Short Report

“Text It” program to track falls in patients with Alzheimer’s disease and dementia

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Abstract

Introduction: Falls are a significant problem among older adults with Alzheimer’s disease, leading to high rates of fracture, hospitalization, and death. Tracking falls in older adults, particularly those with cognitive impairment, is a clinical and research challenge.

Methods: This prospective pilot study evaluated the feasibility of a text message program to track falls among patients with dementia. We also compared this technique with the calendar method of fall data collection.

Results: There was a 96% completion rate of text messaging and 100% of calendars; however, the text-gathered data were more accurate.

Discussion: A text-messaging platform to track falls shows promise in cognitively impaired individuals.

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Keywords: Text It; Alzheimer’s disease; Falls; Dementia; Mobile health

1. Introduction

Falls are a common condition in patients with Alzheimer’s disease (AD) with nearly 70% experiencing at least one fall annually [1–5]. AD patients are twice as likely to fall compared with age-matched cognitively intact older adults [1]. Falls lead to increased rates of institutionalization, fractures, and mortality [6–10]. Indeed, the heightened risk of mortality in AD has been attributed to the higher rate of falls experienced by these patients. The pathogenesis of falls in AD is not yet fully understood and likely relates to the accelerated neurodegeneration observed in AD, poor postural control and gait impairment [11,12], spatial disorientation [13,14], and the increased use of psychotropic medications [15,16].

A limitation of falls research in patients with AD (as well as falls research more broadly in older adults) is the difficulty in accurately tracking fall events. Currently, the gold standard for falls ascertainment involves collecting fall calendars in which patients mark the dates when falls occurred over a period of time [17,18]. The limitations of the fall calendars include difficulty remembering to complete the calendar daily, leading to recall bias when completed at a later date; poor participation; need for reminders to complete or return calendars; and need for phone calls to clarify

Conflict of interest: The authors have no conflicts of interest to disclose.
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https://doi.org/10.1016/j.trci.2018.03.001
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unclear information conveyed on submitted calendars [17–19]. Mobile health (“mHealth”), defined as the delivery of health-care information via mobile technology, is increasingly being used to effectively track and manage disease in older adults [20,21]. There have been multiple studies evaluating the use of mHealth to promote balance and monitor fall risk, but to our knowledge, no studies have reported the use of mobile technology in tracking fall events [21,22]. There have also been studies in cognitively impaired (CI) adults exploring the use of mobile applications involving cognitive training, tracking wandering behavior with Global Positioning System technology, reminders to perform activities of daily living, and promoting physical and cognitive exercise [23]. In this study, we propose a novel falls data collection technique using the application, “Text It” (Nyaruka, LTD & UNICEF) in a small pilot study of patients with cognitive impairment. Daily text messages were sent to participants and their caregivers to query about fall events on a more real-time basis. This pilot study aimed to assess the feasibility of this text-messaging platform in tracking falls in a sample of 10 patients with cognitive impairment associated with mild cognitive impairment (MCI), AD, and dementia due to other causes.

2. Methods

This is a prospective, observational pilot study in which participants were screened and recruited from the Johns Hopkins Memory and Alzheimer’s Treatment Center. Inclusion criteria of CI participants were as follows: diagnosis of MCI, AD or other dementia, age greater than 60 years old, and if cognitively impaired to the extent that a caregiver was needed, that caregiver spends at least 10 hours weekly with the participant. Fall event data were collected via two methods. The first method used the automated, multiplatform messaging service, Text It. Daily text messages were sent each morning at 9:00 am to the cell phone of the CI participant or caregiver asking, “Did you fall yesterday?” Responses “yes” or “no” were recorded. If a response other than “yes” or “no” was sent, another message was sent to the CI participants or caregiver, “Sorry, please respond with a yes or no response.” The texts were sent directly to the cell phones of the CI participant or caregiver, and response data were stored on the online secure, encrypted, anonymized Text It platform.

The second measure was to complete a calendar with each day marked with “yes” or “no” for a fall occurring on that date. CI participants or caregivers completed 1 month of daily texting and then mailed their completed calendars to the research team. Clinical data were extracted from the CI participants’ electronic medical record. Informed consent was obtained from the CI participant and/or their caregiver per established procedures in patients with cognitive impairment [24]. The Institutional Review Board approval was obtained.

3. Results

We recruited 10 CI participants for this study (Table 1). Six participants (60%) had a diagnosis of AD, one participant (10%) had vascular dementia, one participant (10%) had dementia with Lewy bodies, one participant (10%) had MCI, and one participant (10%) had dementia of unknown etiology but was thought to be related to history of stroke, depression, and fibromyalgia. Nine participants had a designated caregiver who completed the daily texts and calendars, whereas the one participant with MCI had no caregiver and completed this himself. The mean age of CI participants was 74.3 years, and five participants (50%) were female. The mean baseline Mini–Mental State Examination was 21.3, and scores ranged from 9 to 27.

Daily text messages were sent on 304 days across all CI participants, and responses were sent on 292 days (292/304 × 100 = 96% completion rate). Calendars had 100% completion rate. However, one caregiver initially forgot to complete the calendar and mailed it one month late after reminders from the research team. Another CI participant’s caregiver lost the calendar and a replacement was sent. Two falls were reported by calendar and two falls were reported by text (Table 2). The caregiver for participant number 3 reported one fall by text and one fall by calendar, which were recorded on the same day. Per caregiver report, the CI participant has peripheral neuropathy, spinal stenosis, and weakness at baseline, and he fell while walking upstairs when he was unable to bring his foot high enough to clear a step. The caregiver for participant number 9 reported one fall by text and one fall by calendar, but the reported dates of the fall were several days apart. After interviewing the caregiver, it was confirmed that the text fall date was correct and the calendar-recorded date was in error. The CI participant had tripped over an object leading to a fall.

| ID | Age | Marital status | Race | Dementia diagnosis | MMSE |
|----|-----|----------------|------|--------------------|------|
| 1  | 77  | Married        | White| Vascular dementia  | 21   |
| 2  | 78  | Divorced       | White| AD                 | 27   |
| 3  | 85  | Married        | White| AD                 | 13   |
| 4  | 68  | Married        | White| Dementia with Lewy Bodies | 27  |
| 5  | 66  | Married        | Other | MCI                | 25   |
| 6  | 87  | Widowed        | White| AD                 | 24   |
| 7  | 69  | Married        | Black| Unknown etiology   | 25   |
| 8  | 71  | Married        | White| AD                 | 20   |
| 9  | 74  | Widowed        | White| AD                 | 22   |
| 10 | 68  | Married        | White| AD                 | 9    |

Abbreviations: AD, Alzheimer’s disease; MCI, mild cognitive impairment; MMSE, Mini–Mental State Examination.

Self-identified race included the following: white, black, American Indian or Alaskan Native, Asian, Native Hawaiian or Pacific Islander, or other.

Mini–Mental State Examination given within 1 year of enrollment in the study.

Unknown etiology but likely secondary to past cerebral vascular event, depression, and fibromyalgia.
4. Discussion

In this small pilot study, we observed 100% completion rates of reporting falls by calendar and 96% completion by daily text message. Text It was simple to program and allows for complex logic in study design. For instance, a follow-up question can be automatically sent if a fall event occurred, such as, “Did you seek medical attention?” We found that one participant had discrepancies between the date of text and calendar-recorded falls. The caregiver confirmed that the text-recorded date was correct.

Although the calendar method is considered the gold standard for collection of falls data [17,18], tracking of health-care outcomes using mobile technology is increasing due to its ability to yield timely and accurate data. Roughly 80% of U.S. adults aged ≥65 own cell phones with SMS (texting) capability, and 42% of older adults own smart devices [25]. Smart devices have shown efficacy in the tracking and management of chronic disease among older adults [20]. As such, automated text messaging which requires an even lower level of mobile technology may represent a new method to track episodic events, such as falls, in near-real time. All calendars were completed; however, this was done retrospectively in two instances, potentially introducing recall bias. Indeed, although the number of fall events was consistent between the texting and calendar methods, we observed inaccuracies with fall dates using the calendar method.

A key limitation of this pilot study is the short 1-month time frame and the consequent low number of fall events recorded. Two falls were recorded over the 1-month study period, which is in line with previous studies showing that nearly 70% of dementia patients experience at least one fall during a 1-year study period [5]. Further studies will be needed to evaluate whether the high adherence we observed would persist for longer follow-up periods, such as in the context of a larger falls research study. At least 1 year of study time will be needed to establish the validity of this instrument in a larger cohort of individuals. This study demonstrates preliminary feasibility of using a text-messaging platform for fall data collection in a CI population of older adults.

Acknowledgments

The work of E.O. was supported by NIA/NIH K23 award (1K23AG043504-01), the Roberts Gift Fund, and the Ossoff Family Fund. The work of Y.A. was supported by NIH K23 award (5K23DC013056-02). The work of E.A. was supported by NIDCD T32 DC000023.

RESEARCH IN CONTEXT

1. Systematic review: Tracking falls in older adults with cognitive impairment is a clinical and research challenge. Currently, falls calendars are the gold standard of tracking falls. Mobile health technology has been successfully used to track and manage disease in older adults. The authors applied a novel “Text It” program in a small pilot study to evaluate the feasibility of a text-messaging program to track falls in a population with cognitive impairment.

2. Interpretation: Among 10 participants over a time frame of 1 month, there was a 96% completion rate of text messaging and 100% of calendars; however, the text-gathered data were more accurate. A text-messaging platform to track falls shows promise in cognitively impaired individuals.

3. Future directions: Further studies involving a larger cohort of individuals over a longer time period are needed to better assess this technique in tracking falls over time.

References

[1] Muir SW, Gopaul K, Montero Odasso MM. The role of cognitive impairment in fall risk among older adults: a systematic review and meta-analysis. Age Ageing 2012;41:299–308.
[2] van Dijk PT, Meulenberg OG, van de Sande HJ, Habbema JD. Falls in dementia patients. Gerontologist 1993;33:200–4.
[3] Visser H. Gait and balance in senile dementia of Alzheimer’s type. Age Ageing 1983;12:296–301.
[4] Ansai JH, de Andrade LP, Masse FAA, Goncalves J, de Medeiros Takahashi AC, Vale FAC, et al. Risk factors for falls in older adults with mild cognitive impairment and mild Alzheimer disease. J Geriatr Phys Ther 2017; https://doi.org/10.1519/JPT.0000000000000135.
[5] Allan LM, Ballard CG, Rowan EN, Kenny RA. Incidence and prediction of falls in dementia: A prospective study in older people. PLoS One 2009;4:e5521.
[6] Morris JC, Rubin EH, Morris EJ, Mandel SA. Senile dementia of the Alzheimer’s type: an important risk factor for serious falls. J Gerontol 1987;42:412–7.
[7] Friedman SM, Menzies IB, Bukata SV, Mendelson DA, Kates SL. Dementia and hip fractures: development of a pathogenic framework for understanding and studying risk. Geriatr Orthop Surg Rehabil 2010;1:52–62.

[8] Walsh JS, Welch HG, Larson EB. Survival of outpatients with Alzheimer-type dementia. Ann Intern Med 1990;113:429–34.

[9] Kasai M, Meguro K, Ozawa H, Kumai K, Imaizumi H, Minegishi H, et al. Fear of falling and cognitive impairments in elderly people with hip fractures. Dement Geriatr Cogn Dis Extra 2017;7:386–94.

[10] Leggett AN, Polenick CA, Maust DT, Kales HC. Falls and hospitalizations among persons with dementia and associated caregiver emotional difficulties. Gerontologist 2018;58:e78–86.

[11] Pettersson AF, Engardt M, Wahlund LO. Activity level and balance in subjects with mild Alzheimer’s disease. Dement Geriatr Cogn Disord 2002;13:213–6.

[12] Mesbah N, Ferry M, Hill KD, Kaur M, Hale L. Postural stability in older adults with Alzheimer disease. Phys Ther 2017;97:290–309.

[13] Liu L, Gauthier L, Gauthier S. Spatial disorientation in persons with early senile dementia of the Alzheimer type. Am J Occup Ther 1991;45:67–74.

[14] Wei EX, Oh ES, Harun A, Ehrenburg M, Agrawal Y. Vestibular loss predicts poorer spatial cognition in patients with Alzheimer’s disease. J Alzheimers Dis 2018;61:995–1003.

[15] Johnell K, Jonasdottir Bergman G, Fastbom J, Danielsson B, Borg N, Salmi P. Psychotropic drugs and the risk of fall injuries, hospitalisations and mortality among older adults. Int J Geriatr Psychiatry 2017;32:414–20.

[16] Taipale H, Koponen M, Tanskanen A, Tolppanen AM, Tiihonen J, Hartikainen S. Drug use in persons with and without Alzheimer’s disease aged 90 years or more. Age Ageing 2016;45:900–4.

[17] Hannan MT, Gagnon MM, Aneja J, Jones RN, Cupples LA, Lipsitz LA, et al. Optimizing the tracking of falls in studies of older participants: comparison of quarterly telephone recall with monthly falls calendars in the MOBILIZE Boston Study. Am J Epidemiol 2010;171:1031–6.

[18] Tinetti ME, Baker DI, McAvay G, Claus EB, Garrett P, Gottschalk M, et al. A multifactorial intervention to reduce the risk of falling among elderly people living in the community. N Engl J Med 1994; 331:821–7.

[19] Ganz DA, Higashi T, Rubenstein LZ. Monitoring falls in cohort studies of community-dwelling older people: effect of the recall interval. J Am Geriatr Soc 2005;53:2190–4.

[20] Kim BY, Lee J. Smart devices for older adults managing chronic disease: A scoping review. JMIR Mhealth Uhealth 2017;5:e69.

[21] Roeing KL, Hsieh KL, Sosnoff JJ. A systematic review of balance and fall risk assessments with mobile phone technology. Arch Gerontol Geriatr 2017;73:222–6.

[22] Reyes A, Qin P, Brown CA. A standardized review of smartphone applications to promote balance for older adults. Disabil Rehabil 2016; 40:1–10.

[23] Bateman DR, Srinivas B, Emmett TW, Schleyer TK, Holden RJ, Hendrie HC, et al. Categorizing health outcomes and efficacy of mHealth apps for persons with cognitive impairment: A systematic review. J Med Internet Res 2017;19:e301.

[24] Alzheimer’s Association. Research consent for cognitively impaired adults: recommendations for institutional review boards and investigators. Alzheimer Dis Assoc Disord 2004;18:171–5.

[25] Anderson M, Perrin A. Technology Use Among Seniors. Washington, DC: Pew Research Center; 2017.