT and formulation focused research is needed to further clarify the effects of SPT generally, and when used specifically as part of a formulation-based approach to care.

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Appendices

Appendix 1.1. Search Strategy

Friday, December 17, 2021 6:28:53 PM

#	Query	Limiters/Expanders	Last Run Via	Results
S18	S15 AND S16 AND S17	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen – Advanced Search Database - CINAHL; Health Source: Nursing/Academic Edition; MEDLINE; APA PsycArticles; Psychology and Behavioral Sciences Collection; APA PsycInfo	314
S17	S2 OR S3 OR S4 OR S5 OR S6 OR S7	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen – Advanced Search Database - CINAHL; Health Source: Nursing/Academic Edition; MEDLINE; APA PsycArticles; Psychology and Behavioral Sciences Collection; APA PsycInfo	Display
S16	S1 OR S8 OR S9 OR S12 OR S13	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen – Advanced Search Database - CINAHL; Health Source: Nursing/Academic Edition; MEDLINE; APA PsycArticles; Psychology and Behavioral Sciences Collection; APA PsycInfo	Display
S15	S10 OR S11	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen – Advanced Search Database - CINAHL; Health Source: Nursing/Academic Edition; MEDLINE; APA PsycArticles; Psychology and Behavioral Sciences Collection; APA PsycInfo	Display
S14	TI app* OR AB app*	Expanders - Apply equivalent subjects	Interface - EBSCOhost Research Databases	Display

		Search modes - Boolean/Phrase	Search Screen – Advanced Search Database - CINAHL; Health Source: Nursing/Academic Edition; MEDLINE; APA PsycArticles; Psychology and Behavioral Sciences Collection; APA PsycInfo	
S13	TI Android OR AB Android	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen – Advanced Search Database - CINAHL; Health Source: Nursing/Academic Edition; MEDLINE; APA PsycArticles; Psychology and Behavioral Sciences Collection; APA PsycInfo	Display
S12	TI iPad* OR AB iPad*	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen – Advanced Search Database - CINAHL; Health Source: Nursing/Academic Edition; MEDLINE; APA PsycArticles; Psychology and Behavioral Sciences Collection; APA PsycInfo	Display
S11	TI dementia OR AB dementia	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen – Advanced Search Database - CINAHL; Health Source: Nursing/Academic Edition; MEDLINE; APA PsycArticles; Psychology and Behavioral Sciences Collection; APA PsycInfo	Display
S10	TI alzheimer* OR AB alzheimer*	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen – Advanced Search Database - CINAHL; Health Source: Nursing/Academic Edition; MEDLINE; APA PsycArticles; Psychology and Behavioral Sciences Collection; APA PsycInfo	Display
S9	TI touchscreen OR AB touchscreen	Expanders - Apply equivalent subjects Search modes -	Interface - EBSCOhost Research Databases	Display

		Boolean/Phrase	Search Screen – Advanced Search Database - CINAHL; Health Source: Nursing/Academic S8Edition; MEDLINE; APA PsS7ycArticles; Psychology andS6 BehavS5ioral Sciences CollectioS4n; APA PsycInfo	
S8	TI touch screen OR AB touch screen	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface – S3EBSCOhost Research DataS2bases Search Screen – S1Advanced Search Database - CINAHL; Health Source: Nursing/Academic Edition; MEDLINE; APA PsycArticles; Psychology and Behavioral Sciences Collection; APA PsycInfo	Display
S7	TI use OR AB use	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen – Advanced Search Database - CINAHL; Health Source: Nursing/Academic Edition; MEDLINE; APA PsycArticles; Psychology and Behavioral Sciences Collection; APA PsycInfo	Display
S6	TI usage OR AB usage	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen – Advanced Search Database - CINAHL; Health Source: Nursing/Academic Edition; MEDLINE; APA PsycArticles; Psychology and Behavioral Sciences Collection; APA PsycInfo	Display
S5	TI attitude* OR AB attitude*	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen – Advanced Search Database - CINAHL; Health Source: Nursing/Academic Edition; MEDLINE; APA PsycArticles; Psychology and Behavioral Sciences Collection; APA PsycInfo	Display

S4	TI acceptability OR AB acceptability	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen – Advanced Search Database - CINAHL; Health Source: Nursing/Academic S3Edition; MEDLINE; APA PsS2ycArticles; Psychology andS1 Behavioral Sciences Collection; APA PsycInfo	Display
S3	TI adopt* OR AB adopt*	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen – Advanced Search Database - CINAHL; Health Source: Nursing/Academic Edition; MEDLINE; APA PsycArticles; Psychology and Behavioral Sciences Collection; APA PsycInfo	Display
S2	TI perception* OR AB perception*	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen – Advanced Search Database - CINAHL; Health Source: Nursing/Academic Edition; MEDLINE; APA PsycArticles; Psychology and Behavioral Sciences Collection; APA PsycInfo	Display
S1	TI smartphone* OR AB smartphone*	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen – Advanced Search Database - CINAHL; Health Source: Nursing/Academic Edition; MEDLINE; APA PsycArticles; Psychology and Behavioral Sciences Collection; APA PsycInfo	Display

Appendix 2.1. Measure of Attachment Adapted

Informant Name:

Participant Name:

Participant ID code: Informant ID code:

Relationship to participant: parent spouse child friend care provider other:___________ (please specify)

How long have you known the participant? ___ years, ____months

These questions have been adapted from Hazan and Shaver's self-report measure concerned with the participant's experiences in romantic love relationships. Section 1 should be completed by those that knew the participant before they received a diagnosis of dementia and Section 2 for those that only knew the participant after diagnosis. We have adapted this to be used by informants due to the possibility that the severity of the participant's dementia may prevent them from accurately answering these questions.

We understand that if you have never observed the participant with a spouse then it may not be possible to answer these. Instead, please consider how the participant interacts with the person considered closest to them, be that one (or all) of their children, their friends, or a member of the care team that they seem to have a close relationship with. Take a moment to think about these experiences and answer the following questions with them in mind.

Read each of the three self-descriptions below (A, B, and C) and then place a checkmark next to the single alternative that best describes or is the nearest to how you have observed the participant to be in romantic or other relationships or is nearest to the way you feel. (Note: The terms "close" and "intimate" refer to psychological or emotional closeness and affection, not necessarily to sexual intimacy.) **PLEASE ONLY CHOSE ONE**

I am answering this question based on my observation of the participant with:

Spouse/Romantic partner Other: ___________________________ (please specify)

Section 1: Please only complete this if you knew the participant *before* they received a diagnosis of dementia.

______A. The participant appeared somewhat uncomfortable being close to others; the participant seemed to find it difficult to trust this person completely, difficult for participant to allow themselves to depend on this person. The participant seemed nervous when anyone gets too close, and often, others would want the participant to be more intimate than they seemed comfortable being.

______B. The participant found it relatively easy to get close to others and seemed comfortable depending on the above person, and having the above person depend on the participant. The participant did not seem to worry about being abandoned by the above person or getting too close to them.

______C. the participant seemed to find that others are reluctant to get as close as the participant would have liked. The participant often worried that their partner/named person above doesn't really love them or will not want to stay with them. They seemed to want to get very close to their partner/above named person, and this sometimes-scared people away.

Section 2: Please complete this if you ONLY knew the participant after they received a diagnosis of dementia.

______A. The participant appears somewhat uncomfortable being close to others; the participant appears distrustful of the above name's person, difficult for participant to allow themselves to depend on this person. The participant seems nervous when anyone gets too close, and often, others want the participant to be more intimate than they seem comfortable being.

______B. The participant finds it relatively easy to get close to others and seems comfortable depending on the above person, and having the above person depend on the participant. The participant does not seem to worry or say anything about being abandoned or about getting too close to the above person.

______C. It can appear as though others are reluctant to get as close as the participant would like them to. The participant often mentions that their partner/named person above doesn't really love them or will not want to stay with them. They seem to want to get very close or are very demanding of their partner/above named person, and this can sometimes scare people away.

Thank you for completing this questionnaire.

SCORING:

Category A = Avoidant attachment

Category B = Secure

Category C = Anxious/Ambivalent

Appendix 2.2. Measure of Attachment Qualities Adapted

Participant name:.. Informant name:..

Participant ID:.. Informant ID:..

Relationship to participant:................................ Length of relationship ……. years, …….months

Respond to each of the following statements by expressing how much you agree with it (if you do generally agree) or how much you disagree with it (if you generally disagree). Make all your responses on the answer sheet only. Do not leave any items blank. Please be as accurate as you can be throughout and try especially hard not to let your answer to any one item influence your answer to any other item. Treat each one as though it is completely unrelated to the others. There are no right or wrong answers, you are simply to express your own personal feelings and opinions. Choose from these response options:

How to fill out the questionnaire

Below is a list of statements about the participant. Please read each statement very carefully and rate how strongly you agree or disagree by selecting the appropriate option opposite each question.

DO NOT MISS ANY STATEMENT OUT.

Examples

E1. They are unwilling to trust others.	Agree a lot	Agree a little	[✓ Disagree a little]	Disagree a lot
E2. They like socialising	Agree a lot	[✓ Agree a little]	Disagree a little	Disagree a lot
E3. They worried about others a lot	Agree a lot	Agree a little	[✓ Disagree a little]	Disagree a lot

Questionnaire A: Please complete this questionnaire if you knew the person *before* they received their diagnosis of dementia.

1. When the participant was close to someone, it seems to give them a sense of comfort about life in general.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
2. The participant would often worry that their partner (or other close relation) doesn't really love them.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
3. They seemed to have trouble getting others to be as close as they wanted them to be.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
4. They found it easy to be close to others.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
5. They would often worry their partner (or other close relation) would not want to stay with them.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
6. Others would want them to be more intimate than they felt comfortable being.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
7. They seemed to find it relaxing and good to be close to someone.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
8. They were very comfortable being close to others.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
9. They never worried about others abandoning them.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
10. Their desire to merge sometimes scared people away.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
11. They preferred not to be too close to others.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
12. They found that others were reluctant to get as close as they would have liked.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
13. They got uncomfortable when someone wanted to be very close.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
14. Being close to someone seemed to give them a source of strength for doing other activities.	Agree a lot	Agree a little	Disagree a little	Disagree a lot

Questionnaire B: Please complete this questionnaire if you ONLY knew the person after they received their diagnosis of dementia.

1. When the participant is close to someone, it seems to give them a sense of comfort and peace of mind.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
2. The participant often says that their partner (or other close relation) doesn't really love them.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
3. The participant seems to be very demanding of time/attention and so struggles getting others to be as close as they would like them to be.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
4. They find it easy to be close to others.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
5. They would often say that their partner (or other close relation) does not want to stay with them.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
6. Others want the participant to be more intimate or sociable than they feel comfortable being.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
7. They seem to be less distressed and more relaxed or positive being close to someone.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
8. They appear very comfortable being close to others.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
9. They never say anything about others abandoning them.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
10. Their desire to merge sometimes scares people away.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
11. They prefer not to be too close to others.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
12. It can appear as though others are reluctant to get as close as the participant would like them to be.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
13. They get uncomfortable when someone wants to be very close.	Agree a lot	Agree a little	Disagree a little	Disagree a lot
14. Being close to someone seems to give them a source of strength for doing activities.	Agree a lot	Agree a little	Disagree a little	Disagree a lot

SCORING:

1 = I DISagree with the statement a lot

2 = I DISagree with the statement a little

3 = I agree with the statement a little

4 = I agree with the statement a lot

Items 4, 8, and 9 are reverse coded.

Security = (Items 1 + 7 + 14) / 3

Avoidance = (Items 4 + 6 + 8 + 11 + 13) / 5

Ambivalence-worry = (Items 2 + 5 + 9) / 3.

Ambivalence-merger = (Items 3 + 10 + 12) / 3

Scale scores above the midpoint (2.5) suggest a tendency agree more than disagree with the items on that scale. Scale scores below the midpoint (2.5) suggest a tendency to disagree more than agree with those statements. The highest scaled score will determine attachment style.

It is highly unlikely to obtain two equal scaled sores on these attachment styles, except possibly Ambivalence-worry and merger. For this reason, these two sub-categories can be defined simple as ‘Ambivalent’ without the need for the subcategory. In the highly unlikely event that Avoidance and the Ambivalence categories are equal, attachment categorisation can be termed as ‘Insecure’. If the Security category should be equal to another category, it is possible that the informant may have made an error and/or malingered in their performance. The administrator in this instance should confirm the responses with the informant and if this remains unchanged, either readminister to another informant and/or select an attachment style following consultation with a clinical psychologist and with reference to the outcomes of any other attachment measure employed.

Appendix 2.3. UTAT-informed Questionnaire regarding use of Simulated Presence Therapy

Professionals name:................................. Professionals ID code:....................................

You will have worked with one or several persons who were receiving SPT and were partaking in a research project. We are asking you to reflect on your experience using SPT and circle your response in the questions below **(PLEASE CIRCLE E VERY QUESTION).**

1. It is easy to implement SPT

Strongly agree Agree Neither agree/disagree Disagree Strongly disagree

2. It will be easy for other staff to learn to use SPT

Strongly agree Agree Neither agree/disagree Disagree Strongly disagree

3. Using SPT is a great idea

Strongly agree Agree Neither agree/disagree Disagree Strongly disagree

4. I do not enjoy using SPT

Strongly agree Agree Neither agree/disagree Disagree Strongly disagree

5. SPT was easy to learn to use

Strongly agree Agree Neither agree/disagree Disagree Strongly disagree

6. I feel apprehensive about using SPT

Strongly agree Agree Neither agree/disagree Disagree Strongly disagree

7. I would recommend SPT to other staff

Strongly agree Agree Neither agree/disagree Disagree Strongly disagree

8. I have the knowledge necessary to use SPT

Strongly agree Agree Neither agree/disagree Disagree Strongly disagree

9. It worries me to that we have sensitive video recordings stored to use SPT

Strongly agree Agree Neither agree/disagree Disagree Strongly disagree

10. I hesitate to use SPT for fear of making mistakes I cannot correct

Strongly agree Agree Neither agree/disagree Disagree Strongly disagree

11. I intend to use SPT whenever I can in future, where it is recommended as an optional intervention

Strongly agree Agree Neither agree/disagree Disagree Strongly disagree

Thank you for completing the questionnaire

SCORING:

1 = Strongly disagree

2 = Disagree

3 = Neither agree/disagree

4 = Agree

5= Strongly agree

Items 4, 6, 9 and 10 are reverse coded.

Appendix 2.5. Relevant Supplementary Documents

The relevant supplementary documents are available on an online repository via the following link: https://osf.io/p4jrc/?view_only=e65dc240813c4da9a089d8e9f9bfee9f. Where files are stored in a folder, this can be opened by clicking the '+' symbol to the left of the folder, and closed using the '-' symbol. A summary of the available documents can be seen below.

Document Name	Document Information
MRP Proposal	Final version of project proposal approved by the University of Glasgow.
Study Protocol	Protocol of study.
Participant Information Sheet[1]	Project information sheet for patient participants who retain ability to provide informed consent.
WA-WG-NR Information Sheet[1]	Project information sheet for representatives who provide informed consent on behalf of patient participants who no longer have the ability to provide informed consent.
Informant Information Sheet[1]	Project information sheet for participants who complete the two attachment style questionnaires.
Recorder Information Sheet[1]	Project information sheet for participants who provide SPT video recordings.
Professionals Information Sheet[1]	Project information sheet for healthcare professionals who answer the UTAT questionnaire.
Participant Consent Form[2]	Project consent form to be completed by patient participants who retain ability to provide informed consent.
WA-WG-NR Consent Form[2]	Project consent forms to be completed by representatives to provide informed consent on behalf of patient participants who no longer have the ability to provide informed consent.
Informant Consent Form[2]	Project consent form to be completed by participants who complete the two attachment style questionnaires.
Recorder Consent Form[2]	Project consent form to be completed by participants who provide SPT video recordings.
Professionals Consent Form[2]	Project consent form to be completed by healthcare professionals who answer the UTAT questionnaire.

[1] Contained in folder entitled 'Information Sheets'

[2] Contained in folder entitled 'Consent Forms'

Insert Patient Identifier label here

Appendix 2.6. Frequency Chart

Psychological Interventions in Response to Stress & Distress in Dementia

	5-7am	7-9	9-11	11-1	1-3	3-5	5-7	7-9	9-12	12-5am	Total
Monday											
Tuesday											
Wednesday											
Thursday											
Friday											
Saturday											
Sunday											