

An elderly couple is shown from the chest up, sitting at a wooden table. The woman, on the left, has short white hair, wears glasses, and a blue and white plaid shirt. She is smiling and pointing at a silver laptop. The man, on the right, has white hair and is wearing a red and white striped shirt. He is also smiling and looking at the laptop. A black smartphone lies on the table in front of the laptop. The background consists of light-colored, patterned curtains.

# FALL PREVENTION WITH AI

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# TECHNOLOGY & OLDER ADULTS

Millions of devices ranging from refrigerators to “smart” cars to entire city infrastructures can be in constant communication with each other. The power of “smartness” needs to also be brought to healthcare and aging to work towards improving health outcomes and easing the final years of our lives.

Many senior living communities or home care agencies have already begun the process of digitizing their centers or adding in new age-tech tools to advance the care of older adults. Many seniors are already tech users themselves as a majority of older adults have cellphones and internet access. Families, seeking the best care possible for their loved ones, also rely on cell phones and video chatting technology to stay connected to residents, as well as more advanced platforms to stay up to date on the health of their loved ones.

Innovative and patient-friendly digital platforms powered by advanced artificial intelligence (AI) can allow caretakers and health providers along the care continuum to make “smart” decisions that will drive better health outcomes.

The remote monitoring technologies have proven that proactivity on health maintenance and timely intervention can significantly improve clinical and health outcomes. This is especially relevant to older adults and fall management as falls are a leading cause of fatal injuries in older adults. RPM for COVID-19 post discharge patients was strongly associated with a decreased risk of readmission across five hospitals in New England.



# THE PROBLEM WITH FALLS

When it comes to elderly, monitoring for chronic conditions and episodic ailments is not enough. Living and health are inseparable in the senior population. Safety and well-being are needed for sustained self-management. Risky and indeterminable behaviors such as falls, unaccounted absences or wandering, and irregular dining and medication habits are as much of a concern as chronic clinical conditions. Most often, these are early indicators of an undetected underlying condition, which, left untreated, can become acute. Psycho-social and functional domains are just as much a predictor of adverse outcomes and social determinants of health.

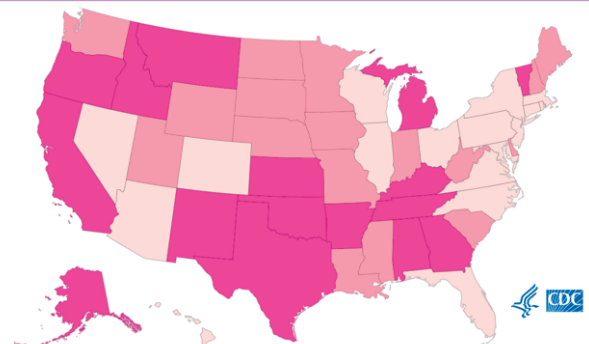
## FALLS

Falls among seniors are extremely common and highly problematic. It's estimated that 40% of injury-related deaths in the United States result from falls. Hospitals have noticed an increase in admissions related to falls. These patients tend to come in with fractured hips, brain injuries, and upper limb injuries.

Per CDC, in the United States alone, about one in four adults (28%) age 65 and older report falling yearly. This results in about 36 million falls each year. Around 3,000,000 seniors contact medical assistance each year for fall-related incidents.

While not all falls result in an injury, about 37% of those who fall reported an injury that required medical treatment or restricted their activity for at least one day, resulting in an estimated 8 million fall injuries.

Falls Reported by State 2018



### Percentage

- 20.0-26.0%
- 26.1-28.7%
- 28.8-33.9%

Higher or lower Compared to National Average



Every day, more than 10,000 people turn 65. By 2050, more than 500M people will be 65+. By 2030, about 73M people in the United States will be 65 and above, with the number of injuries from falls projected to be 12M annually.

Falls jeopardize the physical health of seniors, and they can also add a significant burden to seniors' mental health due to the cost of a hospital visit.



Source: STEADI

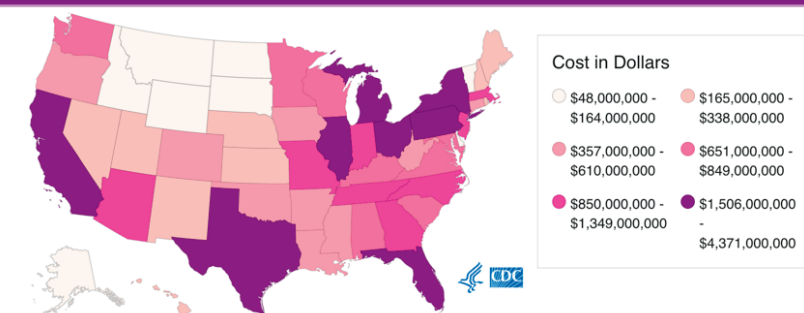
As people age, they become more prone to falls for several reasons. Medical conditions such as diabetes, heart disease, thyroid issues, loss of muscle mass, and poor vision and hearing can cause difficulty balancing. These are just a few examples.

In 2014, annually, older adults' falls cost an estimated \$50 billion from money spent on medical costs related to non-fatal injuries. \$754 million was spent related to fatal falls. By 2030, this estimate is expected to reach or exceed \$100B

With aging, a host of health-related problems come too. There are ways to combat the risk of falling, such as exercise, yoga, physical therapy, strength training, fall-proofing a home, sleeping well, and limiting alcohol.

Medicare and Medicaid cover about 75% of the cost. However, that still leaves seniors to cover the rest, which can be thousands of dollars. With the rising cost of care and diminishing insurance coverage, expect out-of-pocket expenses to increase by about 27%.

Cost of Older Adult Falls 2014



When it comes to falls, there are two large areas of concern.

- 1) Fall Detection and Remediation
- 2) Fall Prevention

## FALL DETECTION AND REMEDIATION

Over the last decade, several new technologies have come into the market targeting the issue of fall detection and remediation.

Technologies ranging from wearables (Apple Watch), and personal emergency response systems (Life Alert<sup>®</sup>) to optical, image recognition, pose estimation, and camera-based solutions have significantly addressed the fall detection and remediation problem.

These solutions were able to successfully spotlight the issue of falls, the gravity of undetected falls, and their physical, emotional, and economic impact.



The significant value proposition of these solutions included ease and timeliness of incident reporting, timely access to help, and consequently, reduced time to remediation which potentially lead to fewer emergencies and reduced the degree of fatalities of these injuries.

As technology for fall detection and remediation continues to evolve, it should help improve health and quality of life outcomes.

## FALL PREVENTION

As far as fall prevention goes, there are no “one size fits all” solutions. Commonly prescribed strategies for fall prevention range from medication management and strength and balance exercises to estimating fall risk in clinical settings and through Medicare Annual Wellness Visits, which are paid for by Medicare. Interventions like these are expected to reduce the number of falls by as much as 29%. However, most older adults do not get routinely screened for falls by their providers.

There are several state-of-the-art technology solutions for estimating fall risk. They take a combination of inputs of gait, posture, pace, balance stability quotients, other health parameters, and comorbid conditions to assess fall risk. Assistive tools and products, such as walkers,



# 29%

Of falls can be  
reduced with  
interventions

wheelchairs, and belts, are being outfitted or upgraded with innovative technological enhancements to better assess fall risks.

Mere assessment of fall risk does not prevent falls. It is hard to attribute the instrumentation of fall risk to the actual reduction in the number of falls. This is because behaviors are hard to predict - especially as elders age, their behaviors change frequently. A more sustainable way is needed to keep them fall free.

The opportunity for preventing falls requires multiple technology solutions, each with its own unique capabilities, but knitted together to create a comprehensive solution. In a cost-restrained and capital-constrained market, this increases the dilemma for decision-makers.



# AN INTEGRATIVE APPROACH TO FALL PREVENTION



One way to address the challenge of incorporating multiple technologies is to choose platform-based solutions. Platform-based solutions are the best answer to “no one size fits all” scenarios. Platform-based solutions can provide the extensibility needed to add technology solutions incrementally while keeping the overall cost down.

With the advancements in data collection through multiple peripheral devices such as IoT devices, cloud, and edge computing, and connectivity, state-of-the-art AI-based solutions can be deployed to harness the power of data and create value.

Another critical aspect to consider is choosing platform solution providers who are ecosystem players.

The pace at which technology changes in and of itself makes it difficult for decision-makers to bet on technology solutions for long-term viability. Regardless of settings (institutional settings or at home), users must adapt to rapid changes.

Platform players combine the strengths of their core competencies and embrace an open architecture that incorporates innovations and other point solutions, thereby making them more potent as a technology choice.

A step-function approach to incorporate technology not only gives provider organizations a better way to ensure adoption and usage for long-term success but also delivers a significantly higher return on investment compared to investments in point solutions.

# ZEMPLEE AND ALEXA: THE MULTIPLIER EFFECT

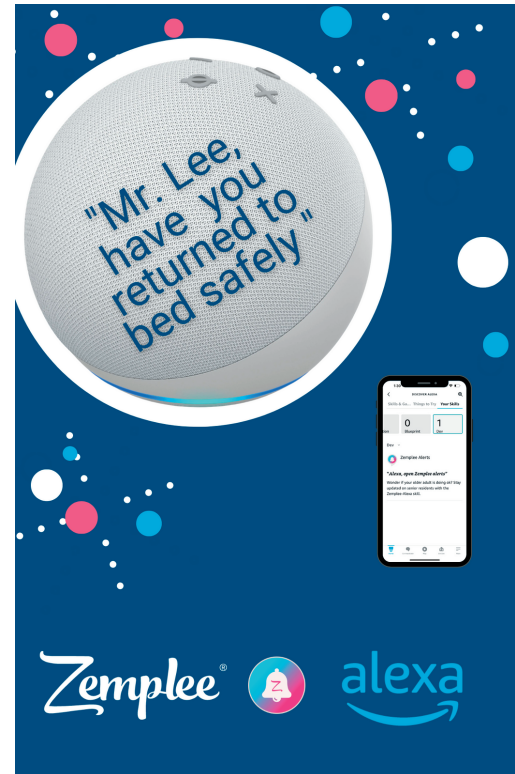
Zemplex's aging in place solution is an excellent example of how scalable platform solutions can deliver value in multiples.

Zemplex's AI-powered assistive technology® system of Passive Sensors and Attentive AI integrates with Amazon's Alexa and Echo Dot solutions to leverage voice-based and natural language processing techniques to deliver a powerful and complete solution for Fall management.

An essential part of fall management is activity and behavior management coupled with a constant stream of information feedback to encourage and influence corrective and positive behavior change.

Zemplex's patented behavior monitoring platform tracks the daily activity patterns of seniors in independent and assisted living settings. Zemplex can track movement patterns inside a living unit, for example, movement from the bedroom to the bathroom, a bed entry or exit, dining habits, medication and sleep habits, and more.

Leveraging Zemplex's AI-powered behavior monitoring capabilities and Alexa's voice-activated interventional features, Zemplex delivers a highly nuanced and targeted method to prevent, detect and remediate falls.



This nuanced approach to identifying discreet events and activity patterns through Zemplex, creating timely intervention opportunities through Alexa to provide feedback, and measuring the response to that feedback for resolution make the powerful combination of Zemplex and Alexa a robust solution.

# USE CASE: CHRISTIAN CARE FELLOWSHIP SQUARE, MESA, AZ

## FALL PREVENTION, DETECTION AND REMEDIATION

A team of developers from Zemlee joined in the conversation with Christian Care Fellowship Square-Mesa and the Arizona State University Smart City Cloud Innovation Center (CIC) to develop a solution to precisely target falls during nighttime activity, which all starts with a resident getting out of bed. The goal was to not only leverage Amazon's Alexa platform and Echo devices, which were previously deployed in the facility, but also to develop a solution to track micro activity and behavior patterns with a higher propensity for fall occurrences and create interventional opportunities for prevention.

Senior falls cost Americans over \$50 billion annually in health care costs – 75% of which is borne by Medicaid and Medicare. The Arizona State University Smart City CIC powered by AWS had previously collaborated with Christian Care Fellowship Mesa in Arizona to develop a solution to reduce senior falls using Alexa for Hospitality and Amazon's Alexa smart speaker.

Their preliminary research found that among Fellowship Mesa residents 20% of falls occurred at night in residence, between 9 pm and 7 am, when seniors woke from sleep to perform various activities. Senior falls at night alone might be responsible for \$10 billion annually in health care costs.

Combining Alexa routines with the Zemlee alert for a nighttime bed exit resulted in a unique, preemptive and accessible solution to reduce the number of falls in seniors, currently in a pilot program at Fellowship Mesa.

Fellowship Mesa is currently testing Alexa for Hospitality as a solution to provide helpful suggestions and guidance through routines, such as reminding seniors to count to 10 before departing from their beds.

Zemlee is already integrating with Alexa to deliver voice-based instructions to residents. Alexa routines have features for lighting up pathways to the bathroom or kitchen. These routines can be combined with Zemlee alerts as a unique fall prevention solution.



# USE CASE: CHRISTIAN CARE FELLOWSHIP SQUARE, MESA, AZ

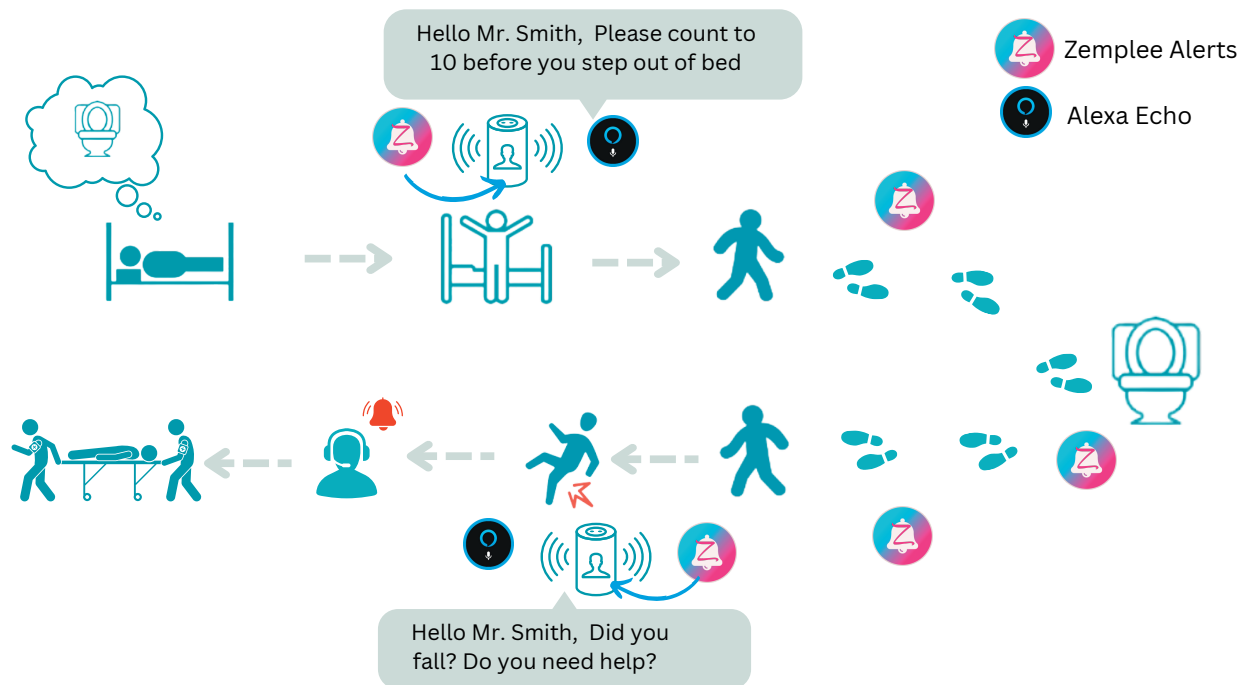
## FALL PREVENTION, DETECTION AND REMEDiation

By training Zemplee's AI on the resident patterns surrounding these nighttime hours, Zemplee and Fellowship Mesa can bolster the confidence of these alerts and the preventative nature of the system based on typical behavior.

In this experimental phase, the project focused on nighttime bathroom visits, a common location of falls and injury in older adults. Falls account for 80% of bathroom injuries in the elderly. And when an older adult falls and is stuck in a bathroom, they often do not have ways to report the incident and ask for help.

Zemplee introduced a new event in their platform to track the discrete loop of a bed exit, followed by round trip movement from the bedroom to the bathroom, closed by a successful bed occupancy. Any deviation from that traversed path was flagged in real time as an alert and escalated to the central station for action and remediation.

### Tracking an unsuccessful roundtrip bathroom visit with Zemplee and Alexa



Incorporating two available-for-consumer products, Zemplex alerts integrated with Alexa routines is a unique and promising solution to reduce the number of seniors who fall at night. Strategically placed sensors in hallways and rooms were used to map the common traversed paths. With the dual-technology solution, Zemplex detects when a resident leaves their bed at night and signals a resident's Alexa to prompt the resident to count to 10 before stepping out of bed. This proactive measure alone can help stabilize seniors moving suddenly and/or in the dark.

Diagram illustrating the Zemplee Alerts system for a smart home. The system uses a Zemplee Alerts device (pink circle with a bell) and an Alexa Echo device (blue circle with a speaker) to monitor a user's movements. The sequence shows a user going to bed, receiving a "Good Night Mr. Smith" message, and then being alerted when they get up and go to the bathroom. The user is shown walking away from the bed, leaving footprints, and returning to the bed. The Zemplee Alerts device is shown sending a signal to the Alexa Echo device, which then triggers the alert.

## Enhancing the Aging in Place Experience



# ABOUT THE TEAM



Fellowship Square-Mesa, a part of Christian Care, is a 501(c)(3) non-profit organization, founded in 1979. Fellowship Square- Mesa is a senior living community in Mesa, Arizona. The Christian Care Foundation Fellowship Square communities support a legacy of the highest quality service to Arizona seniors.



The ASU Smart Cities Cloud Innovation Center (CIC) is a strategic relationship with Amazon Web Services (AWS) and is supported on ASU's Innovation campus - SkySong. The mission of the CIC is to drive Innovation Challenges that materially benefit the greater Phoenix metro area and beyond. The CIC also provides real-world problem-solving experiences to students by immersing them in the application of proven innovation methods.



amazon alexa

Amazon Alexa, is a virtual assistant technology that uses automatic speech recognition and natural language processing for smart speakers like Echo and Echo Dots. It can do voice interaction, music playback, setting alarms, streaming, weather, traffic, sports, and more. Alexa can also control several smart devices using itself as a home automation system. Users can extend the Alexa capabilities by installing "skills" developed by third-party vendors.



Zemlee is a technology platform that utilizes Passive Sensors and Attentive AI<sup>®</sup> to help the elderly age in place gracefully, with round-the-clock remote monitoring capabilities for caregivers that improve quality of life and reduce hospitalizations without compromising privacy. Co-founders Aparna Pujar and Gary Fowler combined decades of experience in Silicon Valley hi-tech companies and clinical care to develop artificial intelligence applications and unobtrusive sensors that power Zemlee's innovative remote elderly care system.

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# ZEMPLEE: A CAREGIVER'S BFF

## A VITAL COMPANION TOOL FOR FALL PREVENTION

Caregivers caring for the elderly often work with insufficient, inaccurate, implausible, and inopportune information.

Zemlee's Passive Sensors and Attentive AI<sup>®</sup> deliver accurate and reliable information and insights to help caregivers better meet the needs of their clients. Zemlee not only helps caregivers prioritize their activities but also, with its real-time alerts, caregivers can promptly respond to urgent and crucial needs.

Nonintrusive lifestyle integrated sensors and devices are quick-to-install and track various signals - including patient's activity, dining, medication and sleep patterns, heart rate, respiratory rate, vitals, and more.

Zemlee's behavior monitoring and smart alerts are essential components of fall prevention.

Alerts triggered on bed exits can invoke assistance from a nearby caregiver. Proactive and routine tracking of sleep habits, vitals, and medication adherence go a long way in preventing conditions that can lead to accidental falls and fall-related injuries.



“  
*I'm an 87 year-old woman who is living at home alone. At night I have a caregiver as I tend to be unsteady on my feet and am at risk for falls. Zemlee was installed in my home to maintain my independence during the day. One afternoon, my agency was alerted that I had been sitting in my recliner for longer than usual. I was having trouble getting out of the chair and needed help. Soon assistance was sent to help me out of my chair.*

- Mrs. K, Roseville, CA

# ADOPTION OF TECHNOLOGY

## SUCCESS DEPENDS ON THE LEADERSHIP AND STAFF

For communities, technology implementation might require an organizational engagement strategy and can even result in a mini-culture change for residents and staff. Supportive, trained staff and leadership are crucial to maximizing the benefits of any new tech brought to senior living communities.

However, with the surge of solutions in the age-tech and senior living tech market, many new technologies are now built precisely to integrate with large-scale senior living. These companies might even offer training, staff orientations, and flyers/brochures for caretakers and residents to better understand and use the technology. The goal of age tech is not to replace the existing institutions- doctors, caretakers, and senior housing staff- but rather to enhance these jobs and allow them to perform better. A tool that automates how a nurse or staff member takes vitals frees up time for that caretaker to have more meaningful, technical conversations with their patients or residents.

With rising healthcare costs, it's vital that senior living and home care providers continue to engage in the best care possible for their residents. Increasing the depth of check-ins with older adults is necessary as it leads to better care planning, faster recovery times, better resident-staff relationships, and healthier lifestyles.



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A photograph of three men standing outdoors in a grassy area with trees in the background. The man in the foreground is a Black man with a grey beard, smiling and looking towards the camera. He is wearing a colorful Hawaiian shirt with a floral and bird pattern. Behind him are two other men, one white and one Asian, both also smiling and wearing hats and Hawaiian shirts. The word 'Zemplee' is written in a pink, cursive font in the top right corner.

# Zemplee

**DISCOVER ZEMPLEE'S FALL MANAGEMENT SOLUTIONS**

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