Using iPads to Improve Moods for Older Adults with Dementia and Interactions with their Caregivers

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Abstract

Background: Individuals with Alzheimer's disease or related dementia (ADRD) represent a significant and growing segment of the older adult (65 years and over) population. Individuals with ADRD are often challenged expressively and may experience difficulties with sharing their feelings or moods. Availability of and easy access to tablets and smart phones facilitates use of information and communication technologies (ICTs) as delivery mechanisms for non-pharmacological interventions, especially for older adults with ADRD. Evidence of the impact of ICTs in different community settings on quality-of-life and mood with older adults and their caregivers is needed for widespread adoption and sustainment of these technologies.

Objective: This projects' research aim was to determine extent of the effects of ICTs (iPad) on positive mood change, and examine effects of study variables on participants' mood changes and caregivers' daily activities.

Methods: The ICT (iPad) intervention was developed and its impact evaluated in five tablet engagement pilots (2017-2018). The primary outcome was caregiver-assessed participants' mood (n=1,096) before and after an iPad engagement session using an 8-point mood visual analog scale. Session impact on caregiver daily activities was captured for a sub-sample of participants (n=544). Frequency distributions were computed for each of the study variables, including the degree of patients' mood changes. ?2 tests of association were calculated to determine the impact of the variables on mood changes for all patients, as well as those being treated in skilled nursing facilities and in-home, and then those that affected caregiver daily activities.

Results: iPad interventions substantially improved most patients' mood. Cumulatively, 51% showed mood improvement while another 41% of patients maintained an already-positive mood resulting from the caregiver engagement session. ?2 analyses demonstrated that positive mood changes resulted from using music (?2(15) = 93.84, P < .001), using YouTube as the sole app (?2(6) = 18.38, P=.005), or when cared for in a skilled nursing facility (?2(6) = 236.36, P < .001) across all participants. Positive improvements in the caregivers' day occurred for patients with a movement disorder (?2(2) = 10.04, P=.007), or when socialization was a component of other interventions (?2(2) = 35.26, P < .001).

Conclusions: The study is one of the first to explore the impact of ICTs, in particular tablets such as iPads and apps such as YouTube, to improve mood in older adults and enhance caregiver perceptions about their patient interactions, especially those with ADRD. Importantly, these pilot data substantiate ICTs as part of a person-centered engagement approach, as beneficial alternatives to pharmaceutical interventions for mood enhancement. However, a more comprehensive study that explores the ICT impact on additional quality of life and clinical outcomes is needed to confirm these preliminary findings.

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Original Manuscript

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Abstract

Background: Individuals with Alzheimer's disease or related dementia (ADRD) represent a significant and growing segment of the older adult (65 years and over) population. Individuals with ADRD are often challenged expressively and may experience difficulties with sharing their feelings or moods. Availability of and easy access to tablets and smart phones facilitates use of information and communication technologies (ICTs) as delivery mechanisms for non-pharmacological interventions, especially for older adults with ADRD. Evidence of the impact of ICTs in different community settings on quality-of-life and mood with older adults and their caregivers is needed for widespread adoption and sustainment of these technologies.

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Results: iPad interventions substantially improved most patients' mood. Cumulatively, 51% showed mood improvement while another 41% of patients maintained an already-positive mood resulting from the caregiver engagement session. $\chi 2$ analyses demonstrated that positive mood changes resulted from using music ($\chi 2(15) = 93.84$, $P < .001$), using YouTube as the sole app ($\chi 2(6) = 18.38$, $P=.005$), or when cared for in a skilled nursing facility ($\chi 2(6) = 236.36$, $P < .001$) across all participants. Positive improvements in the caregivers' day occurred for patients with a movement disorder ($\chi 2(2) = 10.04$, $P=.007$), or when socialization was a component of other interventions ($\chi 2(2) = 35.26$, $P < .001$).

Conclusions : The study is one of the first to explore the impact of ICTs, in particular tablets such as iPads and apps such as YouTube, to improve mood in older adults and enhance caregiver perceptions about their patient interactions, especially those with ADRD. Importantly, these pilot data substantiate ICTs as part of a person-centered engagement approach, as beneficial alternatives to pharmaceutical interventions for mood enhancement. However, a more comprehensive study that explores the ICT impact on additional quality of life and clinical outcomes is needed to confirm these preliminary findings.

Keywords

Mood change; caregiver daily activity; interactive computer technology; tablets; older adults; Alzheimer's; iPads; dementia; and implementation science

Introduction

Background

Cognitive impairment in older adults may predict non-normative memory loss that could progress toward dementia-related diagnoses, [1-3] which has profound implications. Individuals with Alzheimer's disease or related dementia (ADRD) represent a significant and growing segment of the older adult (65 years and over) population. The number of older adults with ADRD is projected to triple to 14 million by 2050.[4-6] This increased prevalence will significantly burden in-home caregivers and long-term healthcare facilities – Skilled Nursing Facilities (SNF) and Assisted Living Facilities (ALF) and could impede adequate care. In ALFs, up to 67% of residents have some form of moderate-to-severe cognitive impairment [7-9] compared to 61% of SNF residents. [10] These individuals can have complex physical health concerns, including co-morbid medical conditions, and exhibit behavioral and psychological symptoms of dementia (BPSD) such as aggression, agitation, anxiety, or sundowning. [7, 11-17] Such disruptive behaviors hinder care in long-term care residential facilities and increase caregiver distress.

Pharmacological or non-pharmacological interventions can help manage BPSD in older adults with moderate-to-severe cognitive impairment. Medications may control the physical aspects of BPSD, but can have many side-effects that diminish a resident's ability to participate in life events.[18] Non-pharmacological approaches such as reminiscence therapy, music therapy, or behavior-management techniques can sustain cognitive function, improve quality of life, and mitigate BPSD. [19-22] Availability of tablets and smart phones has changed how non-pharmacological interventions can be delivered to older adults. Individuals can now obtain informational content, interact socially (including participating in online games), listen to music, or reminisce about the past or a recent special event. Easy access to these electronic resources facilitates use of information and communication technologies (ICTs) as delivery mechanisms for non-pharmacological interventions especially for older adults with ADRD. ICTs, such as MP3 players or You Tube videos, have been employed for memory enhancement across different settings, and support care delivery for both older adults with ADRD and their caregivers.[23-25] Results from these studies suggest that ICTs benefit patients' well-being and mood, communication and interactions, and caregivers' mental health and self-efficacy. [23, 25-27]

ICTs can deliver reminiscence therapy interventions for older adults with ADRD. For these individuals, ICTs mitigate motor and sensory impairments, compensate for memory deficits, reduce social isolation, or enhance latent skills and abilities for sensory awareness, musical responsiveness, and emotional memory.[28-30] National Music & Memory^{SM} staff pre-configured tablets (e.g., iPads) with training resources and recommended apps for dementia care. These tablets tailor interactions to residents' interests or hobbies, to facilitate engagement and enhance emotions through multi-sensory activities. Outcomes are promising, showing that person-centered iPad

engagement reduces resident boredom and isolation while enabling greater independence, productivity, connection, and socialization, [31] increases caregiver confidence and their ability to engage socially while improving their distress and health, [32] as well as improves quality of life for assisted living residents.[33] This project extends this work to develop an iPad application (app) for evaluation in different community settings, to document its effects on quality-of-life and mood with older adults and their caregivers.

Development of the iPad intervention

Over the past four years (2016-2019), Gerontologist Debby Dodds created two community iPad programs and evaluated the effectiveness of tablet interventions in dyads of caregivers and people living with ADRD. These initial iPad pilot program used apps in the public domain for four basic types of engagement activities – games, images, music, and reminiscing; the apps were re-conceptualized for this study and defined in Data Collection. In 2016, Dodds partnered with Generation Connect and six Assisted Living communities to implement the iPad portion of the original Music & Memory iPad pilot. [33] iPad pilot data were manually recorded by Assisted Living staff. After this pilot, all data for the subsequent pilots were collected via Generation Connect community-managed iPad's using a questionnaire included on the home screen, which comprise these study data.

Individuals with ADRD are often challenged expressively and may experience difficulties with sharing their feelings or moods. Visual-analog mood scales (VAMS) represent a valid tool to assess baseline, and changes in mood, especially in those with expressive disabilities. [34-36] VAMS use a sequence of faces expressing negative (e.g., angry, sad) or positive (e.g., joyful, happy) moods, or indifference. Engaging individuals in web-based music interventions (e.g., active listening or vocal/physical participation) or art therapy significantly improve participant moods. [37-41] To address this issue, the iPads utilized by Generation Connect incorporate VAMS for self-reporting changes in participant mood prior to and immediately after their iPad activity.

This manuscript reports aggregate findings from five pilot projects evaluating impact of person-centered iPad engagement sessions. Four research aims represent the purpose of this study, to examine study variables effects on mood changes in: (1) the overall patient sample, (2) the sub-sample of patients being treated in skilled nursing facilities (SNFs), (3) patients in home care only, and (4) caregiver daily activities.

METHODS

Study Settings

The Music & Memory Foundation and a Visiting Angels in-home care agency franchise partnered with Generation Connect to develop and conduct five different tablet engagement pilots (2017-2018). Table 1 describes the five pilot programs contributing the tablet engagement session data analyzed for this study. This study was deemed exempt as research by the Institution Review Board at the University of Wisconsin-Madison.

Table 1: Description of Tablet Engagement Pilot Projects		
Partner and Data Collection Timeframe	**Patient Population**	**Description**
Pilot #1 - Consumer Technology Association Grant, Music & Memory Partner Channel (June 2017-August 2017)	Alzheimer's or other forms of dementia cognitive or physical challenges	Funded by a grant from the Consumer Technology Association (CTA), for 10 nursing homes throughout the U.S. The purpose of the grant was to learn how tablet technology can be leveraged to enhance quality of life for elderly and inform in long-term care. The pilot sought to access which tablet applications are best suited to enhance socialization, cognition, communication, mood, behavior, and overall quality of life for the aging population living in care facilities. A user guide based on pilot outcomes, entitled Tablet Engagement Enriching Lives with Everyday Technology, was created and published for the CTA. The tablet engagement sessions utilized close to 20 different apps including YouTube, music, images, and games to improve resident moods.
Pilot #2 - Verizon Grant, Music & Memory Partner Channel (June 2017-August 2017)	Alzheimer's	Funded by a grant from Verizon and ran concurrently with the CTA-funded grant. The goal of this pilot was to offer training and support for care staff to integrate iPads into the daily workings of SNFs. The Verizon grant included ~~8~~ 6 nursing homes throughout the U.S., and was the only pilot to call out and limit to specific residents with dementia. The tablet engagement sessions consisted of close to 20 different apps including YouTube, music, images, and games to improve resident moods.
Pilot #3 - Music & Memory Partner Channel Partners (January 2018-March 2018)	Alzheimer's or other forms of dementia cognitive or physical challenges	Involved Music & Memory promoting the Tablet Engagement program through email blasts to their nursing home partner channel. Ten participants were offered a reduced rate that included equipment, online training, live webinars, and support. The goal of the project was to provide staff with new, tablet-based, person-centered, non-pharmacologic care and training tools to enable positive mood management for residents, and to improve the care environment for staff. The tablet engagement sessions consisted of utilizing person-centered YouTube videos (including music and personal interests such as work, hobbies, or humor) images, and games to improve resident moods.
Pilot #4 - Visiting Angels (January 2018-March 2018)	Non-normative memory loss, cognitive or physical challenges	A Visiting Angels franchise owner invested in the tablet engagement pilot for one of their two franchise locations. The purpose of the pilot was to improve person-centered, non-pharmacologic, and mood management care through tablet mentoring for clients, and to increase client and staff retention. The tablet engagement sessions consisted of utilizing person-centered YouTube videos (including music and personal interests such as work, hobbies, or humor) images, and games to improve resident moods.
Pilot #5 - Visiting Angels (June 2018-December 2018)	non-normative memory loss cognitive or physical challenges	The same Visiting Angels home care franchise owner decide to expand iPads for personalized client engagement to a second franchise location. The leadership team identified several clients for the program, all of whom had been known to have dementia.

		Caregivers received training on best practices, before initiating engagement sessions. The tablet engagement sessions consisted of utilizing person-centered music playlists, YouTube videos (including music and personal interests such as work, hobbies, or humor), images, and games to improve resident moods.

Participant Attributes

Across the pilots, there was a high incidence of non-normative memory loss in residents that participated in the iPad sessions, but iPad sessions were not limited to that population and targeted a variety of conditions. However, participant demographics beyond these primary challenges were not collected in the pilot programs.

Data Collection

Data gathered in the pilots were to improve residents' socialization, person-centered care, and mood management through non-pharmacologic interventions, and to make the day better for caregivers. In all five pilots, data were collected through a short, 5-10 question, online form included on the iPad homepage for easy caregiver access. Caregiver discretion determined the choice of apps presented to older adults. All data were reviewed for accuracy and completeness. Data cleaning standardized labels and ensured response uniformity prior to analysis (Multimedia Appendix 1). Researchers then reviewed and converted the variables into the following categories:

- Patients' primary physical challenge – memory loss, non-ambulatory, movement disorder, communicative/expressive disorders, or other
- Method used for caregiver/patient engagement (either singularly or combined with other methods) – music, stories-video, games, communication, photos, other
- Type of strategy of caregiver/patient engagement (either singularly or combined with other strategies) – music, reminiscing, socialization, relaxation, achievement
- Number of strategies used – either 1, or 2 or more
- Type of app used to facilitate strategies – YouTube only, YouTube as one method among others, or other
- Number of apps used to facilitate strategies – either 1, or 2 or more.

Facility type was self-reported as "skilled nursing," "home care," or "other." Facility locations were classified as rural or urban using the U.S. Department of Agriculture Rural Urban Continuum Code and, for Canadian facilities, rural/urban status was determined through website search.

Mood rating

Caregivers reported their participants' mood before and after tablet engagement, the type of engagement used, and how the engagement affected the caregivers' day. Participants' mood was assessed using a VAMS consisting of eight faces (Figure 1). For the purpose of analyses, all faces were ordered numerically from Angry (value of "1") to Joyful (value of "8").[37] Individual moods were then categorized into two domains: (1) negative moods (values of "1" to "5"), and (2) positive moods (values of "6" to "8"). "Indifference" was considered a negative mood because of its potential to adversely affect other aspects of the patients' functioning throughout the day, as well as influence caregivers' activities.[42]

The numeric mood values before the caregiver/patient engagement was subtracted from the mood values observed after engagement. Negative values were considered a worsening of mood, while positive values indicated improvement. Values of "0" signified no mood change. Mood changes were then grouped into four categories: Worsening of mood (i.e., all negative change values), maintaining negative mood (i.e., improvements remain within the negative mood domain), maintaining positive mood (i.e., improvements remain within the positive mood domain), or transition from negative to positive mood domains.

Caregiver daily activities

The impact of the sessions with older adults was captured for a sub-sample of caregivers' daily activities across the five pilots. Caregivers responded to the following question: How did the engagement session impact your day? Impact was rated using a five-point scale anchored at 0 (Made it worse), 3 (no impact), and 5 (made it better). Scale values for "2" and "4" had no assigned anchor label, but were, in this analysis, assigned "slight worsening" and "slight improvement," respectively.

Statistical analysis

Frequency distributions were computed for each of the study variables, including the degree of patients' mood changes. All variables were collected as categorical, and ranged from dichotomous, trichotomous, up to six categories. χ^2 tests of association were calculated to determine the impact of the variables on mood changes for all patients, as well as those being treated in SNFs and in-home, and then those that affected caregiver daily activities.

RESULTS

Post-hoc power analysis for the χ^2 tests demonstrated superior power for all analyses, from a single instance of 0.76 to a range of 0.83 to 0.99 depending on the research aim. The power levels calculated for all four research aims conformed to Cohen's accepted standard of a four-to-one weighting between Type II and Type I error

risks[43]. In addition, no significant χ^2 results were associated with more than 33% of contingency table cells having expected counts of less than 5.

Descriptive statistics

Frequencies were computed for each study variable and for each of the analyzed samples (i.e., full sample, SNFs only, and home care only), as shown in Table 2, which also demonstrates a relatively equal distribution of resident mood changes after use of the iPad. Table 3 convincingly represents overall mood improvement after the use of the app technology among individuals with various disabilities, and is further illustrated when examining frequencies within each of the mood change categories.

Table 2. Study Variables

	Full Sample (n=1,096)	Skilled Nursing Facilities (n=374)	Home Care (n=670)
Variable	**Frequency (%)**	**Frequency (%)**	**Frequency (%)**
Primary Challenge			
Memory Loss	790 (72.1)	166 (44.4)	584 (87.2)
Non-ambulatory	105 (9.6)	102 (27.3)	0 (0)
Movement Disorder	130 (11.9)	41 (11.0)	86 (12.8)
Communicative/Expressive disorders	56 (5.1)	55 (14.7)	0 (0)
Other	15 (1.4)	10 (2.7)	0 (0)
Engagement Method Used (Singularly or one of multiple)			
Music	381 (40.0)	115 (31.8)	257 (47.7)
Stories-Video	200 (21.0)	84 (23.2)	103 (19.1)
Games	114 (12.0)	33 (9.1)	65 (12.1)
Communication	96 (10.1)	48 (13.3)	48 (8.9)
Photos	75 (7.9)	16 (4.4)	56 (10.4)
Other	86 (9.0)	66 (18.2)	10 (1.9)
Type of Strategies Used			
Music			

Singularly	201 (38.9)	61 (49.6)	137 (35.6)
One of multiple	316 (61.1)	62 (50.4)	248 (64.4)
Reminiscing			
Singularly	43 (14.1)	37 (27.4)	4 (2.6)
One of multiple	261 (85.9)	98 (72.6)	150 (97.4)
Socialization			
Singularly	188 (34.9)	63 (33.0)	119 (36.8)
One of multiple	351 (65.1)	128 (67.0)	204 (63.2)
Relaxation			
Singularly	13 (5.5)	8 (28.6)	2 (1.0)
One of multiple	225 (94.5)	20 (71.4)	202 (99.0)
Achievement			
Singularly	103 (40.9)	41 (59.4)	48 (29.3)
One of multiple	149 (59.1)	28 (40.6)	116 (70.7)
Number of Strategies Used			
1	545 (49.7)	207 (55.3)	310 (46.3)
2 or more	528 (48.2)	158 (42.2)	348 (51.9)
Missing	23 (2.1)	9 (2.4)	12 (1.8)
Type of App Used for Strategies			
YouTube only	307 (28.0)	168 (44.9)	122 (18.2)
YouTube involved	54 (4.9)	12 (3.2)	38 (5.7)
Other	711 (64.9)	184 (49.2)	496 (74.0)
Missing	24 (2.2)	10 (2.7)	14 (2.1)
Number of Apps Used for Strategy			
1	964 (88.0)	340 (90.9)	581 (86.7)
2 or more	108 (9.9)	24 (6.4)	75 (11.2)

Missing	24 (2.2)	10 (2.7)	14 (2.1)
Urban/Rural Status			
Rural	410 (37.4)	271 (72.5)	121 (18.1)
Urban	686 (62.6)	103 (27.5)	549 (81.9)
Facility Type			
Skilled Nursing	374 (34.1)	374 (100)	0 (0)
Home Care	670 (61.1)	0 (0)	670 (100)
Other	52 (4.7)	0 (0)	0 (0)
Mood Change			
Worse or no change	374 (34.1)	39 (10.4)	320 (47.8)
Slight improvement	453 (41.3)	137 (36.6)	289 (43.1)
Moderate to substantial improvement	262 (23.9)	197 (52.7)	57 (8.5)
Missing	7 (0.6)	1 (0.3)	4 (0.6)
Session Impact on Caregiver Daily Activities			
1 Made it worse	0 (0)	0 (0)	0 (0)
2	0 (0)	0 (0)	0 (0)
3 No impact	42 (7.7)	5 (14.7)	36 (7.4)
4	322 (59.2)	20 (58.8)	294 (60.6)
5 Made it better	180 (33.1)	9 (26.5)	155 (32.0)

Table 3. Mood Transitions for Individuals [a]

Mood Before Session	Mood After Session							
	Angry	*Anxious*	*Sad*	*Confused*	*Indifferent*	*Relaxed*	*Happy*	*Joyful*
Angry (n=33)	2 6.1%					2 6.1%	11 33.3%	18 54.5%
Anxious (n= 52)		4 7.7%	2 3.8%	2 3.8%	4 7.7%	24 46.2%	11 21.2%	5 9.6%
Sad (n= 65)			2 3.1%	1 1.6%		3 4.7%	30 46.9%	28 43.8%
Confused (n= 70)		1 1.4%		3 4.3%	6 8.6%	29 41.4%	23 32.9%	8 11.4%
Indifferent (n= 408)	1 0.2%	1 0.2%		7 1.7%	36 8.9%	91 22.4%	175 43.1%	95 23.4%
Relaxed (n= 120)				1 0.8%	6 5.0%	28 23.3%	71 59.2%	14 11.7%
Happy (n= 326)						7 2.1%	257 78.8%	62 19.0%
Joyful (n= 18)			1 5.6%				5 27.8%	12 66.7%

[a] Worsening of mood (Red shading); Maintaining negative mood (Yellowish red shading); Maintaining positive mood (Yellowish Green shading); Transition from negative to positive mood (Green shading)

Worsening of mood (n=30). Any worsening of mood represented the mood change category with the fewest number of patients. A third of these patients had worsening mood within the negative mood domain, while another 40% had worsening mood among positive moods and the remaining 27% transitioned from positive to negative moods. When examining the extent of mood changes, 10% (n=3) of patients showed the most mood change (i.e., negative change values of 3 or greater), and 7% (n=2) had value decreases of 2. Most cases of worsening mood (83%) comprised only a one-point decrease, with six of those cases involving a transition from positive to negative mood (i.e., going from relaxed to indifferent).

Maintaining negative mood (n=61). Within this category, 77% (n=47) of patients showed no mood change, and most (n=36) of these moods were viewed as indifference. The most frequent mood improvements were found for transitions from confused to indifferent (n=6), while the greatest improvement was found for transitions from anxious to indifferent (n=3).

Maintaining positive mood (n=444). Within this category, 67% (n=297) of patients showed no mood change, and most (86%) of these moods were viewed as happy. The most frequent mood improvements within the positive mood domain represented transitions from relaxed to happy (n=71) and then from happy to joyful (n=62), and the most significant improvement was found for transitions from relaxed to joyful (n=14).

Transition from negative to positive moods (n=554). There was an almost even division between mood improvements involving one- or two-point value increases (53%) and three-point increases or more (47%). Two-thirds (n=361) of all patients began the sessions in an indifferent mood, and then increased to relaxed (n=91), happy (n=175), or joyful (n=95). Further, the proportion of patients achieving joyful mood after the session was noteworthy. Thirteen percent of patients who began the session as either anxious or confused became joyful as a result of the session, while 46% of patients who were sad ended the session in a joyful mood. Importantly, 18 of the 31 patients (58%) transitioned from being angry to being joyful, demonstrating the greatest improvement possible during this study.

Chi-square analyses

Table 4 contains the frequencies for each study variable within the four separate mood-change categories, which provides insight into the category of each variable that contributed to the mood effect.

Table 4. Chi-Square Comparisons of Variables to Degree of Mood Change in Full Sample

Variables	***Mood Change***		
	Worse or no change	Slight improvement	Moderate to substantial improvement
	Frequency (%)	Frequency (%)	Frequency (%)
Primary Challenge			
Memory Loss	334 30.7)	331 (30.4)	120 (11.0)
Non-ambulatory	8 (0.7)	40 (3.7)	57 (5.2)
Movement Disorder	21 (1.9)	63 (5.8)	44 (4.0)
Communicative/Expressive disorders	7 (0.6)	13 (1.2)	36 (3.3)
Other	4 (0.4)	6 (0.6)	5 (0.5)
Engagement Method Use (Singularly or one of multiple)			
Music	103 (10.9)	169 (17.9)	105 (11.1)

Stories-Video	80 (8.5)	71 (7.5)	48 (5.1)
Games	66 (7.0)	34 (3.6)	13 (1.4)
Communication	21 (2.2)	42 (4.4)	33 (3.5)
Photos	37 (3.9)	32 (3.4)	6 (0.6)
Other	22 (2.3)	28 (3.0)	36 (3.8)
Type of Strategies Used			
Music			
Singularly	74 (14.4)	79 (15.4)	46 (9.0)
One or more	73 (14.2)	162 (31.6)	79 (15.4)
Reminiscing			
Singularly	5 (1.6)	10 (3.3)	28 (9.2)
One or more	66 (21.7)	113 (37.2)	82 (27.0)
Socialization			
Singularly	77 (14.4)	81 (15.1)	28 (5.2)
One or more	99 (18.5)	28.7 (23.9)	97 (18.1)
Relaxation			
Singularly	5 (2.1)	3 (1.3)	5 (2.1)
One or more	53 (22.5)	123 (52.1)	47 (19.9)
Achievement			
Singularly	55 (21.9)	35 (13.9)	13 (5.2)
One or more	46 (18.3)	76 (30.3)	26 (10.4)
Number of Strategies Used			
1	218 (20.5)	206 (19.3)	117 (11.0)
2 or more	144 (13.5)	238 (22.3)	143 (13.4)
Type of App Used for Strategies			

YouTube only	81 (7.6)	118 (11.1)	106 (10.0)
YouTube involved	19 (1.8)	27 (2.5)	8 (0.8)
Other	265 (24.9)	301 (28.3)	140 (13.1)
Number of Apps Used for Strategies			
1	316 (29.7)	401 (37.7)	241 (22.6)
2 or more	49 (4.6)	45 (4.2)	13 (1.2)
Urban/Rural Status			
Rural	62 (5.7)	160 (14.7)	187 (17.2)
Urban	312 (28.7)	293 (26.9)	75 (6.9)
Facility Type			
Skilled Nursing	39 (3.6)	137 (12.6)	197 (18.1)
Home Care	320 (29.4)	289 (26.5)	57 (5.2)
Other	15 (1.4)	27 (2.5)	8 (0.7)

Research Aim #1: Analysis of Full Sample

χ^2 analyses of all patients were conducted to determine the extent that significant mood changes occurred for those receiving treatment (n=1,096). When examining the effects of the patients' primary healthcare challenges on their observed mood, memory loss was associated with patients maintaining positive mood as a result of the intervention ($\chi^2(12) = 198.99$, $P < .001$). Engagement methods demonstrated some effect on patients' mood, with music being more likely to facilitate patients' improvements from negative to positive moods ($\chi^2(15) = 93.84$, $P < .001$). Characteristics of the apps used to engage also influenced mood. When using YouTube as the sole app, patients' improvement of mood was more prevalent ($\chi^2(6) = 18.379$, $P=.005$). Results also suggested that some strategies implemented to evoke mood changes were effective. Specifically, using music ($\chi^2(3) = 29.83$, $P < .001$) or socialization ($\chi^2(3) = 46.27$, $P < .001$), as single methods, were associated with patients maintaining positive mood; reminiscing, when used as a component of additional strategies, also was related to patients maintaining positive mood ($\chi^2(3) = 11.77$, $P=.008$). Conversely, achievement, as a component of additional strategies, was more likely to facilitate patients' improvements from negative to positive moods ($\chi^2(3) = 13.06$, $P=.005$). These findings support the separate analysis showing that patients using only one strategy were more likely to maintain positive mood ($\chi^2(3) = 49.59$, $P < .001$). Examining the influences of facility characteristics revealed that patient

placement in a SNF was more likely to be associated with improvements from negative to positive moods ($\chi2(6) = 236.36$, $P < .001$), while placement in an urban setting was associated with maintaining positive mood ($\chi2(3) = 196.03$, $P < .001$).

Research Aim #2: Analysis of Skilled Nursing Facilities

Sub-sample analyses were designed to reveal the effects of the study variables on mood changes for patients from SNFs only (n=374). Notably fewer significant results emerged from this sample compared to either the full sample or the home care sub-sample analyses; however, these results demonstrated a consistent effect on mood. Patients using only one strategy were associated with improvements from negative to positive moods ($\chi2(3) = 7.79$, P=.05). This trend substantiates the finding derived from the full sample – solely using one strategy is an effective approach for positive moods. Finally, staff from SNFs operating in an urban setting was associated with maintaining a positive mood ($\chi2(3) = 20.40$, $P < .001$), again mirroring the full sample.

Research Aim #3: Analysis of Patients in Home Care

A sub-sample analysis also was conducted for patients involved only in home care (n=670). Patients with movement disorder as their primary challenge were more likely to improve from negative to positive moods as a result of the intervention ($\chi^2(3) = 116.62$, $P < .001$). Furthermore, solely using music ($\chi^2(3) = 44.508$, $P < .001$) or, more generally, any strategy used in isolation of others ($\chi^2(3) = 91.999$, $P < .001$), were associated with patients maintaining positive mood. Using YouTube as the sole app was more likely to be associated with patients maintaining positive mood ($\chi^2(6) = 22.48$, $P < .001$). Finally, care occurring in urban settings was associated with patients maintaining positive mood as a result of the intervention ($\chi^2(3) = 79.25$, $P < .001$).

Research Aim #4: Analysis of Caregiver Daily Activities

A sub-sample of caregivers also rated the impact of the intervention on their day (n=544). When patients had a movement disorder, the engagement session made the day better for caregivers ($\chi^2(2) = 10.04$, P=.007). Music, when used singularly, slightly improved the caregiver's day ($\chi^2(2) = 17.15$, $P < .001$), while socialization as a component of other interventions made the day better for the caregiver ($\chi^2(2) = 35.26$, $P < .001$). Using only one strategy ($\chi^2(2) = 38.25$, P < .001), or using apps multiple times ($\chi^2(2) = 12.901$, P=.002), slightly improved the caregiver's day, but using apps other than YouTube made the caregiver's day much better ($\chi^2(4) = 17.34$, P=.002). In urban settings, the positive impact of the engagement session was only slight ($\chi^2(2) = 120.10$, $P < .001$). When engagement occurred in other than SNFs or home care, the session made the day better for caregivers ($\chi^2(4) = 13.80$, P=.008). Importantly, when patients' mood was observed to improve, the engagement session was more likely to make the day better for staff ($\chi^2(6) = 253.76$, $P < .001$).

Discussion

Principal Findings

This study is one of the first to focus on implementation of iPads across institutional (e.g., SNFs) and in-home settings. The most apparent implication from this study was the substantial benefit of the iPad interventions to most patients. Less than 9% of the entire sample evidenced either mood worsening (2.7%) or improvements in negative moods that were insufficient to become positive moods (5.6%) after caregiver engagement sessions. That is, positive patient moods were either maintained or enhanced, or were achieved after beginning the session in a negative mood. The unequivocal therapeutic benefit of person-centered iPad engagement with music and other approaches seems a function not only of the effectiveness of the particular intervention but also of caregiver commitment and compassion for the patient.

Caregiver supports that maintain interest and participation, as well as promote feelings of achievement and mastery, create a positive experience for participants and caregivers with tablets.[44] Successful interactions should provide achievable goals facilitating feelings of self-worth, which require the caregiver to be "in the moment" and select apps based on resident mood to promote engagement.[44] Study results extend this concept further, indicating that app selection should target multiple strategies (e.g., reminiscing or socialization) to facilitate improvements in resident moods.

Our findings also offer guidance around the patient/caregiver engagement process. Specifically, the use of a single app, especially YouTube, resulted in moderate/substantial improvements in resident mood across the entire sample. This influence of YouTube supports additional research indicating that exposure to YouTube videos improves participant wellbeing and mood, as well as their communication, interaction and engagement.[27] In our study, YouTube was primarily used to share music or stories via video, and strategies related to reminiscing, socialization, or music. One resident encounter convincingly illustrates iPad impact on resident mood: "*listened and watched a YouTube video with headphones and closed caption in Navajo. Elder was happy and smiling. He sang along in Navajo and tried [to] teach me the words in Navajo."* This session successfully targeted all three strategies and the resident's mood improved the greatest extent possible, from Sad to Joyful.

Interestingly, using gaming apps (e.g., Puzzable or Solitaire) to engage patients did not statistically improve mood, especially compared to other engagement strategies. For these patients, the complexity of *playing the game* may have undermined mood improvement. For example, one resident reported that "*the worst part [of the game] was there were too many questions - wanted too much information before getting to anything interesting*." Although an unfortunate reaction, this finding supports research suggesting that gaming apps are not as useful for promoting engagement as apps targeting relaxation or telling an individual's life story in this population.[33] Conversely, other research demonstrates that interactive computer games (e.g., a Nintendo Wii) affected

participant cognition.[45] These contradictory findings warrant further research to examine the specific gaming features, as well as the interaction of these features with patient characteristics and cognitive conditions, that prompt mood changes.

Mood changes differed by location. Patients in rural areas reported more negative moods (sad, confused, angry or anxious), or have an indifferent mood, at baseline versus those in urban areas. Similarly, most patients in SNFs began sessions with a negative mood compared to 40% of individuals in home-care settings. However, post-iPad engagement, individuals with a negative mood fell below 10%. Anecdotal observations suggest a greater continuity of care existing between caregivers and patients in home-care care sessions, including more frequent and sustained interactions. How facility setting characteristics influence patient or caregiver mood and mood changes, along with their feelings of isolation or loneliness, remain crucial research topics when implementing iPads or other ICTs.

Limitations

Although illustrating numerous areas for investigation, this study had limitations. First, to ease data collection burden on caregivers, no resident or caregiver attributes (such as gender, age, or duration of the primary challenges), or years of caregiving service, were documented. Second, data collection may not have been systematic either across or within facilities. For example, the key strategy (e.g., music or reminiscing) may have been recorded inconsistently. Third, since caregiver observations determined mood baseline and changes, knowledge of study objectives or varying assessments of residents' mood could, even unintentionally, introduce bias. Fourth, the time allotted for the patient/caregiver interaction may have affected mood changes, but was not collected. Finally, findings related to the caregivers' day suggest that the intervention was beneficial overall, but the effect may differ for larger samples or other patient or caregiver samples.

Conclusions

This study documents further evidence that ICTs, in particular tablets such as iPads and apps such as YouTube, improve mood in older adults and enhance caregiver perceptions about their patient interactions, especially those with ADRD. Importantly, these pilot data substantiate ICTs, as part of a person-centered engagement approach, as beneficial alternatives to pharmaceutical interventions for mood enhancement. As done for this study, matching engagement methods and types of strategies and apps, based on patient preferences or other features to maximize their mood effects, is critical for strengthening the utility of this approach. Accumulating evidence, and the additional research questions emerging from this nascent examination, offer exciting prospects for continued empirical inquiry and bettering patient well-being.

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Conflicts of Interest

Ms. Dodds and Mr. Potteiger work for Generation Connect (https://www.wearegenerationconnect.com/) which is a gerontology-driven technology company with an intergenerational team that works together with forward-thinking care organizations to build engagement solutions that promote person-centered care through technology innovation. All other authors report no conflict of interest.

Abbreviations

ADRD: Alzheimer's disease or related dementia

ALF: Assisted Living Facilities

BPSD: Behavioral and psychological symptoms of dementia

CTA: Consumer Technology Association

ICT: Information and communication technologies

SNF: Skilled Nursing Facilities

VAMS: Visual-analog mood scales

References

1. Rabin LA, Smart CM, Crane PK, Amariglio RE, Berman LM, Boada M, Buckley RF, Chételat G, Dubois B, Ellis KA, et al: **Subjective Cognitive Decline in Older Adults: An Overview of Self-Report Measures Used Across 19 International Research Studies.** *Journal of Alzheimer's disease : JAD* 2015, **48:**S63-S86.
2. Mitchell AJ, Beaumont H, Ferguson D, Yadegarfar M, Stubbs B: **Risk of dementia and mild cognitive impairment in older people with subjective memory complaints: meta-analysis.** *Acta Psychiatr Scand* 2014, **130:**439-451.
3. Reisberg B, Shulman MB, Torossian C, Leng L, Zhu W: **Outcome over seven years of healthy adults with and without subjective cognitive impairment.** *Alzheimers Dement* 2010, **6:**11-24.
4. Alzheimer's A: **2013 Alzheimer's disease facts and figures.** *Alzheimers Dement* 2013, **9:**208-245.
5. Alzheimer's A: **2014 Alzheimer's disease facts and figures.** *Alzheimers Dement* 2014, **10:**e47-92.
6. Hebert LE, Weuve J, Scherr PA, Evans DA: **Alzheimer disease in the United States (2010-2050) estimated using the 2010 census.** *Neurology* 2013, **80:**1778-1783.
7. McKenzie G, Teri L, Pike K, LaFazia D, van Leynseele J: **Reactions of assisted living staff to behavioral and psychological symptoms of dementia.** *Geriatr Nurs* 2012, **33:**96-104.
8. Park-Lee E, Sengupta M, Harris-Kojetin LD: **Dementia special care units in residential care communities: United States, 2010.** *NCHS Data Brief* 2013**:**1-8.
9. Zimmerman S, Sloane PD, Reed D: **Dementia prevalence and care in assisted living.** *Health Aff (Millwood)* 2014, **33:**658-666.
10. **2019 Alzheimer's disease facts and figures.** *Alzheimer's & Dementia: The Journal of the Alzheimer's Association* 2019, **15:**321-387.
11. Cummings JL, Mega M, Gray K, Rosenberg-Thompson S, Carusi DA, Gornbein J: **The Neuropsychiatric Inventory: comprehensive assessment of psychopathology in dementia.** *Neurology* 1994, **44:**2308-2314.
12. Dewing J: **Sundowning in older people with dementia: evidence base, nursing assessment and interventions.** *Nurs Older People* 2003, **15:**24-31; quiz 32.
13. Ishii S, Streim JE, Saliba D: **A conceptual framework for rejection of care behaviors: review of literature and analysis of role of dementia severity.** *J Am Med Dir Assoc* 2012, **13:**11-23 e11-12.

14. Khachiyants N, Trinkle D, Son SJ, Kim KY: **Sundown syndrome in persons with dementia: an update.** *Psychiatry Investig* 2011, **8:**275-287.

15. Konno R, Kang HS, Makimoto K: **A best-evidence review of intervention studies for minimizing resistance-to-care behaviours for older adults with dementia in nursing homes.** *J Adv Nurs* 2014, **70:**2167-2180.

16. Mega MS, Cummings JL, Fiorello T, Gornbein J: **The spectrum of behavioral changes in Alzheimer's disease.** *Neurology* 1996, **46:**130-135.

17. Spector A, Orrell M, Goyder J: **A systematic review of staff training interventions to reduce the behavioural and psychological symptoms of dementia.** *Ageing Res Rev* 2013, **12:**354-364.

18. Olazaran J, Reisberg B, Clare L, Cruz I, Pena-Casanova J, Del Ser T, Woods B, Beck C, Auer S, Lai C, et al: **Nonpharmacological therapies in Alzheimer's disease: a systematic review of efficacy.** *Dement Geriatr Cogn Disord* 2010, **30:**161-178.

19. Cotelli M, Manenti R, Zanetti O: **Reminiscence therapy in dementia: A review.** *Maturitas* 2012, **72:**203-205.

20. Ballard C, Corbett A: **Agitation and aggression in people with Alzheimer's disease.** *Current opinion in psychiatry* 2013, **26:**252-259.

21. Ibrahim F, Knight SR, Cramer RL: **Addressing the Controversial Use of Antipsychotic Drugs for Behavioral and Psychological Symptoms of Dementia.** *Journal of Pharmacy Technology* 2012, **28:**3-9.

22. O'Neil ME, Freeman M, Christensen V, Telerant R, Addleman A, Kansagara D: In *A Systematic Evidence Review of Non-pharmacological Interventions for Behavioral Symptoms of Dementia.* Washington (DC); 2011: *VA Evidence-based Synthesis Program Reports*].

23. Lewis V, Bauer M, Winbolt M, Chenco C, Hanley F: **A study of the effectiveness of MP3 players to support family carers of people living with dementia at home.** *International psychogeriatrics* 2015, **27:**471-479.

24. Lorenz K, Freddolino PP, Comas-Herrera A, Knapp M, Damant J: **Technology-based tools and services for people with dementia and carers: Mapping technology onto the dementia care pathway.** *Dementia* 2017**:**1471301217691617.

25. Nijhof N, van Gemert-Pijnen JE, Seydel E: **A personal assistant for dementia to stay at home safe at reduced cost.** *Gerontechnology* 2013, **11:**469-479.

26. Kerssens C, Kumar R, Adams AE, Knott CC, Matalenas L, Sanford JA, Rogers WA: **Personalized technology to support older adults with and without cognitive impairment living at home.** *American Journal of Alzheimer's Disease & Other Dementias®* 2015, **30:**85-97.

27. O'rourke J, Tobin F, O'callaghan S, Sowman R, Collins D: **'YouTube': a useful tool for reminiscence therapy in dementia?** *Age and ageing* 2011, **40:**742-744.

28. Delello JA, McWhorter RR: **Reducing the digital divide: Connecting older adults to iPad technology.** *Journal of Applied Gerontology* 2017, **36:**3-28.

29. Lazar A, Thompson H, Demiris G: **A systematic review of the use of technology for reminiscence therapy.** *Health education & behavior* 2014, **41:**51S-61S.

30. Ryan AA, McCauley CO, Laird EA, Gibson A, Mulvenna MD, Bond R, Bunting B, Curran K, Ferry F: **'There is still so much inside': The impact of personalised reminiscence, facilitated by a tablet device, on people living with mild to moderate dementia and their family carers.** *Dementia* 2018**:**1471301218795242.

31. **Frontiers of Music Therapy: How iPads are Transforming a Bronx Nursing Home** [https://musicandmemory.org/blog/2013/02/07/frontiers-of-music-therapy-how-ipads-are-transforming-a-bronx-nursing-home/ Archived at http://www.webcitation.org/70xKSgCxv on July 16, 2018]

32. Williams APP, A.; Rudoler, D.; Tam, T.; Watkins, J.: **Evaluation of the Alzheimer Society of Toronto iPod Project.** pp. 1-71; 2014:1-71.

33. Ford II JH, Dodds D, Hyland J, Potteiger M: **Evaluating the Impact of Music & Memory's Personalized Music and Tablet Engagement Program in Wisconsin Assisted Living Communities: Pilot Study.** *JMIR Aging* 2019, **2:**e11599.

34. Arruda J, Stern R, Hooper C, Wolfner G, Somerville J, Bishop D: **Visual Analogue Mood Scales to Measure Internal Mood State in Aphasic Patients: Description and Initial Validity Evidence with Normal and Neurologically Impaired Subjects.** *Archives of Clinical Neuropsychology* 1996, **5:**364.

35. Lorish CD, Maisiak R: **The face scale: a brief, nonverbal method for assessing patient mood.** *Arthritis & Rheumatism: Official Journal of the American College of Rheumatology* 1986, **29:**906-909.

36. Stern R, Arruda J, Hooper C, Wolfner G, Morey C: **Visual analogue mood scales to measure internal mood state in neurologically impaired patients: Description and initial validity evidence.** *Aphasiology* 1997, **11:**59-71.

37. Elefant AB, Contreras O, Muñoz RF, Bunge EL, Leykin Y: **Microinterventions produce immediate but not lasting benefits in mood and distress.** *Internet interventions* 2017, **10:**17-22.

38. Gallagher LM, Lagman R, Bates D, Edsall M, Eden P, Janaitis J, Rybicki L: **Perceptions of family members of palliative medicine and hospice patients who experienced music therapy.** *Supportive Care in Cancer* 2017, **25:**1769-1778.

39. Gallagher LM, Lagman R, Rybicki L: **Outcomes of music therapy interventions on symptom management in palliative medicine patients.** *American Journal of Hospice and Palliative Medicine®* 2018, **35:**250-257.

40. Reilly N, Turner G, Taouk J, Austin M-P: **'Singing with your baby': an evaluation of group singing sessions for women admitted to a specialist mother-baby unit.** *Archives of women's mental health* 2018**:**1-5.

41. Shella TA: **Art therapy improves mood, and reduces pain and anxiety when offered at bedside during acute hospital treatment.** *The Arts in Psychotherapy* 2018, **57:**59-64.

42. Landes AM, Sperry SD, Strauss ME, Geldmacher DS: **Apathy in Alzheimer's disease.** *Journal of the American Geriatrics Society* 2001, **49:**1700-1707.

43. Cohen J: *Statistical Power Analysis for the Behavioral Sciences.* Hillsdale, NJ: Lawrence Erlbaum Associates; 1988.

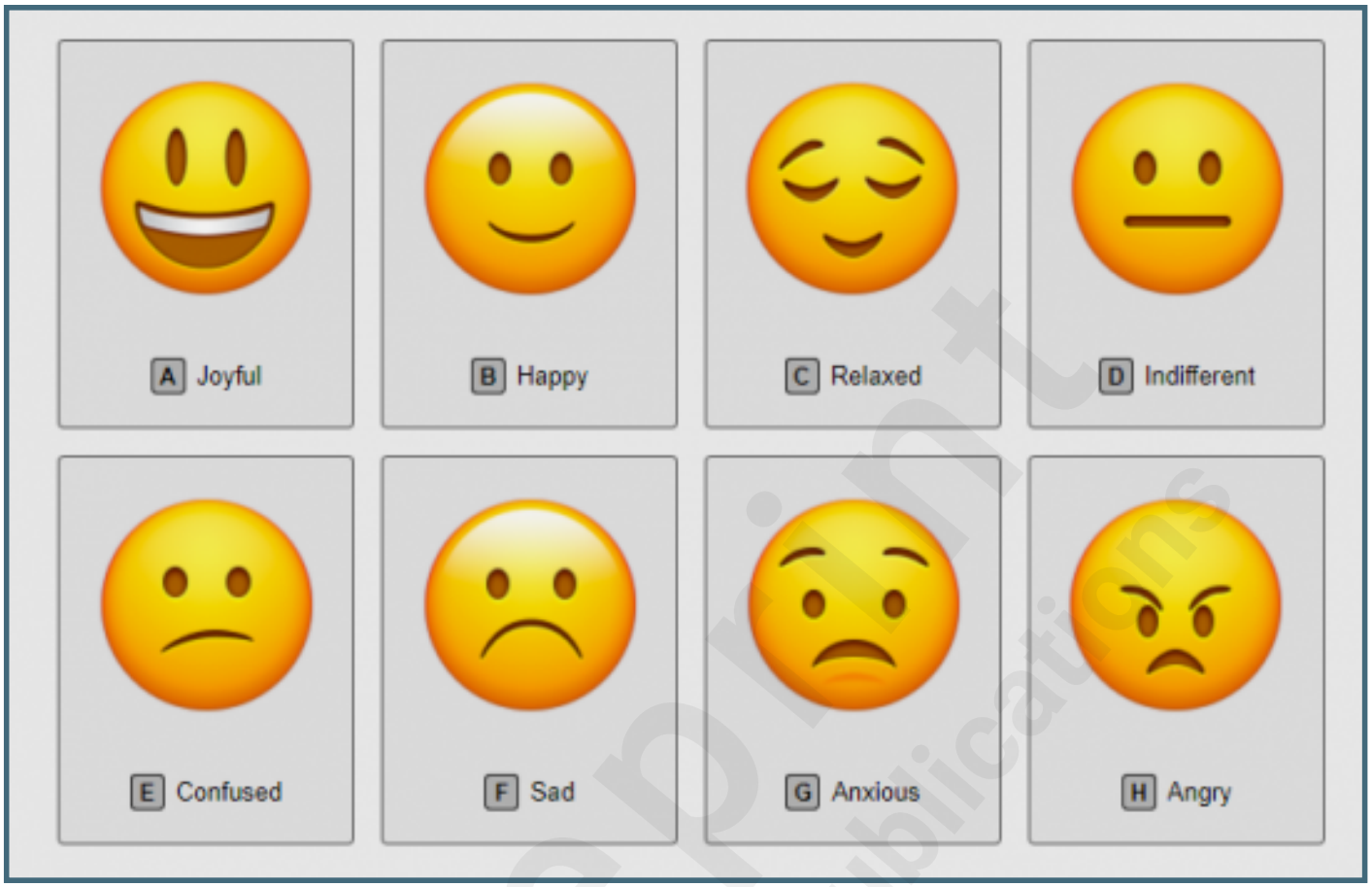
44. Smith SK, Mountain GA, Hawkins RJ: **Qualitatively exploring the suitability of tablet computers to encourage participation with activities by people with moderate stage dementia.** *Dementia (London)* 2018**:**1471301218802897.

45. Bleakley CM, Charles D, Porter-Armstrong A, McNeill MD, McDonough SM, McCormack B: **Gaming for health: a systematic review of the physical and cognitive effects of interactive computer games in older adults.** *J Appl Gerontol* 2015, **34:**Np166-189.

Supplementary Files

Figures

Participant mood rating scale.



Multimedia Appendixes

Description of the key data elements collected over the iPad.
URL: https://assetapi.jmir.pub/assets/a71b4bba022b3f7e7f11932d665c934c.docx