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Feasibility and Acceptability of a Care-Partner-Delivered Virtual Environment for Supporting Activities of Daily Living in Long-Term Care Residents Living with Dementia: A Single-Arm Pragmatic Study

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Abstract

Background: Behavioral and neuropsychiatric symptoms are common in Alzheimer's disease and related dementias (AD/ADRD) and frequently disrupt completion of activities of daily living (ADLs) in long-term care, where direct care staff ("care partners," CPs) hold primary responsibility for ADL support under conditions of high workload and limited dementia-specific training.

Objective: To evaluate the tolerability and feasibility of DevaWorld™, a tablet-based, videogame-derived virtual environment adapted with ADL-themed content, when delivered by CPs to residents with AD/ADRD as part of routine long-term care.

Methods: In this single-arm, open-label, pragmatic feasibility study (ClinicalTrials.gov NCT05418296; funded by NIA SBIR award R43AG071102), CPs at two U.S. memory care communities were trained to run DevaWorld sessions with assigned residents at least three times weekly over a six-week window, timed to precede corresponding real-world ADLs. Resident and CP status were characterized at baseline using the Neuropsychiatric Inventory–Nursing Home version, Global Deterioration Scale, Functional Assessment Staging, and Copenhagen Burnout Inventory. In-session outcomes were CP ratings of easiness, cooperation, completion, autonomy, and time-to-complete across five ADL activities, supplemented by contextual analysis of video-recorded sessions and structured CP exit interviews.

Results: Ten CPs and 28 residents (19 at Site 1; 9 at Site 2) were enrolled and analyzed. CPs ran a mean of 10.6 (Site 1, range 1–20) and an estimated 7.8 (Site 2) sessions each; residents participated in a mean of 3.6 (Site 1, range 1–8) and 4.3 (Site 2) sessions. Cooperation and task completion rose from a mean of approximately 1.5 to approximately 3.0 (of 4 and 3, respectively) from before to after DevaWorld sessions, a pattern stable across residents; perceived task easiness did not change. CPs attributed ADL improvement to the intervention in 37% of Site 1 residents and judged 66% of Site 2 sessions to show resident responsiveness. Qualitative analysis identified carryover of virtual activities into real-world routines, use of sessions to manage sundowning-related agitation, and gains in CPs' relational knowledge of residents, alongside implementation barriers from staffing volatility, a COVID-19-related site substitution, and, at one site, limited CP English proficiency.

Conclusions: A videogame-derived virtual environment delivered by direct care staff was tolerated by residents with dementia and associated with within-subject gains in ADL-related cooperation and completion, though implementation fidelity was constrained by real-world staffing and contextual factors. Findings support further evaluation in a controlled trial using the fully validated outcome battery originally registered for this program of research.

Trial Registration: ClinicalTrials.gov NCT05418296; https://clinicaltrials.gov/study/NCT05418296

Introduction

Dementia is associated with progressive functional decline that erodes a person's capacity to complete activities of daily living (ADLs) independently, including personal hygiene, dressing, grooming, and toileting. Neuropsychiatric and behavioral symptoms—agitation, anxiety, confusion, and resistance to care—arise in the great majority of people living with dementia over the course of the disease and are a principal driver of caregiver distress and diminished quality of life within the care dyad [1,2]. In residential long-term care, direct care staff ("care partners," CPs) are tasked with completing ADLs for residents while navigating these behavioral expressions, often under conditions of high workload, staff shortages, and limited dementia-specific training [2].

Person-centered approaches to dementia care emphasize preserving dignity, respect, and choice for the person receiving care, and frame behavioral expressions as communications of unmet needs rather than symptoms to be suppressed [3]. Non-pharmacological interventions grounded in these principles have an established evidence base for reducing neuropsychiatric symptoms and are recommended ahead of pharmacological approaches where feasible [4]. Digital and virtual-environment tools have emerged as a scalable means of delivering such interventions where trained specialist staff are scarce, and environmental design that reflects dementia-friendly principles has independently been associated with better resident quality of life in residential care [6]. Virtual reality and video-game-derived platforms have shown promise for screening and rehearsing daily-living skills in community-dwelling and nursing-home populations [10,11], and digital delivery of non-pharmacological programming proved both feasible and valuable during COVID-19-era care restrictions [7]. However, functional ability in Alzheimer's disease is multiply determined and not reducible to basic or instrumental task categories alone [8], and relearning of ADLs among people with dementia appears to depend on the learning method used [9]—underscoring the need to evaluate any new ADL-support tool empirically rather than assume transferability from cognitive- or engagement-focused applications.

Most prior digital interventions in this space have been delivered or supervised by engagement specialists or researchers rather than by the direct care staff who are actually responsible for completing ADLs day to day. Whether a videogame-derived virtual environment can instead be handed to already-stretched CPs, integrated into routine care, and used to support real-world ADL completion is therefore an open and practically important question. We report a single-arm, pragmatic feasibility study of DevaWorld™, a tablet-based, dementia-specific virtual environment adapted to depict and rehearse ADL-related activities, delivered by CPs to residents of two long-term memory care communities in the United States. The study was registered prospectively on ClinicalTrials.gov (NCT05418296) and funded through a National Institute on Aging (NIA) Small Business Innovation Research (SBIR) award (R43AG071102) to Mentia DTx. Our objectives were to determine (1) tolerability—whether care

dyads would engage with and sustain use of the technology—and (2) feasibility/effectiveness—whether use of the technology was associated with improved ADL-related cooperation and completion, relative to CP report at baseline.

Methods

Study Design

This was a single-arm, open-label, pragmatic Phase I feasibility study (interventional, single-group assignment, no masking), prospectively registered on ClinicalTrials.gov (NCT05418296). The study was sponsored by Mentia DTx with the National Institute on Aging as a collaborator, under SBIR grant 1R43AG071102-01A1. Ethical approval and consent procedures are detailed in Ethical Considerations below.

Ethical Considerations

This study was approved by Ethical & Independent Review Services (E&I; IRB registration #00007807; approval number 22053-01A). Care partners provided written informed consent prior to participation. Because resident-subjects carried a diagnosis of, or symptoms consistent with, AD/ADRD, informed consent for their participation was obtained by proxy from an authorized decision-maker in accordance with IRB-approved procedures; residents retained the ability to decline or withdraw from individual sessions at any time. Privacy and confidentiality of participants' identities and data were maintained throughout data collection, analysis, and reporting; residents and care partners are referred to in this manuscript only by role, initials, or single-letter pseudonyms, and no directly identifying information is reported. No participant compensation was documented in the study protocol or progress reporting reviewed for this manuscript.

Setting and Participants

The study was conducted in two stages at two memory care communities in Northern California: Site 1 (Elder Ashram, Oakland, CA; May–August 2021) and Site 2 (a memory care community in Elk Grove, CA; May–August 2022). A second site originally intended for the study could not proceed as planned because of COVID-19-related disruption to staffing and resident participation, and the research team subsequently identified and enrolled an alternative community; this substitution accounts for the roughly 12-month interval between the two site-level deployments and for the revised protocol timeline reflected in the trial's registered study-start date.

Care team managers at each site nominated CPs and residents they judged well-suited to the study; nominated CPs then self-selected into the study (5 per site; N=10) and provided informed consent. Residents ("Subjects") were eligible if they had a diagnosis of AD/ADRD, or symptoms of undiagnosed AD/ADRD confirmed by the head of clinical care; had documented difficulty completing one or more ADLs in the preceding month; could sit comfortably for at least 15 minutes; had adequate (corrected) vision and hearing; were not in pain; and were not wholly dependent on others for ADLs or affected by significant non-AD/ADRD neurological, psychiatric, or physical impairment. Residents who experienced anxiety or agitation during ADLs were explicitly eligible. Twenty-eight residents were enrolled across the two sites (19 at Site 1; 9 at Site 2); this fell short of the 40-resident target anticipated at trial registration, primarily reflecting the COVID-19-related disruption described above. Subjects who did not undertake any intervention session were withdrawn from the analytic sample.

Intervention

DevaWorld is a tablet-based, dementia-specific virtual environment built on a video-game engine, previously used as a general engagement and communication tool for people living with dementia. For this study, the research and design team extended DevaWorld with ADL-themed environments and interactive content targeting oral hygiene, grooming, bathing, dressing, medication-taking, and bedtime preparation (Figure 1). Development was informed by the framing of behavioral expressions as communications of unmet need [3], non-pharmacological approaches to dementia care [4], and universal design principles for aging and technology [5], and was refined iteratively with informal input from educators, care staff, board advisors, and people living with dementia. Environments incorporated dementia-friendly interior-design features (layout, color, a pull-down mirror cover, an easy-access shower, and grab bars), consistent with evidence linking built-environment quality to residents' quality of life [6]. A male host character ("Robin") was introduced alongside the platform's existing female host ("Julie") to support gender-appropriate delivery of personal-care content, and the interface was localized into Spanish and Russian, in addition to an existing French localization, to match participants' language preferences (Figure 1A).

CPs received three preparatory sessions: a one-hour group orientation to the study by video conference, a half-hour group session on basic tablet/app use, and an in-person, hands-on training led by the study's principal investigator. During the six-week intervention window at each site, CPs were asked to run a DevaWorld session (DWS) with their assigned resident a minimum of three times per week, timed as closely as possible to the corresponding real-world ADL (for example, running the app's tooth-brushing activity shortly before an anticipated real tooth-brushing task). A text-based group chat was maintained throughout the intervention period for CPs to raise issues, share experience, and receive tips from the research team.

Figure 1. DevaWorld intervention environment. (A) Host- and language-selection screen. (B) Bathroom/grooming environment with interactive grooming and dental-hygiene items. (C) Bedroom/bedtime environment. Screen captures are shown for illustrative purposes; product branding elements are the developer's own intellectual property.

Outcome Measures

As registered on ClinicalTrials.gov, the planned outcome battery comprised the Alzheimer's Disease Cooperative Study–Activities of Daily Living Inventory, severe version (ADCS-ADL-sev) [17], the care-home adaptation of the Dementia Quality of Life instrument (DEMQOL-CH) [18,19], the Neuropsychiatric Inventory–Nursing Home version (NPI-NH) [12,13], the Approaches to Dementia Questionnaire (ADQ) [20], and the Sense of Competence in Dementia Care Staff (SCIDS) scale [21], each assessed over an 8-week timeframe. In practice, given the pragmatic, staff-delivered nature of the study and the burden of lengthy standardized instruments for time-pressed CPs, the research team characterized resident and CP status at baseline using the NPI-NH [12,13] (propensity for anxiety/agitation), the Global Deterioration Scale (GDS) [14] and Functional Assessment Staging (FAST) [15] (cognitive and functional impairment), and the Copenhagen Burnout Inventory (CBI) [16] (CP tolerance for study participation as an add-on to usual duties).

The primary in-session outcome data were drawn from the app itself and from CP report: number and duration of sessions, and, for each of five virtual ADL activities (mouth hygiene, washing, grooming, dressing, and bedding), CP ratings on four purpose-built ordinal scales—easiness (1 = very difficult to 4 = very easy), cooperation (1 = very resistant to 4 = very cooperative), completion (1 = not completed to 3 = completed), and autonomy (1 = CP did it all to 4 = CP did not help)—together with time-to-complete each activity in minutes. Qualitative data comprised video recordings of sessions and a structured 10-minute exit interview with each CP at the end of the intervention period, analyzed contextually to complement the quantitative in-app data. This deviation from the registered outcome battery is discussed as a limitation below.

Statistical Analysis

Given the pragmatic, exploratory design and small, heterogeneous sample, analyses were descriptive. In-app ratings were summarized as means with ranges by site and, where reported, by activity. CP exit interviews and video-recorded sessions underwent contextual/thematic analysis to identify recurring patterns of engagement, carryover to real-world ADLs, and implementation barriers. Video review at Site 1 additionally identified sessions run for CP training/rehearsal without a resident present; these, together with residents without any recorded session, were excluded from the analytic dataset.

Results

Participants and Engagement

Table 1 summarizes enrollment and session engagement by site. At Site 1, video review showed that roughly half of all recorded DevaWorld sessions were conducted for CP training/rehearsal without a resident present; these, and residents without any recorded session, were excluded from analysis, leaving an analytic sample of 5 CPs and 19 residents. CPs ran a mean of 10.6 sessions each (range 1–20), and residents participated in a mean of 3.6 sessions each (range 1–8).

At Site 2, 5 CPs and 9 residents completed a combined 39 sessions (mean 4.3 sessions per resident; approximately 7.8 sessions per CP). CPs at this site described the intervention period as occurring during a “particularly turbulent” time for the community, marked by co-resident illness, injury, and death, which they felt limited the number of sessions they were able to run relative to what was intended.

Site	Enrollment period	CPs (n)	Residents (n)	Total sessions	Sessions/CP, mean (range)	Sessions/resident, mean (range)
Site 1 – Elder Ashram, Oakland, CA	May–Aug 2021	5	19	~53	10.6 (1–20)	3.6 (1–8)
Site 2 – Elk Grove, CA	May–Aug 2022	5	9	39	7.8 (range not reported)	4.3 (range not reported)
Combined	May 2021–Aug 2022	10	28	~92	—	—

CP = care partner. Site 1 total and per-CP/per-resident figures for Site 2 are derived from reported means and totals; individual-level ranges for Site 2 were not reported.

In-App Activity Ratings

Across the five ADL activities assessed at Site 1, cooperation and task completion showed the largest and most consistent change, rising from a mean of approximately 1.5 (between “very resistant”/“not completed” and “resistant”/“partially completed”) before DevaWorld sessions to approximately 3.0 (“cooperative”/“completed”) afterward; this pattern was stable across sessions and consistent across residents. CPs did not perceive a corresponding change in task easiness, which remained around 3 (“easy”) throughout. Autonomy ratings—reflecting the degree of CP assistance still required—remained low (1–2, “I did it all”/“I mostly helped”) for most activities, with the exception of dressing, where autonomy improved from 1 to approximately 2.5, suggesting residents took on a somewhat greater share of the task. Time to complete an activity did not decrease over the intervention period and increased for dressing, which CPs attributed to residents' greater active involvement in the task rather than to increased difficulty.

Parameter	Before DevaWorld sessions	After DevaWorld sessions	Pattern
Cooperation (1–4 scale)	~1.5 (very resistant–resistant)	~3.0 (cooperative)	Consistent improvement across residents and activities
Completion (1–3 scale)	~1.5 (not–partially completed)	~3.0 (completed)	Consistent improvement across residents and activities
Easiness (1–4 scale)	~3 (easy)	~3 (easy)	No perceived change
Autonomy, most activities (1–4 scale)	1 (CP did it all)	1–2 (CP did it all–mostly helped)	Limited change
Autonomy, dressing only (1–4 scale)	1 (CP did it all)	~2.5	Greater resident involvement than other activities
Time to complete (minutes)	Baseline	Unchanged; increased for dressing	Increase attributed to greater resident involvement, not difficulty

Table 2. Change in care-partner-rated activity parameters, Site 1 (n=19 residents). Values are approximate means as reported by care partners across five ADL activities (mouth hygiene, washing, grooming, dressing, bedding); site-level, not fully activity-stratified, data were available for this analysis.

Care-Partner-Reported ADL Outcomes

At Site 1, CPs reported that 7 of 19 residents (37%) showed improved ADL performance they attributed to DevaWorld sessions; three of five CPs described strongly positive shifts in participants' ADL capacity and mood. For example, one resident began independently assisting with wheelchair transfers on non-intervention days after this behavior first emerged during a DevaWorld session, and another showed interest in showering and mouth care for the first time in her CP's experience of caring for her.

At Site 2, CPs judged residents responsive to DevaWorld content in 66% of sessions, with variability within individual residents across sessions. One CP described a resident's 40-minute session involving bathroom-themed content that prompted spontaneous conversation about his own bathroom and dental-hygiene routine; another CP linked a resident's reduced real-world wardrobe selection (from several outfits each morning to three) to the character's limited in-app wardrobe, though this observation was not independently verified. Two of five CPs at this site reported their residents remained largely unengaged with the content.

Qualitative Themes

Contextual analysis of CP exit interviews and session recordings across both sites identified recurring themes, summarized in Table 3, spanning resident responsiveness, real-world carryover, behavioral-symptom management, relational and biographical insight, and CP digital-skill gains, alongside implementation barriers related to staffing volatility and, at one site, language and cultural mismatch.

Theme	Illustrative finding	Implication
Resident responsiveness	Most residents responded to voices, colors, and character movement even when unable to tap the tablet themselves.	Hand-under-hand tapping lets CPs mediate engagement for residents with limited motor function.
Real-world carryover	One resident, prompted by an in-app bedtime sequence, asked for help undressing for the first time in his CP's experience.	Virtual rehearsal may cue related real-world ADL behavior.
Behavioral-symptom management	A CP used a tooth-brushing session to redirect a resident who habitually sought to leave the facility in the early evening, replacing exit-seeking talk with conversation about his morning routine.	DevaWorld sessions may help CPs manage sundowning-related agitation.
Relational/biographical insight	CPs learned new biographical details (travel, past careers, prior marriage) through sessions and described feeling more connected to residents.	Sessions may function as a relationship-building tool alongside ADL support.
Resident-driven personalization	A resident spontaneously discussed personal grooming preferences (e.g., not using aftershave) prompted by in-app content.	Sessions can surface individual preferences relevant to person-centered care.
CP digital-skill gains	CPs reported increased comfort and speed using the tablet over the intervention period.	Routine use may build CP digital literacy alongside its clinical purpose.
Staffing volatility	Rostered absences, short-staffing, and unscheduled events (e.g., resident funerals) reduced sessions below the target cadence of three per week.	Real-world implementation requires flexible cadence expectations.
Language/cultural mismatch (Site 1)	CPs with limited English proficiency had difficulty with study concepts (“cueing,” “prompting”); a bilingual allied-health professional supported training.	Multilingual training materials and on-site language support may be needed for diverse care workforces.

Table 3. Qualitative themes from care-partner exit interviews and session review, both sites.

Discussion

Principal Results

In this pragmatic, staff-delivered feasibility study, direct care partners were able to integrate a videogame-derived virtual environment into routine dementia care and to sustain its use, at variable intensity, over a six-week period at two long-term care communities. Our first aim—tolerability of the technology within the care dyad—was broadly supported: CPs and residents engaged with the platform, residents were reported to respond to its content even when unable to interact with the tablet directly, and CPs identified specific, actionable ways the tool supported real-world care challenges, including sundowning-related agitation and gaps in relational knowledge of residents. Our second aim—feasibility of DevaWorld as an effective ADL-support tool—was partially supported: CP-rated cooperation and task completion rose substantially and consistently from before to after DevaWorld sessions, and a substantial minority of residents (37% at Site 1) were judged by CPs to show carryover improvement in ADL performance. However, task easiness and time-to-complete did not improve, autonomy gains were limited to dressing, and both cadence and depth of implementation were constrained by factors outside the study's control—most notably staffing volatility, a COVID-19-related site substitution, and, at one site, language and cultural mismatch between CPs and the study's conceptual framework.

Comparison With Prior Work

The cooperation and completion gains we observed are broadly consistent with previously reported “priming” effects of DevaWorld in non-trial use, in which clients undertook ADLs they had previously declined following a session, and with the wider non-pharmacological intervention literature, which supports approaches that engage residents' preserved abilities and personal history rather than targeting behavior directly [3,4]. Our findings extend a small literature on virtual-environment and videogame-based tools for ADL support in dementia, most of which have evaluated screening or training applications delivered by researchers or engagement specialists rather than by the direct care staff who hold day-to-day responsibility for ADL completion [10,11]. To our knowledge, this is among the first studies to evaluate such a tool when operated by CPs themselves as part of routine care, which we believe is a more externally valid test of real-world scalability, at the cost of the tighter fidelity control possible in specialist-delivered protocols.

Limitations

This study has several important limitations that should temper interpretation of the results. The design was single-arm, open-label, and unblinded, without a concurrent control condition, so improvements in cooperation and completion cannot be attributed to DevaWorld with certainty and may reflect regression to the mean, increased attention from CPs, or general study effects. The sample was small (28 residents, 10 CPs), non-randomly selected by site managers and self-selected by CPs, and heterogeneous across sites in language, culture, and care-setting circumstances, which limits generalizability. The primary in-session outcome measures—the five-parameter, ordinal activity ratings—were purpose-built for this study rather than independently validated instruments, and were completed by the same CPs who delivered the intervention, raising the possibility of rating bias; we were unable to administer the full standardized battery registered at the outset (ADCS-ADL-sev, DEMQOL-CH, ADQ, and SCIDS) in this pragmatic setting and instead relied on the NPI-NH, GDS, FAST, and CBI to characterize the sample at baseline, together with the study-specific activity ratings as the primary effectiveness signal; this is a material deviation from the registered protocol that

future, adequately resourced trials should address directly. The 12-month, pandemic-driven gap and site substitution between Site 1 and Site 2 introduced additional heterogeneity in timing and context, and consent for resident-subjects was necessarily obtained by proxy given participants' cognitive status, which is standard practice but nonetheless limits residents' own voice in the study. Finally, the study was designed and conducted by Mentia DTx personnel, and the first author (MS) is an employee, founder, and Principal Investigator of the company with a financial interest in DevaWorld's commercial success—an important source of potential conflict of interest in the interpretation of these largely positive findings (see Conflicts of Interest). The second author (MM) has no financial or employment relationship with Mentia DTx and independently reviewed the study design, outcome interpretation, and this manuscript to help mitigate that risk; however, the underlying data collection and analysis were performed by company personnel, and independent replication by investigators with no commercial stake in the platform remains an important next step.

Notwithstanding these limitations, the study's pragmatic, real-world design is also a strength: by deploying the tool through existing direct care staff rather than research or engagement specialists, and by allowing CPs to integrate sessions flexibly into daily workflow, the findings speak more directly to real-world implementation feasibility than a tightly controlled efficacy trial would.

Future Directions

The barriers identified here—CP time pressure, staffing volatility, and reliance on CP availability and engagement skill—point toward specific product and protocol refinements rather than abandonment of the underlying approach. In response, the study team is developing an AI-mediated version of the platform in which digital personas draw on residents' life history and clinical notes to converse with and guide residents directly, intended to reduce dependence on CP availability and engagement style, alongside a complementary training product to build CP digital and engagement skills. Future evaluation of these next-generation tools should incorporate a concurrent control condition, independently validated outcome measures administered as originally planned, and pre-specified strategies for maintaining protocol fidelity under real-world staffing constraints.

Conclusions

In this single-arm pragmatic study, a videogame-derived virtual environment delivered by direct care partners was tolerated by residents living with dementia in long-term care and was associated with meaningful within-subject improvements in ADL-related cooperation and task completion, alongside qualitative evidence of carryover to real-world routines and improved CP relational knowledge of residents. Implementation fidelity was constrained by staffing volatility, a pandemic-related site disruption, and language/cultural factors at one site, and the effectiveness signal reported here should be confirmed in a controlled trial using the fully validated outcome battery originally registered for this program of research.

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Conflicts of Interest

MS is Chief Executive Officer, founder, and Principal Investigator of Mentia DTx, which develops and commercializes DevaWorld, and holds a financial interest in the company's commercial success. MM has no financial, consulting, or employment relationship with Mentia DTx and declares no competing interests.

Data Availability

Individual participant data are not available for sharing, consistent with the data-sharing plan declared at trial registration.

Authors' Contributions

MS conceived and directed the study, led care partner training, and drafted the manuscript. MM, an independent methodological advisor with no financial or employment ties to Mentia DTx, contributed to study design, outcome interpretation, and critical revision of the manuscript for important intellectual content. Both authors approved the final manuscript and take responsibility for the accuracy and integrity of the work.

Abbreviations

AD/ADRD: Alzheimer's disease and Alzheimer's disease–related dementias

ADCS-ADL-sev: Alzheimer's Disease Cooperative Study–Activities of Daily Living Inventory, severe version

ADL: activity of daily living

ADQ: Approaches to Dementia Questionnaire

CBI: Copenhagen Burnout Inventory

CP: care partner

DEMQOL-CH: Dementia Quality of Life instrument, care-home version

DWS: DevaWorld session

FAST: Functional Assessment Staging

GDS: Global Deterioration Scale

IRB: institutional review board

NIA: National Institute on Aging

NPI-NH: Neuropsychiatric Inventory–Nursing Home version

SBIR: Small Business Innovation Research

SCIDS: Sense of Competence in Dementia Care Staff scale

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