

Automating Fall Detection to Prevent Morbidity and Mortality: A Personal Emergency Response System with Optimized Automatic Fall Detection

By Tine Smits, Research Scientist, Philips Research; Andrea Ryter, Senior Global Product Manager, Philips Healthcare, Home Monitoring

One in three seniors falls each year in the United States, according to a prospective study.¹ Some falls lead to bumps and bruises, but others can cause fractures, head trauma, and even death if the person is unable to place a call to access the help they need. With the rising senior population, health care organizations are under constant pressure to manage patients who are at risk for falls so as to improve outcomes and lower costs.

Enter the personal emergency response system (PERS) with automatic fall detection.

A retrospective quantitative analysis of more than 400,000 PERS users whose falls were registered by an emergency response center showed the effectiveness of PERS with automatic fall detection.² These systems detected more than twice as many falls as systems requiring a button-push to register the fall. During an emergency, the user may not be able to push their help button because they are unconscious or may be experiencing motor function impairment.

More reporting of falls can lead to better outcomes, faster hospital transport, shorter hospital stays, and interventions that can be undertaken because others know that a person has experienced a dramatic incident and may be at a greater risk for falling.

What Are the Costs of Falls for the Elderly Population?

The rapidly expanding population of older adults is using more health care per capita than any other age group. Ways of controlling associated rising costs include facilitating healthy aging or aging in place.³⁻⁵ In 2013, direct medical costs of falls among older adults were \$34 billion.⁶

Trauma records have shown that among adults 65 and older who fall, 30% have moderate to severe injuries.⁷ When these people lie on the floor for a long time, they are often hospitalized for serious injuries and later

moved into long-term care.⁸ What's more, the mortality rate from falls is 67% when people lie on the floor for more than 72 hours, but only 12% when the duration is less than one hour.⁸

PERS, also called medical alert systems, can provide seniors who fall with immediate access to appropriate help. PERS enable users to press a button—usually worn as a pendant or wrist strap—that transmits a signal to a response center representative, who then contacts appropriate help. Faster average times for a response center connection, which automatic fall detection provides, enables faster access to help. Such access provides benefits: reduced inpatient admissions, hospital days, and mortality.^{9,10}

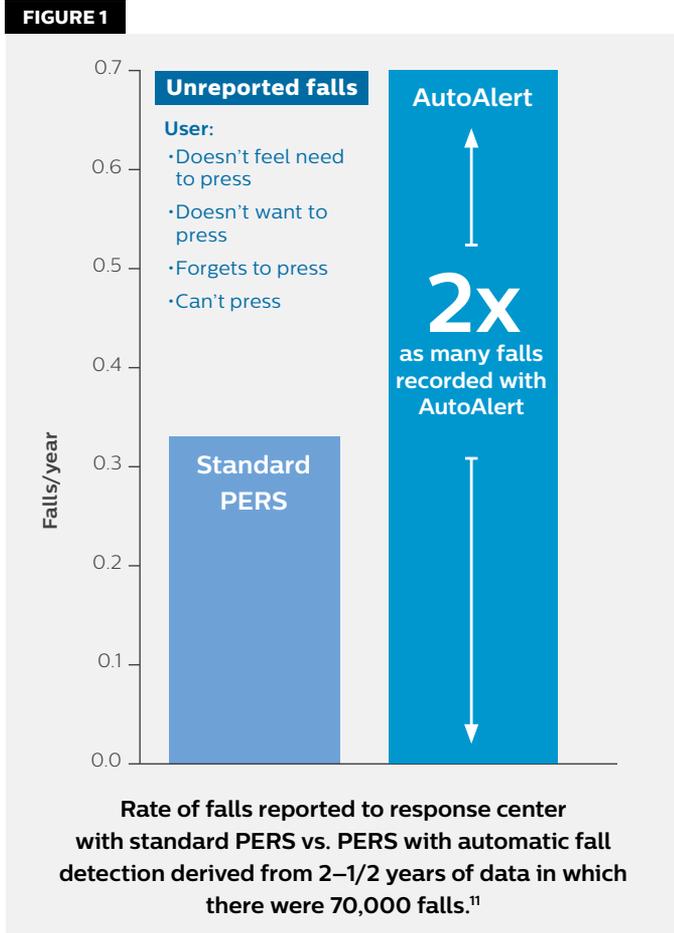
But what if the user dismisses the seriousness of their fall, doesn't want to bother caregivers, or forgets to press the button because of cognitive decline or incapacitation? Such instances are where automatic fall detection technology can provide a potential solution for unreported falls among seniors.

Different Results With Different Technologies

One study testing a PERS with automatic fall detection technology¹¹ showed that the device had a high rate of falls detection from a standing position (over 95%*), a low false alarm rate, and the ability to recognize when a user immediately stood up after a fall.

Between January 2012 and June 2014, more than 400,000 records of seniors equipped with a standard medical alert service, and a group having the system with automatic detection, were analyzed. From this group were selected a subset of 145,315 direct-to-consumer, private-pay users. The difference in fall incidence (number of falls per user per year in this population) between the 69,430 standard PERS users and the 75,885 users of PERS with automatic fall detection was measured.

Within the study population, the rate of recorded falls for those who used a PERS with automatic fall technology was 0.71 falls per year. Among those without auto detection, the fall rate was 0.34 falls per year (Figure 1).



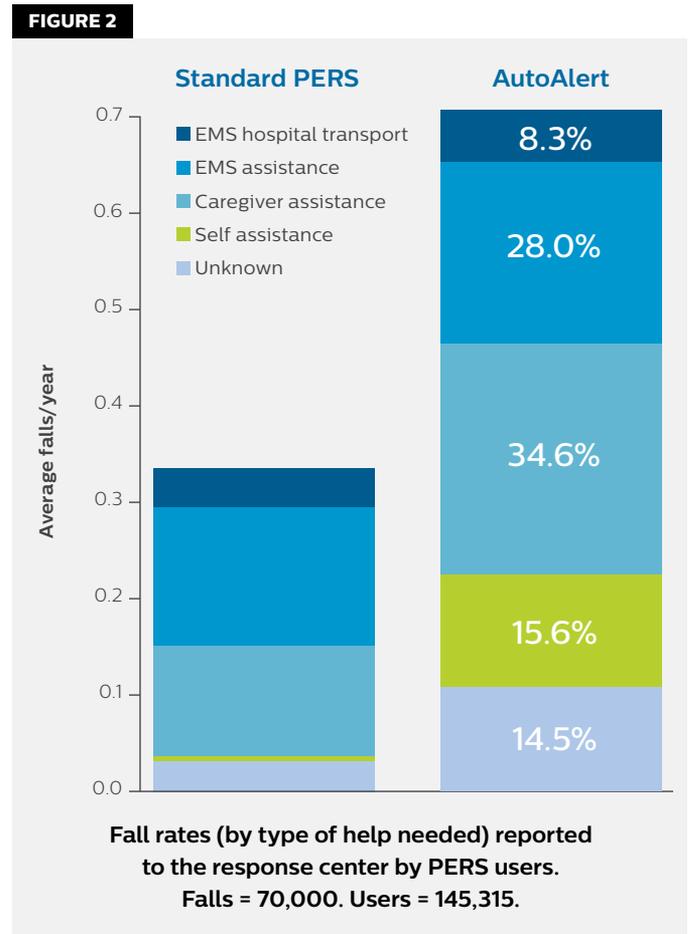
Among a population with similar demographic characteristics and self-reported medical conditions, the implication of these reported falls rates is that standard PERS users press their help button only half the time.¹¹ In those cases, no action is taken or follow-up evaluation performed.

The study data also reveal the types of help needed by the aforementioned 145,315 subscribers, as shown in Figure 2.

When comparing fall statistics for standard PERS and PERS with automatic fall detection, the latter captured 30% more falls resulting in emergency hospital transport. Users who did not press their help button are assumed to have had similar types of injuries as those using the automatic fall detection PERS.¹¹ Additionally, the reported rate of falls resulting

in a caregiver providing assistance was 100% higher for the PERS users who had automatic fall detection technology.¹¹

When a standard PERS user doesn't press their button to report a fall, caregivers and providers may never know about such events and be unaware of problems the senior may be having. The present fall may not have left any lasting scars, but subsequent ones might.



Which Seniors Benefit Most From PERS with Auto Fall Detection?

When a senior is enrolled in a medical alert service, relevant information for optimal service delivery and evaluation of incoming emergency calls (such as specific diseases and medical conditions) is collected.

Nearly three-quarters of PERS with automatic fall detection users had at least one medical condition at service enrollment, while 20% reported five or more.

Among a population with similar demographic characteristics and self-reported medical conditions, the implication of these reported falls rates is that standard PERS users press their help button only half the time.¹¹ In those cases, no action is taken or follow-up evaluation performed.

Reported conditions at enrollment included severe chronic diseases, as well as risk factors such as high blood pressure, high cholesterol, and balance problems/unsteady gait. The conditions are self-reported and don't reflect a complete medical diagnosis, but do provide valuable information to derive insights on fall rates, severity, and outcomes related to disease profiles.

Fall Rates and Number of Reported Medical Conditions

A significant increase in the fall rate occurs when three or more conditions are reported. The increase is even greater for the falls that result in emergency transport. Seniors reporting three or more conditions have 15% to 40% more severe falls than seniors reporting no medical conditions (Figure 3), so those with more conditions could potentially benefit from the automated fall technology more than their peers with fewer conditions.

Fall Rates and Type of Reported Medical Conditions

Frequently reported conditions include heart conditions, diabetes, cognitive impairment, COPD, osteoporosis, and Parkinson's disease. Seniors reporting these six chronic conditions all have a significantly higher severe fall rate compared to those reporting no conditions, as shown in Figure 4.

Conclusion

Qualitative analysis of a large PERS user database shows that the addition of automatic fall detection identifies twice as many falls than are reported with standard PERS solutions. Falls requiring hospital transport are reported 30% more often with PERS having automatic fall detection. The potential benefits to seniors, caregivers, and health care organizations may include:

FIGURE 3

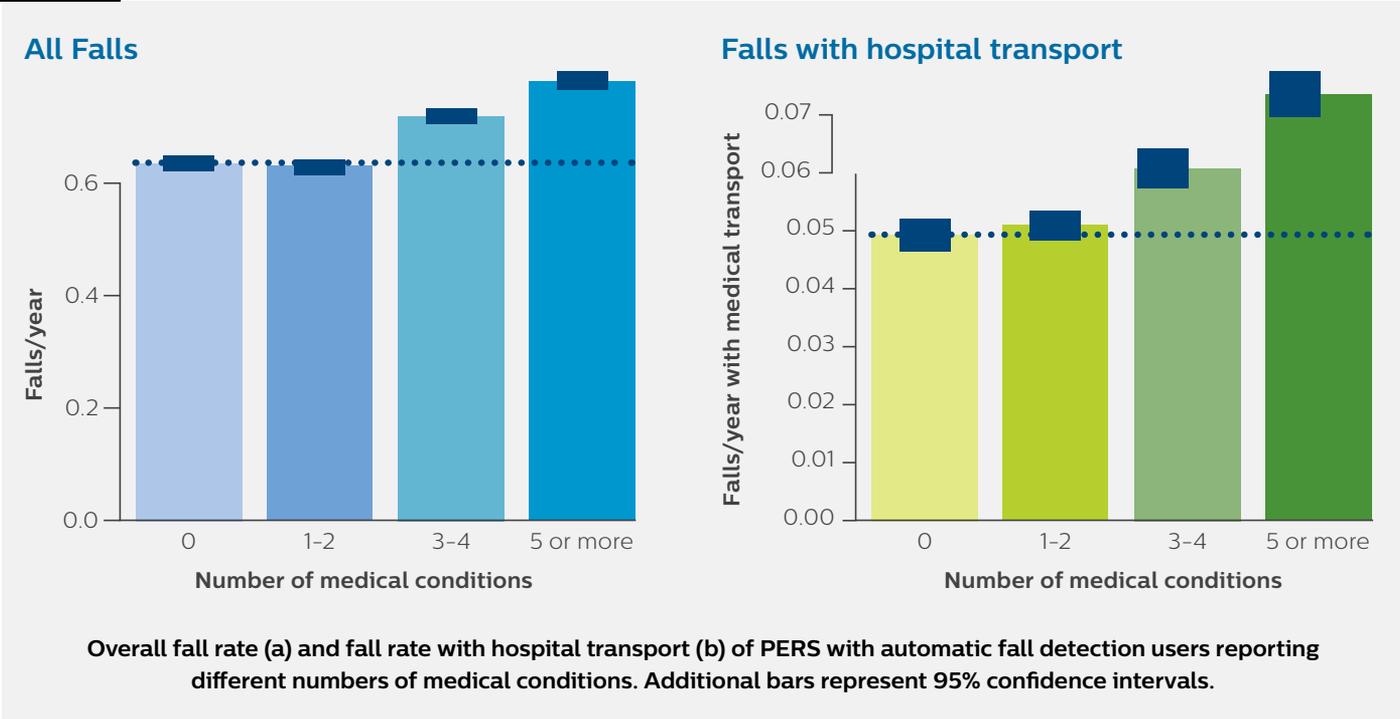
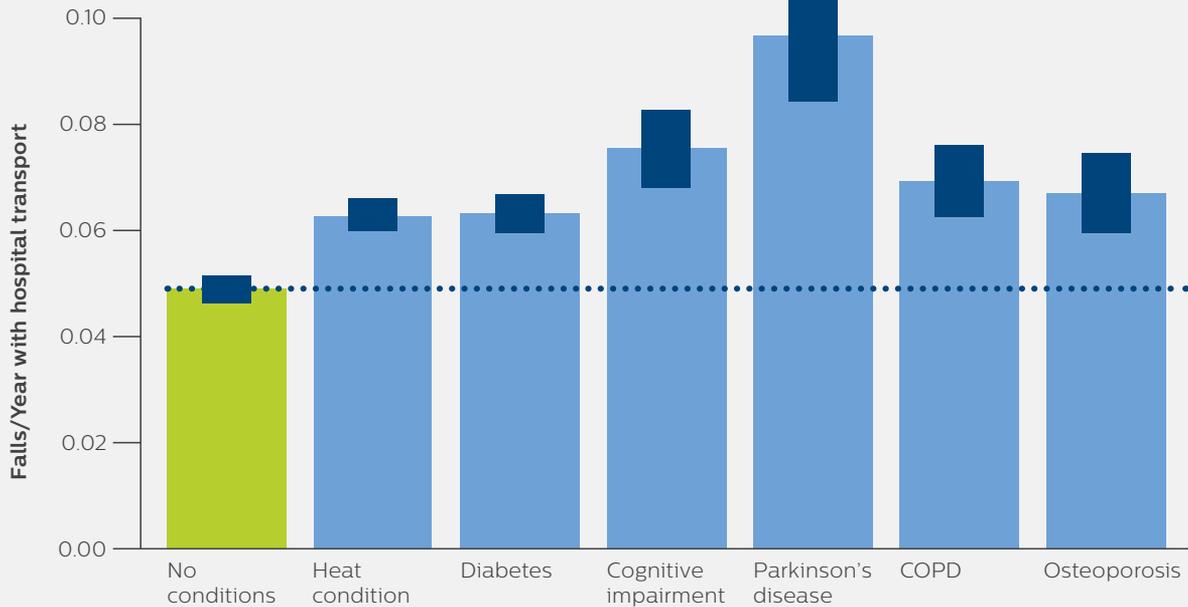


FIGURE 4



Fall rate with hospital transport of user of PERS with auto fall detection by reported medical condition. Additional bars represent 95% confidence intervals.

- Delivery of prompt urgent care
- Avoidance of unnecessary care
- Prevention of future falls
- Enabling proactive care

Tine Smits has a Masters degree in biomedical engineering and serves as Senior Analyst for ISMS Belgium.

Andrea Ryter, MBA, is Senior Global Product Manager, Philips Healthcare.

References

* Based on internal data collected Jan–July 2012. AutoAlert does not detect 100% of falls. If able, subscribers should always push their button when they need help. Button signal range may vary due to environmental factors.

1. Tromp AM, Pluijm SMF, Smit JH, et al. Fall-risk screening test: a prospective study on predictors for falls in community-dwelling elderly. *J Clin Epidemiol.* 2001;54(8):837-844.
2. Philips Home Monitoring internal data.
3. Colby SL, Ortman JM. The Baby Boom Cohort in the United States: 2012 to 2060. Published May 2014. www.census.gov/prod/2014pubs/p25-1141.pdf. Accessed June 13, 2018.

4. Centers for Disease Control and Prevention. Helping People to Live Long and Productive Lives and Enjoy a Good Quality of Life. Published 2011. www.aarp.org/content/dam/aarp/livable-communities/learn/health/Healthy-Aging-Helping-People-to-Live-Long-and-Productive-Lives-and-Enjoy-a-Good-Quality-of-Life-2011-AARP.pdf. Accessed June 13, 2018.

5. National Health Expenditures 2013 Highlights. Published June 9, 2015. www.heartland.org/publications-resources/publications/national-health-expenditures-2013-highlights. Accessed June 13, 2018.

6. Stevens JA, Corso PS, Finkelstein EA, Miller TR. The costs of fatal and nonfatal falls among older adults. *Inj Prev.* 2006;12(5):290-295.

7. Sterling DA, O'Connor JA, Bonadies J. Geriatric falls: injury severity is high and disproportionate to mechanism. *J Trauma.* 2001;50(1):116-119.

8. Gurley RJ, Lum N, Sande M, Lo B, Katz MH. Persons found in their homes helpless or dead. *N Engl J Med.* 1996; 334(26): 1710-1716.

9. Roush RE, Teasdale TA, Murphy JN, Kirk MS. Impact of a personal emergency response system on hospital utilization by community-residing elders. *Southern Med J.* 1995;88(9):917-922.

10. Bernstein M. 'Low-tech' personal emergency response systems reduce costs and improve outcomes. *Manage Care Q.* 1999;8(1):38-43.

11. Philips qualitative research study of AutoAlert users, January 2014.

CEU exam

Take this exam online >

Take the test online and then immediately print your certificate after successfully completing the test. Or print, complete, and mail the exam on the next page.
Exam expires July 15, 2020.

This exam is FREE to all.

[Click here to join ACCM](#) and get access to more CEs—up to 24 per year!

Questions

- 1. According to a prospective study, how many seniors in the United States fall each year?**
 - a. 1 in 2
 - b. 1 in 5
 - c. 1 in 3
 - d. 1 in 7
- 2. Falls can lead to:**
 - a. Bumps and bruises
 - b. Fractures and head trauma
 - c. Death
 - d. All of the above
- 3. In 2013, direct medical costs of falls among older adults were:**
 - a. \$25 billion
 - b. \$34 billion
 - c. \$38 billion
 - d. \$42 billion
- 4. What is the mortality rate from falls when people lie on the floor for more than 72 hours?**
 - a. 12%
 - b. 62%
 - c. 67%
 - d. 73%
- 5. Immediate access to a fallen individual helps provide:**
 - a. Reduced inpatient admissions
 - b. Reduced morbidity
 - c. Reduced mortality
 - d. All of the above
- 6. Automatic fall detection technology can provide a potential solution for unreported falls among seniors.**
 - a. True
 - b. False
- 7. A study to test a PERS with automatic fall detection technology showed that the device detected what percentage of falls from a standing position?**
 - a. 85%
 - b. 90%
 - c. 95%
 - d. 98%
- 8. Seniors who would benefit from a PERS with automatic fall detection technology include individuals with:**
 - a. Heart conditions
 - b. Cognitive impairment
 - c. COPD
 - d. All of the above
- 9. A significant increase in fall rates occurs when a senior has 3 or more chronic conditions.**
 - a. True
 - b. False
- 10. The potential benefits to seniors, caregivers, and healthcare organizations for those seniors with a PERS with automatic fall detection technology includes:**
 - a. Delivery of prompt care
 - b. Avoidance of unnecessary care
 - c. Prevention of future falls
 - d. All of the above

Take this exam online >

Take the test online and then immediately print your certificate after successfully completing the test. Or print, complete, and mail this answer sheet. Exam expires July 15, 2020.

Automating Fall Detection to Prevent Morbidity and Mortality: A Personal Emergency Response System with Optimized Automatic Fall Detection

Objectives

July 2018

1. State three benefits of a personal emergency response system (PERS) with optimized automatic fall detection.
2. State the fall rates by type of help needed reported to a response center by users of standard PERS or personal emergency response systems with auto fall detection.
3. State which seniors benefit most from PERS with auto fall detection?.

Answers

Please indicate your answer by filling in in the letter:

1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____ 8. _____ 9. _____ 10. _____

Continuing Education Program Evaluation

Please indicate your rating by circling the appropriate number using a scale of 1 (low) to 5 (high).

- | | | | | | |
|--|---|---|---|---|---|
| 1. The objectives were met. | 1 | 2 | 3 | 4 | 5 |
| 2. The article was clear and well organized. | 1 | 2 | 3 | 4 | 5 |
| 3. The topic was both relevant and interesting to me. | 1 | 2 | 3 | 4 | 5 |
| 4. The amount and depth of the material were adequate. | 1 | 2 | 3 | 4 | 5 |
| 5. The quality and amount of the graphics were effective. | 1 | 2 | 3 | 4 | 5 |
| 6. I would recommend this article. | 1 | 2 | 3 | 4 | 5 |
| 7. This has been an effective way to present continuing education. | 1 | 2 | 3 | 4 | 5 |
| 8. Additional comments: | | | | | |

Please print:

*Certificant's Name: _____
 *Email Address: _____
 *Mailing Address: _____

Please complete all that apply:

CCM ID# _____
 CMSA ID# _____
 CDMS ID# _____
 RN ID# _____
 ACCM Membership# _____
 ACCM Exp. Date _____

*CE exams cannot be processed without above information.

CE contact hours applied for: CCM RN CDMS

This educational manuscript has been approved for 2 hours of CCM and CDMS education credit by The Commission for Case Manager Certification and the Certification of Disability Management Specialists Commission. Provider #00059431. It has also been approved for 2 contact hours of nursing credit by the California Board of Registered Nursing. To receive credit for this exam, you must score 80% or above. Exam expires July 15, 2019.

PLEASE NOTE: Exam may be taken online at www.academyCCM.org/ce or by clicking the link found in this supplement. Take the exam and immediately print your certificate after successfully completing the test. Mailed exams should be sent to: Academy of Certified Case Managers, 1574 Coburg Road #225, Eugene, Oregon 97401. Please allow 4 to 6 weeks for processing of mailed exams.

This CE exam is protected by U.S. Copyright law. You are permitted to make one copy for the purpose of exam submission. Multiple copies are not permitted.

If you are not an ACCM member and wish to become one, please [click here](#).