LETTER

Real-Time Video Detection of Falls in Dementia Care Facility and Reduced Emergency Care

Glen L. Xiong, MD; Eleonore Bayen, MD, PhD; Shirley Nickels, BS; Raghav Subramaniam, MS, BS; Pulkit Agrawal, PhD; Julien Jacquemot, MSc, BSc; Alexandre M. Bayen, PhD; Bruce Miller, MD; and George Netscher, MS, BS

Fall injury is the leading cause of Alzheimer dementia–related hospitalizations, with $5.3 billion in annual cost to Medicare.[1,2] In residential care facilities, individuals with dementia fall, on average, 4 times per year and twice as often as other residents.[3] Falls often go unwitnessed. Due to uncertainty regarding the seriousness of each fall, facility staff frequently activate local emergency medical teams (EMTs) to examine the residents, and such visits often result in emergency department (ED) visits. This pilot study examined the use of a scalable artificial intelligence (AI)–enabled camera monitoring system (SafelyYou Guardian) to detect falls, videotape falls, and notify care staff so that video review of the incident could occur immediately after each fall. Here, we report the impact of fall videos on reduction of EMT and ED visits.

METHODS

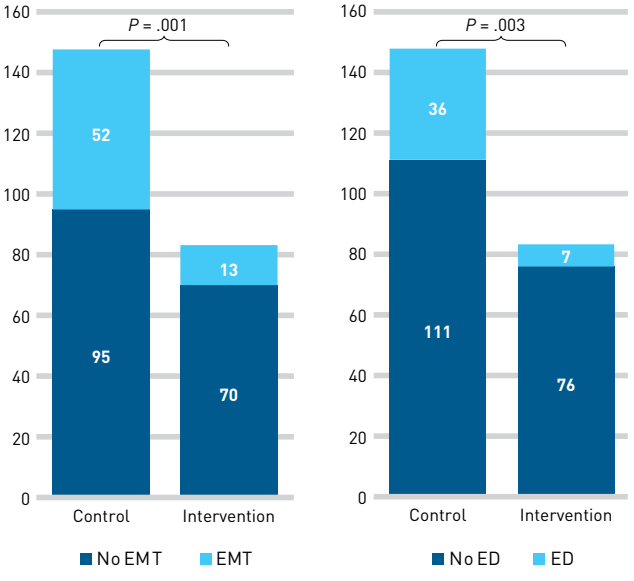
After institutional review board approval from the University of California, Berkeley, participants were enrolled in a pilot study to test the feasibility and acceptability of using SafelyYou Guardian in 6 residential care facilities from June 1 to August 31, 2018. Previous work had shown a reduction in falls at 1 care facility over a 3-month period through video incident review.[4] This specific pilot study was supported in part by a National Institutes of Health, National Institute of Aging Small Business Innovation Research Grant (1R43AG058354-01).

From a potential population of 193 residents in 6 communities, 55 participants enrolled in the study. However, fall data for both participants and nonparticipants were treated equally by the facilities. For participants, falls were detected and recorded by the AI-enabled camera system. Due to administrative and regulatory requirements, data about fall incidents and outcomes were routinely recorded for facility residents. Facility staff were able to review the falls in real time, immediately after each incident, for study participants. With the exception of video review for study participants, staff had to rely on routine protocol to manage each fall. The assigned shift manager would decide when to activate the EMT with support from the surrogate decision maker for the resident with dementia. Using Stata version 15 (StataCorp; College Station, Texas), χ^2 tests were performed to examine the difference in the numbers of EMT and ED visits in those residents who benefited from SafelyYou Guardian (intervention group) versus those who did not (control group).

RESULTS

Among 147 falls in the control group, 52 (35.4%) resulted in EMT visits and 36 (24.5%) resulted in ED visits (**Figure**). In contrast, the intervention group had 83 falls, with 13 (15.7%) and 7 (8.3%) resulting in EMT and ED visits, respectively. There were relative reductions of 75% ($P = .001$) in EMT visits and 80% ($P = .003$) in ED visits.

FIGURE. Comparison of EMT Visits and ED Visits Among Residents Benefitting From SafelyYou Guardian (intervention) Versus Not Benefitting From SafelyYou Guardian (control)



ED indicates emergency department; EMT, emergency medical team.

DISCUSSION

We observed a robust reduction in unnecessary EMT and ED visits in this pilot study by providing better understanding of unwitnessed falls. The AI-enabled camera fall-detection system coupled with staff review of fall videos led to more accurate identification of serious falls and incidents compared with less serious falls, such as when a resident intentionally moved to the ground but did not fall. The reduction in use of emergency services will likely lead to lowered healthcare costs and stress among residents, families, and facility staff. Larger randomized controlled studies matching baseline facility and resident characteristics are needed to validate and confirm the results from this pilot study. ■

TAKEAWAY POINTS

- Real-time fall detection using artificial intelligence (AI)–enabled video recording reduced utilization of emergency services by 80%.
- Dementia care in long-term care settings may benefit from AI-enabled video technology.

Author Affiliations: University of California, Davis (GLX), Sacramento, CA; Global Health Brain Institute (EB, BM) and Memory and Aging Center (BM), University of California, San Francisco, San Francisco, CA; SafelyYou, Inc (SN, RS, PA, JJ, AMB, GN), San Francisco, CA; Electrical Engineering and Computer Sciences, University of California, Berkeley (JJ, AMB), Berkeley, CA.

Source of Funding: National Institutes of Health/National Institute of Aging.

Author Disclosures: Dr Xiong is an unpaid advisory board member of SafelyYou, which is a for-profit entity that provides fall detection and prevention services; he was co–principal investigator on the current study funded by a National Institute of Aging grant and owns SafelyYou stock. Dr Eleonore Bayen is an unpaid advisory board member and owns SafelyYou stock. Ms Nickels is a board member and the chief operations officer of SafelyYou, attends conferences on behalf of SafelyYou, and has vested stock options in SafelyYou as an employee. Mr Subramaniam is employed by and owns stock in SafelyYou. Dr Agrawal is employed by SafelyYou, is a coauthor on a patent submitted by SafelyYou, and owns stock in SafelyYou. Mr Jacquemot is a former board member and employee of SafelyYou and owns SafelyYou stock. Dr Alexandre Bayen has patents pending for SafelyYou and owns SafelyYou stock. Dr Miller is an unpaid advisory board member and owns SafelyYou stock. Mr Netscher is a board member and the chief executive officer of SafelyYou, attends conferences on behalf of SafelyYou, is a coauthor on 1 patent submitted by SafelyYou, owns stock as a founding member of SafelyYou, and has a grant pending from the National Science Foundation Small Business Innovation Research (NSF SBIR) program phase 2B for SafelyYou and has received National Institutes of Health and NSF SBIR funding.

Authorship Information: Concept and design (GLX, EB, SN, JJ, AMB, BM, GN); acquisition of data (SN, RS, JJ, GN); analysis and interpretation of data (GLX, EB, SN, RS, PA); drafting of the manuscript (GLX, EB, AMB); critical revision of the manuscript for important intellectual content (GLX, EB); statistical analysis (EB, SN, RS); provision of patients or study materials (SN, BM, GN); obtaining funding (GLX, AMB, BM, GN); administrative, technical, or logistic support (GLX, SN, RS, PA, JJ, AMB, BM, GN); and supervision (PA, GN).

Address Correspondence to: Glen L. Xiong, MD, University of California, Davis, 2230 Stockton Blvd, Sacramento, CA 95817. Email: gxiong@ucdavis.edu.

REFERENCES

1. Alzheimer's Association. 2016 Alzheimer's disease facts and figures. *Alzheimers Dement*. 2016;12(4):459-509. doi: 10.1016/j.jalz.2016.03.001.
2. Burns ER, Stevens JA, Lee R. The direct costs of fatal and non-fatal falls among older adults—United States. *J Safety Res*. 2016;58:99-103. doi: 10.1016/j.jsr.2016.05.001.
3. van Doorn C, Gruber-Baldini AL, Zimmerman S, et al; Epidemiology of Dementia in Nursing Homes Research Group. Dementia as a risk factor for falls and fall injuries among nursing home residents. *J Am Geriatr Soc*. 2003;51(9):1213-1218.
4. Bayen E, Jacquemot J, Netscher G, Agrawal P, Tabb Noyce L, Bayen A. Reduction in fall rate in dementia managed care through video incident review: pilot study. *J Med Internet Res*. 2017;19(10):e339. doi: 10.2196/jmir.8095.

Visit **ajmc.com/link/4062** to download PDF