Use of Tablet Devices in the Management of Agitation Among Inpatients with Dementia: An Open-Label Study

*Ipsit V. Vahia, M.D., Rujvi Kamat, Ph.D.,
Cheng Vang, M.S.,
Carolina Posada, Ph.D., Lisa Ross, R.N.,
Sarah Oreck, M.D., Alok Bhatt, M.D.,
Colin Depp, Ph.D., Dilip V. Jeste, M.D.,
Daniel D. Sewell, M.D.*

Objective: *To investigate the feasibility, safety, and utility of tablet devices as novel nonpharmacologic tools in managing older psychiatric inpatients with agitation and dementia.* **Methods:** *Thirty-six patients at a geriatric psychiatry inpatient unit were provided with tablets when agitated and used various apps on the tablet related to communication, games, music, web browser, and photography during their stay. Study staff documented the frequency, duration, and app usage history and rated the extent to which agitation improved after tablet use.* **Results:** *All participants, regardless of dementia severity, were able to use apps and were rated by staff to have clinical benefit. Dementia severity was negatively associated with app complexity. Age was negatively associated with frequency and duration of tablet use.* **Conclusion:** *Tablet use as a nonpharmacologic intervention for agitation in older adults, including those with severe dementia, appears to be feasible, safe, and of potential utility.* (Am J Geriatr Psychiatry 2016; ■■:■■–■■)

INTRODUCTION

Behavioral symptoms such as agitation, aggression, and psychosis in individuals with dementia are associated with significant caregiver stress, frequent need for institutionalization, increase in healthcare costs, and higher mortality.[1] Antipsychotics and other pharmacologic approaches for these symptoms have limited benefit and significant risk of side effects.[2] Nonpharmacologic approaches (e.g., individualized musical experiences, reminiscence, or art therapy) may be effective; existing guidelines for implementation of these interventions for managing agitated patients with dementia recommend an individualized approach for each patient to identify potential unmet needs and then targeting these needs to alleviate behavioral symptoms.[3,4] However, such approaches are time and resource intensive.[5]

A potential solution may lie in the use of electronic devices, such as tablets. These devices are capable of delivering a number of the components of nonpharmacologic interventions for agitation, such as music, reading, viewing family videos or photographs, and videoconferencing with family members.[6] They have been used in clinical settings,[7] for managing behavioral symptoms such as screaming and aggression in patients with autism, with fewer episodes of this behavior occurring with tablet use.[8] However, it is not known if these devices are feasible and effective for reducing agitation in patients with moderate to severe dementia, the population most likely to exhibit agitation and least likely to have prior exposure to such devices.

Therefore, we conducted an open-label study to investigate if persons with dementia would be able to engage with tablet devices in a safe manner and, if so, to assess whether there is a relationship between severity of dementia and complexity and type of apps used. We hypothesized that individuals with lower levels of cognitive impairment would have greater levels of tablet engagement, use relatively more challenging apps, and experience a greater staff-rated reduction in agitation.

METHODS

Study Participants

This longitudinal, open-label study was approved by the University of California (UC), San Diego Human Research Protection Program. We recruited participants from the UC San Diego Senior Behavior Health inpatient unit. For this study, we included only English-speaking patients with cognitive impairment (defined as a Montreal Cognitive Assessment [MoCA] score ≤25). We excluded any participants who did not have a legally authorized proxy to provide consent. There were no additional clinical exclusion criteria. We obtained informed consent from 64 potential participants and their legally authorized proxies. Of these, 36 patients used the tablet at least once during their stay on the inpatient unit. The remaining 28 patients did not use the tablet at any point during the inpatient stay, because they did not exhibit any symptoms that triggered tablet use.

Participants were administered the MoCA and classified as mildly impaired (i.e., MoCA score = 18–25; N = 13), moderately impaired (i.e., MoCA score = 10–17; N = 7), or severely impaired (i.e., MoCA score < 10; N = 16). These patients did not differ from the non–tablet users in mean age, gender distribution, or level of education. We did not perform a diagnostic assessment as part of the study protocol.

We documented diagnoses made by inpatient psychiatrists, all of whom were board-certified in geriatric psychiatry, and faculty of the Department of Psychiatry at UC San Diego. Diagnoses were based on *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* criteria. We noted that most patients were diagnosed with Dementia, Not Otherwise Specified, whereas one patient had a diagnosis of vascular dementia. We also obtained information on participants' general likes and dislikes and prior use of technology from patients and their family members. This information helped us personalize potential apps for each patient.

Personalization of Tablet Applications

We used two tablets (second-generation iPads, Apple, Cupertino, CA) and installed 70 applications (apps) onto the tablets. All apps were available for free on the online iTunes (Apple, Cupertino, CA) store and were selected based on consensus among study staff and volunteers (a list of the apps used in provided in the Appendix, online). The broad categories of apps were communication, games, music and musical instruments, video entertainment and recording, web browser and news, and picture/photograph-viewing apps. Two study investigators (S.O. and I.V.V.) reviewed all the apps and rated them based on the number and level of cognitive domains involved. Both investigators independently assigned each app a complexity score ranging from 1 (low complexity, e.g., an app [e.g., Amazing Dogs] to view pictures requiring only passive visual attention) to 10 (high complexity, e.g., a puzzle-solving app such as Sudoku involving higher order planning and problem-solving skills). The investigators then compared scores, and discrepancies were resolved by consensus. Internet-based content was accessed through the hospital's protected wireless internet service. No personal data (e.g., login information, passwords) were stored on the devices. We also secured each tablet in a heavy-duty silicon case.

Procedure for Using Apps as a Nonpharmacologic Intervention

When participants demonstrated restlessness or agitation, nurses and/or study volunteers provided them with a tablet and selected an app based on the preference list for that patient. The decision to initiate tablet use was based on the clinical judgment of the faculty and staff. The patient's tablet use was supervised by staff, and the type of apps used and the total amount of time the patient engaged with the tablet were documented. Study staff also rated the magnitude of reduction in agitation after tablet use on a scale from 1 (no reduction in agitation) to 5 (no longer agitated). No other alterations to usual care for agitation were

conducted, and agitation was managed with medications if it persisted.

Statistical Analysis

Tablet use characteristics were compared across dementia severity groups using analysis of variance and pairwise comparisons used t tests. A one-way analysis of variance was conducted to examine the effect of severity of cognitive impairment on patterns and characteristics of tablet use variables. Correlational analyses were performed between tablet use and demographic characteristics of the groups using Spearman's ρ. The study p value was set at 0.05. We visually reviewed the data to ensure there were no missing data among the 36 persons included in the study.

RESULTS

Table 1 summarizes demographic and tablet use characteristics of the groups. The average length of stay was 22 days (range, 7–56 days; standard deviation: 11.8). Patients in the severely impaired groups had signifi-

cantly higher percentage of psychotic symptoms (94%) than those in the moderately (57%) and mildly impaired (46%) groups. Mood disorders were more prevalent in the mildly impaired group (92%) compared with the moderately (86%) and severely (31%) impaired groups.

All patients, even those with severe impairment, used the tablet apps. All patients tolerated tablet use, and there were no reports of adverse events or damage to the tablets by any study participants, including those with severe impairment while experiencing agitation. Median use of the tablet per patient was three times during their hospital stay, although there was a wide range (1–18 times). There were 121 total instances of app use; the five most commonly used apps were YouTube (used 44 times), Internet browsers (e.g., Safari, Chrome; used 31 times), picture-viewing apps (e.g., Google images, Amazing Dogs; used 15 times), game/puzzle apps (e.g., Sudoku, backgammon; used 16 times), Pandora (used 9 times), and music-playing apps (e.g., harp, piano; used 6 times). We noted that participants typically used apps that engaged one to two sensory modalities (most commonly touch and vision) and one to two cognitive domains (most

TABLE 1. Demographic and Psychiatric/Medical Characteristics of the Three Impairment Groups Based on MoCA Scores

	Total (N = 36)	Mildly Impaired (N = 13)	Moderately Impaired (N = 7)	Severely Impaired (N = 16)	F(df) or χ^2 (df)	p
Demographic characteristics						
Mean age, y (SD)	79.9 (8.2)	75.3 (8.3)	85.0 (6.1)	81.4 (7.4)	F(2,33) = 4.4	0.02
Mean education, y (SD)	13.3 (4.2)	13.2 (4.5)	13.0 (5.0)	13.6 (3.8)	F(2,30) = 0.05	0.95
Gender (% female)	61.1	92.3	85.7	25.0	χ^2(2) = 15.9	<0.001
Prior tablet use experience, N (%)	17 (47)	7 (54)	2 (29)	8 (50)	χ^2(2) = 1.3	0.53
Prior computer experience, N (%)	13 (36)	8 (61)	0 (0)	5 (31)	χ^2(2) = 7.8	0.02
Psychiatric characteristics						
Frequency of comorbid depression-spectrum diagnosis, N (%)	23 (64)	12 (92)	6 (86)	5 (31)	χ^2(2) = 13.8	<0.01
Frequency of psychotic symptoms, N (%)	25 (69)	6 (46)	4 (57)	15 (94)	χ^2(2) = 8.3	0.02
Number of psychotropic medications (SD)	1.8 (1.4)	1.7 (1.3)	1.3 (1.1)	2.1 (1.5)	F(2,33) = 0.9	0.39
Medical characteristics						
Mean number of medical comorbidities (SD)	4.91 (2.4)	5.3 (2.9)	4.85 (1.6)	4.6 (2.2)	F(2,33) = 0.3	0.75
Mean number of nonpsychotropic medications (SD)	4.9 (2.5)	4.8 (1.3)	3.7 (1.2)	5.3 (3.5)	F(2,33) = 0.8	0.45
Tablet use characteristics						
Median number of instances of tablet use per subject (IQR)	3 (2, 5)	3 (2, 6)	2 (1, 3)	4 (3, 5)	F(2,33) = 1.0	0.37
Median number of unique apps used per subject (IQR)	2 (1, 3)	3 (1, 4.5)	3 (1, 3)	2 (1, 3)	F(2,33) = 1.2	0.54
Median complexity of apps (IQR)	2.8 (2, 6)	5.3 (2, 8.4)	3.0 (2.0, 8)	2.14 (1.6, 3.5)	F(2,32) = 3.0	0.06
Mean total amount of time using tablet, min (SD)	101.8 (220.8)	183.8 (350.8)	53.3 (59.0)	53.3 (38.0)	F(2,32) = 1.5	0.24
Mean minutes per instance of tablet use (SD)	18.3 (13.4)	24.0 (19.0)	19.2 (6.1)	13.0 (7.3)	F(2,32) = 2.51	0.09
Mean rating of magnitude of reduction in agitation (average across subject; SD)[a]	3.4	3.9	3.5	2.8	F(2,32) = 2.8	0.07

Notes: SD: standard deviation; IQR: interquartile range.

[a]Subjectively scored by staff member administering tablet use from 1 (no reduction in agitation) to 5 (no longer agitated).

commonly visual recognition and visual attention). The median number of unique apps used was two.

Pairwise comparison of groups to study effects of dementia severity on characteristics of tablet use revealed that relative to patients with mild impairment, those with severe impairment used significantly less complex apps (t = 2.27, p = 0.02) and tended to use the tablet for a shorter length of time (t = 2.05, p = 0.03). Based on staff ratings of post–tablet use reduction in agitation, the benefit of tablet use was greatest in the mildly impaired group compared with patients with severe impairment (t = 2.45 p = 0.02). When age was added as a covariate to these three models, the pattern of results was unchanged.

Correlates of Tablet Use

The total duration of tablet use was negatively correlated with age (ρ = −0.35, p = 0.04). Younger age was associated with higher staff perception of agitation reduction after tablet use (ρ = −0.47, p < 0.01). Female patients exhibited lower levels of post–tablet use agitation/restlessness than male patients, (t = −2.45, p = 0.02). Other variables (e.g., education, age, or prior experience using computers/tablets) were not associated with tablet use characteristics.

DISCUSSION

Our study demonstrates preliminary feasibility and potential positive impact of tablet use as a nonpharmacologic intervention for agitation in older hospitalized patients with dementia. To our knowledge, this is the first study to examine such an intervention in this cohort. There were no reports of adverse events or damage to the tablet equipment. Consistent with our expectation, all cognitively impaired groups were able to use tablets; as hypothesized, those with severe impairment used the least complex apps for the shortest amount of time. Prior data support the use of tablets for leisure activities by individuals with mild cognitive impairment.[9] Extending the literature, we noted that tablet use appeared to be most effective in reducing agitation (as reported by the staff) for patients with mild impairment. Our findings also add to a growing body of literature supporting the use of technology in inpatient psychiatry. Researchers have demonstrated use of smartphone apps for a range of

indications including meal control in anorexia[10] and use of smartphone sensors to monitor behavior and location among patients with schizophrenia.[11] Wearable devices such as actigraphs have been used to quantify psychomotor retardation and behavior among inpatients with unipolar depression and bipolar disorder.[12] These devices are powerful tools with the potential to greatly enhance the process of individualizing inpatient care, but it will be important to generate evidence to both support their use and identify possible adverse outcomes.

Our findings suggest under caregiver supervision, even persons with severe impairment may use simple and intuitive apps, especially when they are matched to each individual's preferences and level of cognitive function. Tablets can be used to administer apps targeting distinct cognitive abilities and interests, thereby providing an individualized treatment approach, which in turn may optimize preserved cognitive abilities. In general, our participants used the tablet for just under 20 minutes at a time, suggesting these were well tolerated. This provides evidence of feasibility as a nonpharmacologic intervention.

There are several limitations to the current open-label, proof-of-concept study. This was a nonrandomized trial with a relatively small sample size in a single inpatient setting. We did not perform standardized diagnostic assessments or use objective measures of agitation before and after each episode of tablet use. Staff members rating post–tablet use agitation were not blinded, and the indicator of change in agitation was a single subjective rating. The study design did not permit tracking the rate of refusal for tablet use or the examination of the duration for which the therapeutic effect of tablet use persisted. The small sample size limited our examination of other factors (e.g., experience with computers or frequency of psychotic symptoms) that may contribute to app engagement. A larger, well-balanced sample would enable greater capacity to examine patient-level predictors of tablet uptake.

These preliminary data are a first step in developing much-needed[13] empirical data for clinicians and caregivers on how to use technology such as tablets as tools to enhance care and also for app developers working to serve the technologic needs of this population. Future studies should expand our findings by including objective measures of agitation measured before and after tablet use as well as markers of

improved behavioral change such as a reduction in the use of psychotropic medication, especially antipsychotics for agitation. They should also examine applicability of these findings to noninpatient settings.

APPENDIX: SUPPLEMENTARY MATERIAL

Supplementary data to this article can be found online at doi:10.1016/j.jagp.2016.07.011.

References

1. Jeste DV, Blazer D, Casey D, et al: ACNP White Paper: update on use of antipsychotic drugs in elderly persons with dementia. Neuropsychopharmacology 2008; 33:957–970
2. Jin H, Shih PA, Golshan S, et al: Comparison of longer-term safety and effectiveness of 4 atypical antipsychotics in patients over age 40: a trial using equipoise-stratified randomization. J Clin Psychiatry 2012; 74:10–18
3. Cohen-Mansfield J, Thein K, Marx MS, et al: Efficacy of nonpharmacologic interventions for agitation in advanced dementia: a randomized, placebo-controlled trial. J Clin Psychiatry 2012; 73:478–1261
4. Kales HC, Gitlin LN, Lyketsos CG: Assessment and management of behavioral and psychological symptoms of dementia. BMJ 2015; 350:h369
5. Mihailidis A, Blunsden S, Boger J, et al: Towards the development of a technology for art therapy and dementia: definition of needs and design constraints. Arts Psychother 2010; 37:293–300
6. Huang Y-C, Hsu Y-L: Social networking-based personal home telehealth system: a pilot study. J Clin Gerontol Geriatr 2014; 5:132–139
7. Patel V, Hale TM, Palakodeti S, et al: Prescription tablets in the digital age: a cross-sectional study exploring patient and physician attitudes toward the use of tablets for clinic-based personalized health care information exchange. JMIR Res Protoc 2015; 4:e116
8. Neely L, Rispoli M, Camargo S, et al: The effect of instructional use of an iPad® on challenging behavior and academic engagement for two students with autism. Res Autism Spectr Dis 2013; 7:509–516
9. Lim FS, Wallace T, Luszcz MA, et al: Usability of tablet computers by people with early-stage dementia. Gerontology 2012; 59:174–182
10. Ben-Zeev D, Wang R, Abdullah S, et al: Mobile behavioral sensing for outpatients and inpatients with schizophrenia. Psychiatr Serv 2016; 67:558–561
11. Cardi V, Lounes N, Kan C, et al: Meal support using mobile technology in anorexia nervosa. Contextual differences between inpatient and outpatient settings. Appetite 2013; 60:33–39
12. Krane-Gartiser K, Henriksen TE, Vaaler AE, et al: Actigraphically assessed activity in unipolar depression: a comparison of inpatients with and without motor retardation. J Clin Psychiatry 2015; 76:1181–1187
13. Hsin H, Torous J, Roberts L: An adjuvant role for mobile health in psychiatry. JAMA Psychiatry 2016; 73:103–104