

**AGING IN PLACE:
CAN ADVANCES IN TECHNOLOGY HELP
SENIORS LIVE INDEPENDENTLY?**

HEARING
BEFORE THE
SPECIAL COMMITTEE ON AGING
UNITED STATES SENATE
ONE HUNDRED FOURTEENTH CONGRESS

FIRST SESSION

WASHINGTON, DC

MAY 6, 2015

Serial No. 114-05

Printed for the use of the Special Committee on Aging



Available via the World Wide Web: <http://www.govinfo.gov>

U.S. GOVERNMENT PUBLISHING OFFICE

SPECIAL COMMITTEE ON AGING

SUSAN M. COLLINS, Maine, *Chairman*

ORRIN G. HATCH, Utah
MARK KIRK, Illinois
JEFF FLAKE, Arizona
TIM SCOTT, South Carolina
BOB CORKER, Tennessee
DEAN HELLER, Nevada
TOM COTTON, Arkansas
DAVID PERDUE, Georgia
THOM TILLIS, North Carolina
BEN SASSE, Nebraska

CLAIRE McCASKILL, Missouri
BILL NELSON, Florida
ROBERT P. CASEY, JR., Pennsylvania
SHELDON WHITEHOUSE, Rhode Island
KIRSTEN E. GILLIBRAND, New York
RICHARD BLUMENTHAL, Connecticut
JOE DONNELLY, Indiana
ELIZABETH WARREN, Massachusetts
TIM Kaine, Virginia

PRISCILLA HANLEY, *Majority Staff Director*
DERRON PARKS, *Minority Staff Director*

C O N T E N T S

	Page
Opening Statement of Senator Susan M. Collins, Chairman	1
Opening Statement of Senator Claire McCaskill, Ranking Member	3
PANEL OF WITNESSES	
Laurie M. Orlov, Founder, Aging in Place Technology Watch	5
Carol Kim, Ph.D., Vice President for Research, University of Maine	7
Maureen McCarthy, M.D., Deputy Chief Patient Care Services Officer, Veterans Health Administration, and Acting Chief Consultant for Telehealth Services, U.S. Department of Veterans Affairs	8
Marjorie Skubic, Ph.D., Professor of Electrical and Computer Engineering, and Director, Center for Eldercare and Rehabilitation Technology, University of Missouri	10
Charles S. Strickler, Caregiver	12
APPENDIX	
PREPARED WITNESS STATEMENTS	
Laurie M. Orlov, Founder, Aging in Place Technology Watch	31
Carol Kim, Ph.D., Vice President for Research, University of Maine	34
Maureen McCarthy, M.D., Deputy Chief Patient Care Services Officer, Veterans Health Administration, and Acting Chief Consultant for Telehealth Services, U.S. Department of Veterans Affairs	37
Marjorie Skubic, Ph.D., Professor of Electrical and Computer Engineering, and Director, Center for Eldercare and Rehabilitation Technology, University of Missouri	41
Charles S. Strickler, Caregiver	43
QUESTIONS FOR THE RECORD	
Laurie M. Orlov, Founder, Aging in Place Technology Watch	51
Marjorie Skubic, Ph.D., Professor of Electrical and Computer Engineering, and Director, Center for Eldercare and Rehabilitation Technology, University of Missouri	53
STATEMENTS FOR THE RECORD	
Laurie M. Orlov - Technology for Aging in Place	59
Marjorie Skubic, Ph.D. - Aging in Place and Eldertech Research at the University of Missouri	100

**AGING IN PLACE:
CAN ADVANCES IN TECHNOLOGY
HELP SENIORS LIVE INDEPENDENTLY?**

WEDNESDAY, MAY 6, 2015

U.S. SENATE,
SPECIAL COMMITTEE ON AGING,
Washington, DC.

The Committee met, pursuant to notice, at 2:07 p.m., Room 216, Hart Senate Office Building, Hon. Susan M. Collins, Chairman of the Committee, presiding.

Present: Senators Collins, Cotton, Perdue, Sasse, McCaskill, Casey, Blumenthal, Donnelly, and Kaine.

**OPENING STATEMENT OF SENATOR
SUSAN M. COLLINS, CHAIRMAN**

The CHAIRMAN. This hearing will come to order. Good afternoon. This afternoon's hearing will explore the potential of new technologies to help seniors age in place safely and to retain their independence.

The U.S. population is aging. According to Census Bureau projections, 21 percent of our population will be age 65 and older by the year 2040. That is up from just under 14 percent in 2012. Every day, 10,000 Baby Boomers turn 65. As many as 90 percent of them have one or more chronic health conditions.

Americans aged 85 and older, our oldest old, are the fastest-growing segment of our population, and this is the very population that is most at risk of multiple and interacting health problems that can lead to disability and the need for long-term care.

At the very time that our population is growing older, the need for care and support is increasing. The population of professional and informal caregivers is, however, declining. Today there are seven potential caregivers for each person over age 80 and at the highest risk of requiring long-term care. By the year 2030, there will be four, and by 2050, the number drops to fewer than three. As a consequence, in the future more and more people will have to rely on fewer and fewer caregivers.

As people age, they naturally want to remain active and independent for as long as possible. Aging in place is the ability to live in one's own home and community safely, independently, and comfortably, regardless of age or ability level.

Surveys taken by AARP consistently reflect the fact that aging in place is the preferred option for seniors who want to continue

living independently and avoiding nursing homes and other institutionalize care for as long as possible.

Today's hearing will examine some of the recent advances in technology that are providing new options to allow seniors to remain in their homes longer by monitoring their health status, detecting emergency situations such as debilitating falls, and notifying families and health care providers of potential changes in health status or emergencies.

While it is not a replacement for professional care or personal attention from family members, technology can help to bridge the care gap and extend the amount and length of time a person is able to live independently. Technology can also help to reduce isolation and enrich the lives of seniors by keeping them engaged and connected to their families and their communities.

We will also hear this afternoon about technologies that can make the lives of family caregivers easier by giving them the tools they need to support their loved ones as they age in place.

Finally, we will hear from the Veterans Administration, a real pioneer in telehealth, which has used technologies such as videoconferencing and smart monitors to reduce hospital admissions and to shorten hospital stays. This has resulted in lower costs and has also allowed some of our older veterans with chronic health conditions to live independently at home right where they want to be.

Many of us are familiar with the decades-old and well-known phrase, "I've fallen and I can't get up." That phrase, of course, was an advertisement for a medical alert system. While many seniors still rely on this device, breakthroughs in modern technology have brought us a long, long way, providing many new options for seniors and for their families.

Technological solutions can be cost-effective and tailored to meet the specific needs of a senior and his or her living situation. Companies that develop these technologies are starting to realize that not only is there a growing need to design products that meet seniors' needs, but also that there are many seniors who want technology and devices that look just like those used by younger generations.

For example, this phone is an older-generation device that is specifically designed for seniors to be easy to use. It has large numbers, for example. This new-generation version of the phone is a smartphone that still has the same ease of use as this old version of the Jitterbug phone, but looks like the smartphones that people's children and grandchildren use.

Much more important than its appearance, however, this new generation device also includes technologies that help seniors maintain their independence. For example, it has features to help with medication adherence, provide 24/7 access to medical emergency operators, as well as an app that the family caregiver can download to keep them up-to-date on their loved one's well-being.

We will also explore the challenges posed by these technological advances such as privacy concerns and the unequal access to the Internet that exists across our country.

Before I turn to Senator McCaskill for her opening statement, I want to give a special welcome today to Dr. Carol Kim, the vice

president for research at the University of Maine. Dr. Kim oversees the university's Successful Aging Initiative for Living, or SAIL, program. She has traveled to Washington today to tell us about Maine's aging and thriving in place movement that will benefit significantly from the development of new technologies, products, and devices. I look forward to hearing not only from her but from all of our witnesses this afternoon.

Senator McCaskill.

**OPENING STATEMENT OF SENATOR
CLAIRE MCCASKILL, RANKING MEMBER**

Senator MCCASKILL. Thank you, Chairman Collins. Helping our seniors remain in their communities and age with dignity is an important issue and a top priority of this Committee. You have assembled a great panel today, and I am looking forward to hearing about the exciting innovations that can help seniors and their families.

There is a real disconnect between the number of seniors who say they want to stay in their homes and communities and the number of seniors who end up having to move to nursing homes. In fact, a recent AARP study found that 87 percent of older adults would prefer to remain in their own communities as they age. While it may not be possible for every person, depending on a number of factors, to remain in their homes, for many of us, with the right supports, it is possible, and it is preferable both in terms of quality of life and certainly for financial implications.

Recent advances in technology are providing these new options for seniors and their families that can allow them to remain at home for longer by monitoring health status, detecting emergency situations, and notifying health care providers about changes in health status. These technologies can also make family members' and caregivers' lives easier by providing them with tools to support their loved ones and giving them peace of mind. This really is a win-win situation. Seniors are much happier continuing their normal routines and social activities where they feel comfortable, family members can make sure their loved ones are safe, and society as a whole benefits from significantly reduced health care and long-term-care costs.

There are many assistive technologies that are already on the market. Home improvement stores, other big-box retailers, and even telecommunications companies all sell versions of connected home systems that can keep seniors secure in their homes. Developers are creating senior-specific monitoring devices such as bed, toilet, and pillbox sensors that can monitor activity within the home. Pillbox sensors are so simple in nature, but can prevent tragic accidents by making sure that seniors are not mixing medications or taking too many pills. Wearable devices are also popular for tracking physical activity and helping to prevent falls. Falls are the leading cause of injuries in older adults, with one out of every three seniors falling each year. Some of the newer fall-monitoring devices do not even require the push of a button; they can detect when a person has fallen using an accelerometer. Technology has also been critical to the growth of telehealth and particularly helpful for seniors who, by using telehealth services, can have their

most of their health monitored from the comfort of their home rather than the doctor's office.

These innovative technologies are being developed by researchers all across the country, one of whom is with us here today. I am so pleased and proud to introduce Dr. Marjorie Skubic. Dr. Skubic is the director of the Center for Eldercare and Rehabilitation Technology at my university, the University of Missouri. The Center at Mizzou, in partnership with Americare, has created TigerPlace, a specifically designed continuing-care living environment that utilizes a number of advanced technologies in the senior apartments. Dr. Skubic and her team have even found a way to use radar and 3-D sensors to monitor seniors' risk level for falls. I look forward to learning more about this and other emerging technologies from Dr. Skubic's testimony.

I know there are some concerns about preserving the privacy of seniors and that using webcams and video-monitoring might present some challenges. We definitely want to ensure the privacy of seniors and their dignity using this technology, but we also want to make sure that we are looking out for their safety. I know that Mizzou has utilized privacy-preserving techniques, such as using only silhouettes on video monitors that can help ease some of the privacy concerns of older adults. The challenge for those who develop these technologies is to find ways to maximize safety with a minimal invasion of privacy.

Thank you to Chairman Collins and to our witnesses for taking the time to be here today, and I look forward to listening and learning from your testimony.

The CHAIRMAN. Thank you very much for that excellent statement.

I want to note that we have been joined by Senator Perdue, Senator Kaine, Senator Sasse, and Senator Casey, and I am very pleased that you could join us this afternoon.

We are now going to turn to our panel. We will first hear from Laurie Orlov, who is a tech industry veteran and the founder of Aging in Place Technology Watch. I understand that she also has the wisdom to have a summer home in the State of Maine on Frye Island. That cinched it for me as far as inviting you to testify today.

I have already introduced Dr. Carol Kim, who is the vice president for research at the University of Maine.

Our next witness will be Dr. Maureen McCarthy from the Department of Veterans Affairs. She is the Acting Chief Consultant for Telehealth Services and will discuss the VA's telehealth program, which by many measures has been a success and has helped to reduce costs.

Professor Marjorie Skubic from the University of Missouri has already been introduced by the Committee's Ranking Member.

Finally, I would like to welcome Charles Strickler to today's hearing. Mr. Strickler, who is from Virginia, knows all too well the challenges of caring for seniors who have a desire to age in place, and he will share his personal story with us and how he has used technology to assist in the care of his mother and mother-in-law.

First we will start with Ms. Orlov.

**STATEMENT OF LAURIE M. ORLOV, FOUNDER,
AGING IN PLACE TECHNOLOGY WATCH**

Ms. ORLOV. Thank you. Chairman Collins, Ranking Member McCaskill, and members of the Committee, I want to thank you for the opportunity to testify today about the potential and requirement for technology innovation to help older adults age in place.

As you have noted, demographics make this technology market essential. These categories of enabling technology will help make it feasible for older adults to meet their needs as they age, and as we have already noted, nearly 90 percent of adults age 65 want to remain in their own homes and, in fact, today actually are remaining in their own homes.

Successful aging has been described as “the ability to do things for myself; feel safe; and have good health.” Aging in place, therefore, is the ability to successfully age in your home of choice, and aging-in-place products and services, including technology, provide a useful underpinning and enhancement of the quality of life for seniors as they age in place.

We have talked a bit about demographics. I just want to add a couple of refinements of what we have already heard.

We know there are 46 million adults who are 65 or older today, and of those, 20 million are 75 or older; 46 percent of women aged 75-plus today are living alone. The Society of Actuaries recently updated life expectancy at age 65 to reflect a new reality that women age 65 can now expect to live on average to be 88.8, with 25 percent of them living to 90 or more. Men at 65 are going to live on average to 86.6. The average 1-year cost of assisted living in the United States will be \$51,000 a year by 2020, and in the Northeast, San Francisco, Chicago, and most memory-care units, that number has already been reached and exceeded. Seniors know this, and they are deferring move-in to assisted living communities until they reach their mid-80’s, but most of them still remain at home.

Let us talk about the categories of technology for aging in place. If you could bring up that slide? Thank you.

They are best represented by what I describe as “interlocking pieces of a puzzle”; and the puzzle paradigm is specifically used here to show that if you leave out any one of these pieces of the puzzle, people are at risk of depression, of isolation, and undetected illnesses, and all kinds of complications in their lives. Older adults benefit from innovations, and particularly related training and how to benefit from them, that address their ability to connect with other people and opportunities, stay engaged in their communities, be safe, and manage their health and well-being, so looking at each category, starting with the upper-left puzzle piece, let us examine them one at a time.

In the category of communication and engagement technologies, while the devices may change over time—and have changed significantly as you showed by your examples of phones—their purpose remains the same: They help older adults stay connected to others, through e-mail, online text, and video chat, searching the Internet, participating in forums, playing games, finding people with shared interests, and just as important, finding services and resources that meet their changing needs, and in particular, with video it can be used to monitor but can also be used to engage people in some so-

cial connections with their families and friends. Today, while 59 percent of the 65-plus population has access to the Internet and 27 percent have smartphones, both percentages drop off noticeably at age 75.

The second category on the right upper corner is the safety and security category. The most important aspect in this category is a home alarm system that can monitor and alert about fire, temperature, and excessive moisture in the home. Without it, the other technologies are just nice-to-haves. Other useful technologies listed here include personal emergency response system pendants, which we have already talked about, and safety watches; fall detectors in the home; home-based motion sensors; and activity monitors that can now monitor absence of activity and decline over time. Increasingly, information from various devices will be combined to detect changes in patterns over time and we are hoping detect gait changes or other signs that indicate a risk of falling.

Health and wellness technologies is the category at the bottom right that includes telehealth, as we have heard, but also wearables, smartphone apps—as people acquire smartphones, that may be useful—and online health information, and there are new tools being developed all the time to help with dementia care, support care coordination, and help find home care workers, and a variety of these new devices can also assist with people of low vision and people with hearing impairment.

The bottom left-hand corner is about learning and contribution and how we stay engaged in our society, continue to learn new things, which is how we remain content with our lives and interested, and it helps keep our minds sharp. Tools that help people tell and record their life stories, for example, online sites that enable them to volunteer, enable them to find work, 20 percent of people after the age of 65 these days are actually working, many of them full-time.

People can learn new skills. They can learn new skills that are leisure-related and work-related, and all of this online training is free. This is the times we live in now. It is free. Forums are available to find expertise and ask questions. The biggest problem we have is that mobile device data plans today average between \$60 and 80 a month, and WiFi access is typically being used by people in coffee shops and libraries because having a high-speed Internet connection into the home can be quite costly, \$50 a month or more. That is a limitation on access for lots of folks.

As people age, all the four categories are enhanced by inclusion of the role of the formal and informal caregiver, which you can see in the middle, and that could include the professional caregiver. There are newer technologies that not only track time and attendance of caregivers but also communicate care status—that is, what is going on with activities of daily living, communications with family members, mobility, eating, and cognitive function.

One last point. The future market potential of this market is greater availability of smartphone features, in-car technologies, and will move even into robotics. It has been sized at the low end at \$20 billion by 2020, but in the future, you will see fewer special-purpose offerings for seniors. There will be more examples of standard hardware and device platforms with customizable software that

will meet the specific needs of the user, so we will not have to invent special-purposes technologies for everything. That concept is called “Design for All” and can be seen today in the customizable features in your car, in tablets, in smartphones, in television, and consumer electronics. Design once, customize for the individual.

I hope this overview has been helpful to you, and I want to thank you very much for your time.

The CHAIRMAN. Thank you for your testimony.

Dr. Kim.

**STATEMENT OF CAROL KIM, PH.D.,
VICE PRESIDENT FOR RESEARCH, UNIVERSITY OF MAINE**

Dr. KIM. Good afternoon, Chairman Collins, Ranking Member McCaskill, and distinguished members of the Senate

Special Committee on Aging. My name is Dr. Carol Kim, and I am appreciative of the opportunity to share with you the technologies that the University of Maine is developing to allow older individuals to age and thrive in place.

It could not be timelier. We are convinced that the aging and thriving in place movement is destined to benefit greatly from the rapid deployment of technologies, products, and devices that maximize human performance; improve mobility, navigation, home environments, and intelligent living; improve emergency detection; and contribute to older adult falls prevention, mitigation, and response.

The University of Maine has launched a major cross-campus aging research initiative in partnership with community agencies and organizations and has established an interdisciplinary research incubator from social work to engineering to disability studies that is responding to major public health issues that affect aging Americans.

In the area of home safety optimization and falls prevention, we are developing technologies to promote mobility, avert falling, increase contrast sensitivity, promote outdoor exercise, and improve balance.

One of the most common challenges that occurs with age is loss of visual contrast sensitivity. This can be extremely dangerous for older adults as it turns commonplace low-contrast features—show here in this slide—such as cement stairs, curbs, or benches into falling hazards. Our goal is to improve safety and reduce falling via a cost-efficient solution that can be implemented without any infrastructure build-out. To do this, we are exploring the use of computer vision as a means to detect low-contrast edges in the environment and improve their visibility. This technology is likely to reduce the falling problem because it is optimized to address known perceptual and cognitive changes that occur with age.

Although walkers, crutches, and canes have long been available, these are minimally functional for outdoor exercise and are perceived as stigmatizing and inconvenient, so in this movie, the assistive jogger was created to fill an unmet need for populations who, without adequate mobility support, would be less likely, unable, or unwilling to participate in ambulatory exercise. The assistive jogger is an aesthetically designed, convenient, foldable, actively steered, three-wheeled standing support device that improves balance and weight-bearing assistance during walking, jogging or

running. It is fitted with biofeedback and innovative load-sensing technology and is currently in the early phase of commercialization.

In the area of falls mitigation and impact minimization, we are developing advanced energy-absorbing clothing technology. A team at the University of Maine is currently working to develop non-stigmatizing protective gear to mitigate injury for individuals at risk for falls. The Maine company, Alba-Technic, a UMaine corporate partner, has developed a highly effective, impact-resisting material system and offers a head gear option for older adults that can be integrated into fashionable headwear while providing protection against head injury, as shown in this slide. This technology is lightweight and can be incorporated into caps, scarves, and hats. Performance tests demonstrated a significant potential for reducing head injury.

In 2013, 258,000 people over the age of 65 were admitted for treatment of hip fracture. The Hip Project expands our current work with head gear to innovative, wearable hip protection for elders. UMaine researchers are collaborating with Alba-Technic to design aesthetically pleasing hip protection consisting of undergarments in a changeable shell that will be regularly worn by elders at risk for falling, and I have samples of this material here if anyone is interested in taking a look at that.

In the areas of fall response, we are developing wireless networking technologies with wireless detection and vital sign sensors to assist first responders.

Loss of sensory, cognitive, and motor function that occurs as people age can lead to many safety risks for older adults living independently. Current responses to this concern involve installation of expensive and obtrusive video monitoring. We have re-created a typical apartment setting for testing a new extensible system that makes use of minute and low-cost technology such as RFID tags and micro controllers. RFID tags can easily be embedded into the physical structure of an apartment—under carpets, behind the paint on walls and ceilings. Our RFID reading device is small and designed to be worn comfortably by an individual. The system tracks the user's location as they move about their home and sends an alert if there is a problem. The system will help to reduce in-home falls and improve safety, efficiency, and independence.

Finally, I would like to thank the Committee for the opportunity to describe some of the exciting and necessary technologies that researchers at the University of Maine are pursuing to improve the quality of life for our older population.

The CHAIRMAN. Thank you very much, Dr. Kim.
Dr. McCarthy.

**STATEMENT OF MAUREEN MCCARTHY, M.D., DEPUTY CHIEF
PATIENT CARE SERVICES OFFICER, VETERANS
HEALTH ADMINISTRATION, AND ACTING CHIEF
CONSULTANT FOR TELEHEALTH SERVICES,
U.S. DEPARTMENT OF VETERANS AFFAIRS**

Dr. MCCARTHY. Thank you. Chairwoman Collins, Ranking Member McCaskill, and distinguished members of the Senate Committee on Aging, thank you for the opportunity to discuss the high-quality care and support that the Department of Veterans Affairs, Veterans Health Administration, Telehealth Services programs are

privileged to provide to our Nation's veterans. Joining me today are Dr. Richard Allman, Chief Consultant for Geriatrics and Long-Term Services, and Ms Catherine Buck, National Home Telehealth Lead and Clinical Nurse Analyst for Telehealth Services. Senator Kaine, she is from Richmond.

VA is recognized as a world leader in the development and use of telehealth. Telehealth Services are mission-critical to the future direction of VA care to veterans, and they are one of the VA's major transformational initiatives aimed at ensuring care is convenient, accessible, and patient-centered.

Telehealth increases access to high-quality-care services by utilizing secure information and telecommunication technologies to provide health services when the patient and practitioner are separated by geographical distance. In Fiscal Year 2014, VA telehealth occurred in over 900 sites of care, allowing more than 717,000 patients—that would be 12.6 percent of our enrolled veterans—to receive care through telehealth. This amounted to over two million telehealth episodes of care. Currently, telehealth is available in over 45 specialty care areas.

At VA, we use three telehealth modalities to ensure excellence in care delivery.

Clinical Video Telehealth is the use of real-time interactive videoconferencing, sometimes with supportive peripheral technologies, to assess, treat, and provide care to a patient remotely.

Home Telehealth is a program for veterans that applies care and case management principles to coordinate care using health informatics, disease management protocols, and technologies such as in-home and mobile monitoring, messaging, and video technologies.

Last, Store and Forward Telehealth is the use of technologies to asynchronously acquire and store clinical information that is then forwarded to or retrieved by a provider at another location for clinical evaluation.

Home-Based Primary Care began in 1970 and provides long-term primary medical care to chronically ill veterans in their homes under the coordination of an interdisciplinary treatment team. Telehealth support for chronically ill veterans can include recording the weight of the patient, sending regular reminders about medication, taking medication, asking key symptoms that indicate the need for a particular intervention.

Telehealth support also allows the patient to send pictures of healing wounds to a nurse or doctor who can then advise on what additional care is needed. In addition, telehealth can act as an educational tool and a support system for a caregiver.

For example, a spouse who might be overwhelmed by the complexity of caring for a loved one is provided with the needed knowledge and skills as well as access to emotional support.

VA Telehealth Services have delivered many positive outcomes. We have increased to primary care and specialist consultations leading to reduced wait times. Telehealth has improved patient outcomes resulting in reduced utilization of inpatient care. For example, in Fiscal Year 2014, when we studied veterans receiving Home Telehealth services for non-institutional care needs and chronic care management, those enrolled veterans had a 54-percent

decrease in VA bed days of care and a 32-percent decrease in VA hospital admissions compared when those veterans were compared to themselves in the year prior to their enrollment in Home Telehealth.

Veterans receiving mental health services via Clinical Video Telehealth, what we call “TeleMental Health,” had a 35-percent reduction in acute psychiatric bed days of care.

In addition, VA Telehealth Services programs reduce the necessity for veterans to travel to VA facilities for care. Clinic Video Telehealth and Store and Forward Telehealth have been shown to result in an average cost savings of \$35 to \$40 per patient per consultation. Home Telehealth has also decreased costs for VA and non-VA care and has been shown to reduce VA net patient costs by \$2,000 per veteran per year that were Home Telehealth that year.

Most importantly, veteran satisfaction scores have rated high with between 88 and 94 percent approval for these kinds of telehealth modalities.

In conclusion, VA is transforming health services from being provider-centric to being veteran-centric. For many veterans and their loved ones, travel to the VA medical centers can be a complicated and sometimes arduous task. Not only that, travel time is time away from the veteran’s work or family. VA’s Telehealth Services programs revolutionize this travel time challenge by changing the location where health care services are routinely provided, improving access to care for veterans, and helping veterans take a more active role in the management of their health and well-being.

Madam Chair, this concludes my testimony, and I am prepared to answer any questions you or other members of the Committee may have.

The CHAIRMAN. Thank you very much.

Dr. Skubic.

**STATEMENT OF MARJORIE SKUBIC, PH.D., PROFESSOR OF
ELECTRICAL AND COMPUTER ENGINEERING, AND DIRECTOR,
CENTER FOR ELDERCARE AND REHABILITATION
TECHNOLOGY, UNIVERSITY OF MISSOURI**

Dr. SKUBIC. Thank you for the opportunity to be here among this distinguished panel and all the Senators and the visitors.

I want to tell you a story about Eva who lived a TigerPlace, the facility that Senator McCaskill mentioned, an aging-in-place senior housing facility in Columbia, Missouri, with 54 independent apartments. Residents can stay there through the end of life. If they need extra help, services are delivered to them.

A private corporation, Americare, build TigerPlace and operates the housing, housekeeping, and dining. Clinical operations are handled through the nursing school at the University of Missouri.

Dr. Marilyn Rantz, a nursing professor at MU, set up TigerPlace to investigate new ways to help seniors age in place. We started testing technology there in 2005.

Back to my story, Eva had a history of congestive heart failure and a cycle of rehospitalization as her condition worsened, got better, and then worsened again. She volunteered to be a participant in our sensor study. We installed motion bed and chair sensors in her apartment. The sensor system detected changes in Eva’s pat-

terns. When Marilyn saw this, she knew that Eva's health was again worsening. If we did not act now, she would have to go back to the hospital again.

In this case, it meant changing her medication. Eva's doctor was resistant to this request because Eva had not gained enough weight to satisfy his standards protocol. However, his one-size-fits-all protocol did not work for Eva. She needed the change now. Marilyn finally convinced the doctor to change Eva's medications, and she never went back to the hospital for heart failure again. This broke the cycle of rehospitalization. The sensors in Eva's apartment picked up subtle changes before Eva or her doctor noticed it.

Since then, we have developed a clinical decision support system with automated health alerts sent to nursing staff. The system now includes a bed sensor that captures pulse, respiration, and restlessness; a fall detection system; and a walking gait analysis system. Sensors are discreetly mounted in the environment and operate without the client required to wear anything or do anything special.

For example, the bed sensor is installed under the bed mattress. Two sensors can be installed in the same bed for couples. To respect the senior's privacy, no surveillance cameras are used. Instead, we use depth images that produce shadowy silhouettes.

The sensor system observes the seniors, learns their typical patterns, and sends alerts to clinical staff when there are signs of health problems. We have detected early signs of pneumonia, urinary tract infections, pain, delirium, and hypoglycemia. In one case, we were able to recognize changes in walking speed and stride length of the husband in the home that corresponded to his early dementia, even when his wife was living there and they had many visitors coming into the home.

In the case of a fall, alerts are sent to staff with a link to a depth video so they can see what happened leading up to the fall. Residents get help immediately.

I do not have a presentation, but pictures and links are included in my written testimony so you can see what these look like, and I would be happy to show them to anybody. As a professor, I carry all of my slides with me, and I have lots.

I have another story about my mother-in-law, Yvette, who did not have this technology. She got up in the middle of the night, fell down and broke her shoulder. My father-in-law, Andy, was sleeping soundly without his hearing aids, so he did not hear her call. She lay on the floor for hours in pain. The next morning, Andy found her, but by then the damage had been done. Her shoulder never healed properly, and she was in constant pain for the rest of her life.

With her damaged shoulder, her mobility was severely limited. She could not cook or bake anymore or pick up her great-grandchildren, and the constant pain was a drain. Even though she survived the fall, her quality of life was drastically diminished. I can imagine a different outcome if she had had our sensors in her home and gotten help immediately.

Research studies have shown that the in-home health alert system works. Seniors with the sensors have better health outcomes.

Seniors with sensors have a longer stay in independent apartments at TigerPlace compared to those without sensors by nearly two years longer. We now have a commercial partner, Forsyth Healthcare, that is bringing this technology to seniors. Many of my colleagues at other universities have also developed exciting technology to help seniors, such as we have already heard today.

The potential for proactive health care is significant. Detecting health problems early so that early treatment can be offered is more effective and less expensive than the current approach and will help keep seniors healthier so they can stay in their own homes.

We have seen this work in Missouri. I would like to see it used throughout our country so that others can benefit, including my Mom and Dad in South Dakota and your loved ones, too.

The CHAIRMAN. Thank you very much for your testimony.

Mr. Strickler.

STATEMENT OF CHARLES S. STRICKLER, CAREGIVER

Mr. STRICKLER. Good afternoon, Chairman Collins, Ranking Member McCaskill, and members of the Committee. On behalf of caregivers of aging parents, thank you all for the opportunity to testify before you today.

It has been a difficult process to find the right assistive technologies to help our parents achieve their goal to age in place in a home environment. My wife and I have widowed mothers who are ages 85 and 76, respectively. Both have always desired to live at home as long as possible. Needless to say, it has been a challenge to stay in tune with their state of mind, safety, and well-being while respecting their spirit of independence and privacy. Living several hours apart makes it even more challenging.

My mother is very independent and lives alone. She is active in her community and continues to enjoy gardening. Consequently, she uses a cellular pendant so she can remain independent and yet have the security of an alert system that enables her to summon help with the touch of a button or automatically if she is incapacitated. It works wherever she goes. Unlike most PERS customers, she is diligent about wearing her pendant. However, we know PERS solutions have been ineffective for the vast majority of users for many reasons.

My mother-in-law's aging experience is one such case. My mother-in-law has experienced a much different aging scenario than my mother. She has dementia. After arriving at her home and finding a toaster oven had been left on for more than 24 hours, it was apparent she needed more assistance and we needed to have her closer to us. We modified a cottage next to our home by incorporating a walk-in tub and handicap accessibility features. She moved in full-time in September 2012.

Our existing home security system would alert us to doors opening and detect motion in each of the four rooms of the cottage, so we were able to know when she was active.

As the dementia progressed, we became concerned about falls. We tried several different PERS products, but she refused to wear the pendants and would not respond to the unfamiliar "voice in the

box.” In short, these products were ineffective and failed to solve our concerns.

We worked with our home security company to find and install some alternative technologies, including a bed sensor, chair sensors, a toilet sensor, a refrigerator sensor, and three big easy buttons to summon help. Incorporated with the existing door and motion sensors, this system enabled Lib to continue to have some independence and privacy while we were able to monitor her normal schedule and get alerts when patterns changed or when issues arose that required immediate assistance. We were able to set parameters that allowed us to be alerted via cell phones to potential falls or wandering alerts, so we could immediately check on her.

For example, bed sensors facilitated tracking normal and changing sleep patterns. The refrigerator sensor helped recognize when she would forget to eat.

Before she had full-time caregiving, pressing the help button summoned help. While the system provides many of the alerts based on individual sensors, it provides a comprehensive wellness overview, including data summary tools that make it much easier to see trends and patterns. User-friendly graphics make it easy to understand what is gradually changing in Lib’s lifestyle. Thus, the system has enabled to us to know when to layer in additional care and assistance, matching it to her state of health as her capabilities changed.

My wife and her twin sister, who are the two primary caregivers, will tell you the three most valued benefits of the system are encompassed by the breadth and totality of the solution.

First and foremost, the system provides a tremendous “peace of mind, assuring us Mom is safe, even allowing us to check on her even when we are not in her cottage.”

The second major benefit is that the technology is a “priceless gift enabling us to honor Mom’s request to stay at home and live as independently as her capabilities allow.” My wife also said, “Financially, it has been a relief to be able to preserve her resources allowing us to provide the best possible one-on-one care now that she needs it.” Had we moved her into assisted living, the costs would have been significant. To date, the cumulative cost for 2091/2 years, moving into an average Virginia nursing home, would have been \$223,000 plus an additional \$104,000 for homemaker and health aide services. In contrast, the cost of our system was about \$2,200, plus a \$59 monthly fee.

While we still need to supplement our own caregiving efforts with contracted home care support, the nominal investment in technology has clearly provided a huge cost savings and a higher standard of care in a more comfortable environment.

The company we are working with has continued to innovate, and now our system has even more capabilities that would have been very useful for our family when Lib was more mobile: a stove sensor alerting caregivers when the stove is left on for prolonged periods; remote control over thermostats, lights, and locks; motion sensors activating lights; alert pendants which can unlock the doors; PERS functionality in their app for quick emergency notifications away from home.

Aging-in-place technologies are not a magic solution that will solve all of our problems of cost-effectively caring for our aging population, but from our experience, they can be a very integral part of the solution. These technologies can be objective tools that can help with the difficult conversations, prolong independence, and help guide assistance intervention, all in a very cost effective and non-intrusive manner, affording both caregivers and their aging loved ones excellent lifestyle choices.

Thank you.

The CHAIRMAN. Thank you very much for your firsthand experience and sharing it with the Committee.

Dr. Kim, as I watched the technology that you illustrated for us today, I could not help but think that I could have thought for years and never come up with the assistive jogger. I realize that there is a certain stigma that is associated with walkers, for example, and that seniors are very eager to avoid those, but how do you come up with the technologies and the products that you are developing at the University of Maine?

Dr. KIM. In terms of that assistive jogger, for instance, that started with two faculty members in disability studies. One of the faculty members, she herself has walking and balance issues and wanted to develop some kind of system so that she could exercise outside and remain active in part of the community. Her goal was to participate in a 5K.

She partnered with a professor in mechanical engineering, and students as well, and developed this assistive jogger, and she was able to complete the 5K, so even though the technology was originally designed for someone with walking issues and who had disabilities, easily you could see that this assistive jogger would be a great piece of equipment for someone who is aging or someone who has had a knee or hip replacement and is going through rehabilitation.

As I mentioned in my testimony, there are also sensors that are included in the assistive jogger so that you can make sure that you are not putting too much weight on a joint, especially if you are, again, rehabbing, so there are lots of technologies that can come from this original technology that can be transferred to the aging people.

The CHAIRMAN. That is an example of where some professors came up with it. Do you survey seniors to see what their biggest problems are? Do you reach out to health care providers, home health agencies?

Dr. KIM. All the above, so as an example, you know, even with a small group of students going to the local assisted living facility in Orono—that is right there—the students in engineering met with residents at this facility, and in a 1-hour period of time, you know, they were asked—the residents were asked, “Well, what could we design that would help you in your daily lives?” In a 1-hour period, they came up with 50 different items that they would like to have designed.

The CHAIRMAN. That is incredible. That just shows that there really is such a need for this kind of innovative devices.

Ms. Orlov, let us look at the other side of this issue. I read an article in which you were quoted as observing that, “Aging in place

does not imply watching us age.” I do understand the concerns about privacy that some of these technologies may raise, particularly web cams, implanted devices even. How can we make sure that we are striking the right balance between maximizing safety so that people can stay in their own homes and yet not making them feel that Big Brother—or maybe actually not Big Brother but the adult child who is watching them?

Ms. ORLOV. Well, the first thing I would like to say about the use of any monitoring technologies, there is a concept opting in and giving permission basically that you are willing, and I know a lot of implementations of monitoring technology have been done under sort of the—I would not call it the “guise,” but on a basis of threats basically: “If you do not let me put this technology in your home, I am going to have to have you move to assisted living because I am too nervous about your well-being to leave you living alone.” I would call that sort of the “loving threat.” The loving threat has worked in many cases, but it is very important that people understand what they are opting into. They are not opting in necessarily to having their every move watched, and people who design technology properly design for alerts that show, for example, the absence of activity in a particular window of time or the absence of going near the refrigerator, the presence of a cat or a dog that may jump by the sensors, the idea that you may go on vacation and, you know, there are your sensors saying you are not moving but you are really away for several weeks, I mean, a lot of thought has to go into how these things are set up and configured, but when configured properly, they can work well.

The CHAIRMAN. Thank you.

Senator McCaskill?

Senator MCCASKILL. Thank you.

I would like to talk a little bit about cost savings and the financial implications of all this and taking things to scale. Professor Skubic, what are the cost savings that you all can attribute to some of these advancements as it relates—one of the things we have tried to stress in this Committee that I think many people out there who are not directly involved, they do not understand that a huge proportion of the Medicaid dollars that are spent in this country are not spent on struggling families who are not working but, rather, are spent on our seniors who are in nursing homes, and that the high proportion of nursing home beds that are Medicaid beds makes this a really important hearing for our debt and our deficit, because if we can figure this out, the cost savings and the implications of those cost savings are dramatic to the long-term problem we have with the demographic bubble that is represented with my generation going into Medicare and ultimately, if not having sufficient money saved, into a Medicaid nursing home bed.

What kind of savings can you actually quantify at this point that we might be able to realize if we started embracing these monitors in people’s homes, these sensors?

Dr. SKUBIC. Well, first I want to clarify something. You know, I am talking about a relatively narrow aspect of this technology rather than the very broad array that Laurie had mentioned, but in the context of what we are doing, we are specifically looking for early signs of health changes, early signs of illness and functional de-

cline, and when we first started working with the nurses, they talked about the typical trajectory of aging and functional decline in a stairstep fashion where you will go on a trajectory—you will go on a plateau for a while until something dramatic happens, and you get dropped down to the next level very quickly until the next, you know, dramatic thing happens.

Our premise was always if we can recognize the beginning of that decline so that an intervention could be offered, we can keep people up at the top of that level, and some people call this “squaring the life curve,” where you go along for some period of time and then there is a sharp dropoff when you die. I mean, I am hoping this is what happens to my parents actually.

Senator MCCASKILL. And to me.

Dr. SKUBIC. To all of us, right. Yes, to all of us, that we would end up being very functionally active until the end.

Senator MCCASKILL. Right.

Dr. SKUBIC. Now, trying to quantify that in terms of cost savings is really hard. We have not yet done the study that really quantifies the effectiveness in those terms, in economic terms, of the technology alone. We are involved in an NIH-funded randomized controlled study right now that has scaled up this work beyond TigerPlace, and we are hoping to have some economic cost-savings figures associated with this.

I can tell you that my collaborate, Marilyn Rantz, has looked at the economic impact of—or the cost savings of using nursing care coordination in this context, which is what they are doing at TigerPlace as well. It is how they do the nursing care as well as how you add the technology part on top of that, and they have shown quite a dramatic potential cost savings associated with what they have been able to do with just the organized and coordinated care, and we have seen, as we have compared the standard level of care at TigerPlace with those—between those who have sensors and those who do not, we see much improved health outcomes and a longer stay in independent living, so I am extrapolating and saying—I do not have the actual quantitative numbers for you, but I suspect that they are quite significant.

If you look in my written testimony, I did include some numbers that are based on just the nursing care coordination, part of it, and those are pretty dramatic by themselves, too. This one statement that is in here—and this comes from Marilyn’s work—that “About 10 million people need long-term care in the U.S.” Of these, 4.6 million are older than 65 and live in the community. These 4.5 million represent a potential \$89 billion in cost savings if everyone had access and participated in the RN nurse care coordinator intervention that has been tested at the University of Missouri. That is huge.

Senator MCCASKILL. Yes, we would love to get the details of that survey, and just as soon as the academic community can begin to put some numbers on some of these advancements.

I know that TigerPlace is more expensive than some of the other facilities that are in the area in terms of care, but I understand it is small, and you guys are doing a lot of research, and I understand all that, but I think we have got to start monetizing these savings as quickly as possible, because the more quickly we can monetize

them, the more quickly we can begin adopting them as part of public policy preferences, which would have a huge impact on their availability to most people.

Dr. SKUBIC. Actually, TigerPlace is not that much more expensive than a lot of other facilities.

Senator MCCASKILL. Just slightly more.

Dr. SKUBIC. Yes, it is not too much more.

Senator MCCASKILL. Yes, that is right. Listen, I am a big fan of what you are doing there. I am not trying to—I am just saying I want to try to deliver this to as many people as possible. I think in the long run not only does it help their lives, but it helps us struggle with how we are going to make sure our grandchildren are not inheriting a debt that they cannot swallow.

Thank you very much.

Dr. SKUBIC. Yes, and I am all in support of that.

The CHAIRMAN. Thank you.

Senator Perdue?

Senator PERDUE. Well, I want to echo the Ranking Member for her comments. There is an ulterior motive. First of all, we want the best care we can for our parents and that generation. They have earned it, and second is this is—I am hearing an opportunity here, a tremendous opportunity to deal with one of the largest cost items we have coming at us in the next 20 to 30 years to affect this debt.

Like several of you, Mr. Strickler and others, I have a personal experience with this. Contrary to some of my political opponents, I do have a mother, and she is 89, and she is very tech savvy. She is independent, but this “aging in place” is a new phrase for me. It is a new phrase for her, but she is living that out.

Contrary to that, my wife’s mother is a bit younger and has just been diagnose with Alzheimer’s disease, and so we have a different trajectory there to deal with.

Dr. McCarthy, I am very excited about what you are doing with the VA. I think you have got a perfect laboratory to answer some of these questions that you are hearing today, particularly about cost, about accessibility, acceptability. You have got a perfect laboratory. You have independent patients who are sometimes in denial about need. Second, you have got a medical staff that might be less than receptive potentially to some of these sort of new technologies, or not. Maybe it is a perfect lab to develop these.

I would like to get your experience about cost, just give us a general sense of that, acceptability with the patients, and also with the medical staffs that you deal with.

Dr. MCCARTHY. I would like to start by answering about home telehealth in particular. We have an example of a little device that would be placed, for instance, in the veteran’s home. I am not going to turn it on, but this is a device that would monitor, for instance, the blood pressure or the weight or the temperature or something of the veteran, and we provide those devices. A device like that costs about \$350 and can be repurposed when one veteran is finished with it, cleaned and used for someone else. The costs of using a device like that are about \$1,600 a year.

When I talked about the cost savings, I did not translate the bed days of care or the hospital admissions into savings, but if you think a veteran before the use of a device like this and after the

use of a device like this, for last year, for the patients we started last year, they had a 54-percent decrease in bed days of care, numbers of days in a facility, and then a 32-percent decrease in actual numbers of admissions, so that translates into a significant cost savings.

I think it is important, though, to know that the devices do not exist alone. The devices are part of a system, and for us, we have home telehealth coordinators, so for about every 100 veterans who are enrolled in our program—and patients need to be selected. It needs to be the right population of patients. For about every 100, we have one care coordinator. We—people smart than me—have published about this data, and we have had inquiries—I have been in the role of Acting Chief Consultant for Telehealth since September. I have inquiries from all over the world where people want to reproduce our results, and some of the problems that people in other countries have experienced, for instance, not having the care coordinator available or perhaps selecting the wrong group of patients. There are four disease conditions for which these are extremely helpful.

One is congestive heart failure that people have mentioned before. Congestive heart failure basically means that the heart is not functioning as strongly, as effectively as it used to, and “congestive” because it backs up, the fluids back up. When the fluids back up, you see things like weight gain, and so weight is an incredibly important sensor for when someone with congestive heart failure is starting to deteriorate because of their diet or because of some other condition, and so when the data about weight is conveyed to, for instance, the home telehealth coordinator, that is a very important piece of information to notice the trend.

Another one is COPD, lung disease, chronic obstructive pulmonary disease, what people sometimes call “emphysema.” Pulse oximetry devices are attached which can measure, for instance, oxygen saturation and give us a hint when someone needs to intervene.

The beauty of the devices is that for us, the veteran and the caregiver do not have to get in the car and travel, but the intervention can be made based on the result that is available.

I also wanted to mention PTSD, which is a very important condition for us, where people are able to track their moods or their symptoms and so forth.

The fourth one I wanted to mention was diabetes, where blood sugars can be monitored and with that other conditions as well.

The care coordinator serves such a crucial role in trending the data, in communicating with the patient, communicating with the health care team, to make sure the interventions happen appropriately.

Senator PERDUE. Well, thank you for that very thorough answer, and thank you all for your contributions today. Thank you.

Thank you, Ms. Chairman.

The CHAIRMAN. Thank you.

Senator Blumenthal?

Senator BLUMENTHAL. Thank you, Madam Chair, and thank you very much for holding this very important hearing.

I want to focus on an aspect of security, which perhaps has not been mentioned so far, and that is the security of the data and the information that is collected, and perhaps begin with you, Ms. Orlov, if you could tell us what specific steps have been taken and what more has to be done to make sure that the personal information, confidential medical and other information, can be kept secure.

Ms. ORLOV. Well, we are in the midst of a data crisis right now in the United States. You all know about the Anthem 80 million records that were stolen and the identity theft that is associated with that. I would say this has created a heightened awareness of all of the players that are in the continuum of care for not just older adults but for everyone, and that includes insurance companies, for which this data was, in fact, stolen, but also includes health care providers and their management of electronic medical records, so the good news is that awareness has been dramatically heightened in the past four to six months.

Senator BLUMENTHAL. Well, awareness has been increased, but should have been heightened years ago.

Ms. ORLOV. Years ago, yes.

Senator BLUMENTHAL. And Anthem's data, for example, was not encrypted. Is yours?

Ms. ORLOV. Are you talking to me? I do not have any data, thank God. The VA maybe you could ask.

Dr. MCCARTHY. Ours is encrypted, yes, sir.

Senator BLUMENTHAL. Would you recommend that data be encrypted as part of this program to provide that kind of insurance?

Dr. MCCARTHY. We certainly would recommend the protection of privacy. It is interesting for us because our journey started in the early 2000's decade, and the technology that was available to ensure privacy and security has changed, and so some of our rules and requirements reflect what was available then. Some of our care into the veteran's home, for instance, is using devices or technology that was required at that point. There are newer means to conduct those kinds of visits, the telehealth visits, and we are migrating our technology that way, but without compromising security and safety.

Senator BLUMENTHAL. I want to ask what may seem to be a complicated question. I am going to try to make it simple. As you know—and I am the Ranking Member of the Veteran' Affairs Committee—we have an ongoing controversy about the 40-mile rule, whether the 40-mile rule should apply to clinics or to the clinics that can provide the care that the veteran needs. A veteran may be within 40 miles of a clinic, but the clinic may not be able to provide the care that is needed, so then a veteran is able to go to a private health provider.

What I am wondering is whether the telehealth program from hospitals, the 100-plus hospitals that there are, to the hundreds of clinics would fill a gap that would enable more veterans to go to the clinics and get the care that they need. How much of that potential have we explored and actually fulfilled? I hope my question is comprehensible to you.

Dr. MCCARTHY. It is, sir, and thanks for your service on the Veterans' Affairs Committee. We appreciate it.

What you are talking about is the part of telehealth that we call "clinical video telehealth," in particular, in which a provider sees a patient, and a lot of folks are familiar with Skype or Facebook—not Facebook. FaceTime, I am sorry, but that is the technology that people are most familiar with, which replicates what goes on with clinical video telehealth. In VA Central Office, I provide care, continue to provide care now as a psychiatrist to patients I had seen in the Salem, Virginia, VA Medical Center from time to time, so those clinical visits can happen from one of our parent hospitals to the community-based outpatient clinics. They can happen from one community-based outpatient clinic to another. They are also happening into the patient's home, and with us, space is a challenge. We are also looking at exploring ways for the provider to not have to take up the space of a medical center to be able to provide this kind of care.

We have probably about 12.7 percent of our patients are engaged in clinical video telehealth or other kinds of telehealth. There is a large opportunity for expansion. It is music to my ears that you ask, and we are working down the barriers that we see and expanding this as an option. I can tell you that someone who wrote in the mid-1990's wrote that the biggest barriers to the expansion of telehealth are not the technologies; they are the administrative burdens, and what we often refer to as the fact that our Nation has a health care system that is excellent, but it is a bricks-and-mortar kind of base health care system based on hospitals.

In Third World countries where there is not a system of hospitals but there are many smartphones, telehealth has taken off in an incredible way to provide access to patients who have the smartphones. It is our goal that we will get to the point where the care can be provided timely, in a veteran-centered way, not clunky, so that it is easy for the provider, easy for the veteran and the family member to be able to have that care.

Senator BLUMENTHAL. And you used percentage, I think, 12 to 20 percent, is that—

Dr. MCCARTHY. I said 12.7 percent.

Senator BLUMENTHAL. 12.7.

Dr. MCCARTHY. Yes.

Senator BLUMENTHAL. Okay, now use the telehealth.

Dr. MCCARTHY. Yes.

Senator BLUMENTHAL. Thank you. Thank you all for your excellent work.

Dr. MCCARTHY. Thank you

The CHAIRMAN. Thank you.

Senator Cotton, welcome.

Senator COTTON. Thank you, and thank you all, as Senator Blumenthal said, for your excellent work on a very critical topic that we will all face one day in our life sooner or later.

Dr. McCarthy, I would like to continue along the lines that Senator Blumenthal was discussing. At the VA, you have focused a lot on various telehealth approaches. I want to expand that a little bit and talk more about home telehealth. In a rural State like Arkansas, we face a couple challenges that are relevant here. One is the

small number of health care providers in rural areas. Second is also the sometimes slow nature of broadband services in rural areas, in particular areas like eastern Arkansas, where we have very low population density or the Ozarks or the Ouachita Mountains, given the line-of-sight issues.

In what you have experienced at the VA, how much of the telehealth challenges do you think are going to revolve around that kind of infrastructure limitation? How much is going to revolve around the novelty of it or the resistance to change that we all have a natural human instinct?

Dr. MCCARTHY. That is a good question. I think there is a requirement for buy-in on multiple parts, administratively from the provider's perspective and from the patient's perspective. We can tell you stories of elderly patients that have kind of coached our younger providers through their first telehealth visit in a way that has been very positive for everybody engaged.

Technology is an issue. We have for home telehealth three kinds of technology that we use: we use device connections; we use the interactive voice responses; and then we use the Web browsers.

The interactive voice responses is how a lot of people used to do their banking. They would put in their number in the phone and what they want to do with what account and so forth, and you can do that either by pushing buttons or by voice recognition.

The device connections can be through the telephone system, just a regular telephone system—it is sometimes called the “P-O-T-S” for “plain old telephone system”—the cellular system or with an Internet type protocol, and then through the Web browser.

We have some devices that we are rolling out that have built-in cellular antennae that allow for that kind of connection, but sometimes the technology is a barrier, and adoption of the technology, but it has been my experience that so many of our aging veterans who have grandchildren at a distance are becoming more and more familiar with the FaceTime and the Skype and so forth, so they are very engaged in this.

The incredible convenience of not having to travel, to park, to kind of figure out what is going on, to move around the medical centers and so forth, to kind of have an appointment at two and see your provider at two and be done and not have to engage in all that whole process has been very well received by them. The home telehealth they are very positive about as well.

Senator COTTON. Ms. Orlov, in your work have you developed a perspective on this question about infrastructure challenges on the one hand and consumer taste preferences and habits on the other hand?

Ms. ORLOV. Well, I have looked into it. One of the things we have not talked about is the role of carriers, telecommunications carriers, in boosting connectivity for older adults. There have been pilot programs in the United States to provide discounts for Internet connectivity for seniors, but at this point there is not a standard program across all the carriers in the United States that would make Internet access affordable for many people of lower income, so that is an opportunity, it seems to me, that can be—we can do a lot more with. The same thing with cell plans, so I think the average cellular plan in the United States now is around \$50 to \$60

a month, and an Internet service plan at \$60 a month now means you are out \$120 a month, which is beyond the means of many people of lower income, so I believe there is an opportunity to work with the carriers and come up with a better idea.

Senator COTTON. I would say for the record it is just another example of the importance of rural broadband.

Ms. ORLOV. Absolutely.

Senator COTTON. It may provide some cost on the up-front, but the savings that we can achieve through the Government in Medicare or in our society as a whole through private insurance are no doubt substantial.

Ms. Orlov, building on some of the work you have done, I have no doubt that there are very strong incentives in the market to provide this kind of technology given that seniors are a rapidly growing population as the Baby-Boom generation retires. They are generally some of the most affluent citizens in our country as well, so there are strong market incentives. Are there strong legal barriers for markets for aging in place to develop, things that we could address as a Congress?

Ms. ORLOV. Legal barriers? Well, I mean, just looking at the physical environment for aging in place, which is the home—right?—and looking at building code and looking at the way even new housing for older adults is being designed, there is no nationwide building code that would make homes even modestly accessible. There is nothing that requires smooth thresholds, nothing that requires wide doorways and bathrooms, nothing that requires sink heights that could potentially enable faucets to be accessed if you are, in fact, in a wheelchair, so if you want to think about something that could be done to enable people to age longer in their home from a policy standpoint, it would be to talk to organizations that lobby on behalf of builders, like the National Association of Home Builders, and look at what are the barriers, and there are probably barriers at the State level in 50 States one way or the other to enabling use of standards. Even if, in fact, you move into the home and you are completely able-bodied and have no issues at all, is your home able to age with you? That is the question.

Senator COTTON. Great. Thank you all again.

The CHAIRMAN. Thank you very much, Senator Cotton. I am very glad you brought up the issue of rural broadband because that is a real issue in my State as well, and I was thinking about some of these sensors and other devices would simply not work in some parts of the State of Maine. It is something that nationwide we really need to do more work on.

I am just going to ask a couple of other questions. Mr. Strickler, I noticed that you did do the cost comparison that all of us are interested in, and you have talked about the cost of the setup was \$2,000 and then a monthly fee of \$59, and if my math is right, when you look over the 2091/2 years, if you had had nursing home plus home health, it is more than \$300,000, and so I think this does have very important cost implications for us, and one of the issues I think we as Congress need to work with the administration on is what is reimbursable to health care providers under the Medicare and Medicaid program, because a lot of times we will pay for the consequences of unchecked diabetes, but we will not pay for

the ongoing consultation that prevents the person from having the complications, and I can see many of you nodding on this, so that is something we need to look at as well.

Mr. Strickler, one final question that I want to ask you, and that is, in your testimony, you mentioned that I think it was your mother-in-law did not want to wear that emergency alert pendant. How did you find out about the alternative ways of keeping her safe by the use of sensors, by putting them all over—it sounds like all over the house. To make sure she is eating, you put on in the refrigerator door. I do not think most people would even know where to begin. How did you get the advice you needed on what you should purchase for her and what was available?

Mr. STRICKLER. I think the approach that we tried to take was to find a trusted adviser that could help us. Honestly, we started grappling in the dark, groping in the dark a little bit, if you would, and explored a couple things that were not successful, and we really reached out and visited with other people that had found solutions that did work, and then said, okay, let us find somebody that really knows and understands technologies and can help sort of guide us through this process, so my advice to anybody also trying to do that would be find a trusted adviser, and then they can help you identify which technologies are appropriate, because different technologies are appropriate in different circumstances, and so I think in our case we reached out to our home security folks, and they were able to sort of help us zero in on things that really spoke to the needs that my mother-in-law had, and when we couldn't get her to wear a pendant, we needed to be alerted if she fell, so having those sensors, being able to identify if she was up and about and did not reach Point A or Point B in a timely fashion, it would send us cellular alerts to let us know, hey, you need to go check on her and make sure if something is amiss, and so that was very helpful to be able to reach out and have that resource.

The CHAIRMAN. Thank you, and my final question is for Dr. McCarthy, and that is, you mentioned that you were doing telemedicine I believe from 900 sites. Is that correct on that?

Dr. MCCARTHY. Let me just check. I believe that is the correct figure, yes.

The CHAIRMAN. I guess my real question about that is: Is this happening from your community-based clinics and your VA hospitals?

Dr. MCCARTHY. Yes.

The CHAIRMAN. Or it is not individual outside providers that you are contracting with?

Dr. MCCARTHY. It could include that, but that is primarily VA driven from our community-based outpatients and our clinics, and some of the sites where the care is provided to would be other clinics or other parts across the country; you know, as a network we are supporting one another, but also the veteran's home as much as possible, too.

The CHAIRMAN. I think the cost savings that you have quoted of \$2,000 per veteran per year, when you start multiplying that, you get into real numbers very quickly.

This has been a very interesting hearing. I want to call on Senator McCaskill for any final questions she might have.

Senator MCCASKILL. I really do not have any final questions, but I do think we need to go back and look and see how we began distributing scooters with reckless abandon. At one point in time in the Medicare program, I know when I began talking about scooters, we actually found a couple of—one woman who worked in my office whose grandmother had three, and the lift chairs and all of those things where we are—in many cases they are needed, but how do we get approval for all those to be paid for by the Medicare program? And what do we need to, instead of paying for those, pay for sensors that can monitor things that will allow us to intervene in a way that is cost-effective and healthy and allow seniors to age in place? And the more quickly the entrepreneurial free market in this country comes with products that can be brought to scale that they can present to the Medicare system for possible reimbursement that would result in these savings, I think the more quickly we could really turn this thing.

I certainly urge all of you that are in academia to continue to reach out in the public-private partnerships that I know many of you are engaged in with your companies at the University of Maine and with your partners at the University of Missouri, and I know the VA has a lot of commercial partners, the more quickly we can get this technology to the point that you do not have to have—I mean, most of us do not have a trusted tech adviser. Therein lies the problem. Most Americans do not even know where to find a trusted tech adviser, because if you look up online for a trusted tech adviser, you are liable to get somebody who is not a trusted tech adviser.

I think the more quickly we can do that, the more quickly we can really make some progress in this area, and I really appreciate this hearing. I learned a lot. I think all of us are motivated at this point to see if we cannot push this envelope, and I thank all of you for your work, and thank you once again, Chairman, for a really good hearing.

The CHAIRMAN. Thank you very much. I think your comments are very well taken. This Committee has held a number of hearings on scams, and we want to make sure that as we start promoting this kind of new technology that can give peace of mind to caregivers and help our seniors age in place and be in the comfort, security, and privacy of their own homes, that we are not opening a whole new avenue for con artists out there who will exploit any possible opening as we have found in our various investigations.

I want to thank all of our witnesses for being here today. Dr. Kim, I love the fact that you are involving the students at the University of Maine and taking them, I suspect, to Dirigo Pines to talk with seniors there, and it is incredible that that 1-hour visit came up with 50 different ideas. That should keep them busy for quite some time.

Each of our witnesses has contributed to our understanding of this issue, and I thank you for taking the time to testify before us today.

Committee members will have until Friday, May 22nd, to submit questions to any of our witnesses or additional materials for the record.

I want to thank Senator McCaskill and all the members of our Committee who participated, as well as the Committee staff who put together an excellent hearing for us today. Most of all, thank you to our witnesses.

This hearing is now adjourned.

[Whereupon, at 3:31 p.m., the Committee was adjourned.]

APPENDIX

Prepared Witness Statements

Technology for Aging in Place

Written Testimony of Laurie M. Orlov

Aging in Place Technology Watch

United States Senate Special Committee on Aging

Wednesday, May 6, 2015, 2:30 p.m.

Chairman Collins, Ranking Member McCaskill, and Members of the Committee, thank you for the opportunity to testify today about the potential and requirement for technology innovation to help older adults age in place. I am here today to describe the demographics that make this market of technology essential – and to describe the categories of enabling technology that will make it more feasible for older adults to meet their own hopes and expectations. According to AARP, nearly 90% of adults aged 65+ want to remain in their own homes.

What is ‘aging in place’? Successful aging has been described as ‘the ability to do things for myself, feel safe, and have good health.’ Aging in place therefore is the ability to successfully age in your home of choice. Aging in place technology, continually innovated by entrepreneurs, provides a useful underpinning and enhancement of the quality of life of seniors as they age in place.

Demographics. Today there are 46.3 million adults aged 65+. There are 20 million adults aged 75+. Furthermore, 46% of women aged 75+ live alone. The Society of Actuaries recently updated life expectancies at age 65 to reflect a new reality: women at aged 65 can now expect on average to live to be 88.8, with 25% of them living to age 90+. Men at 65 will live on average to age 86.6. The average 1-year cost at an assisted living community will be \$51,000/year by 2020, but in the Northeast, San Francisco, Chicago and most memory care units, that number has already been reached. Seniors know this and defer move-in to assisted living communities until they reach their mid-80s.

Aging in place technology categories can be thought of as interlocking pieces of a puzzle that supports and enables successful aging. With all of the puzzle pieces, older adults benefit from innovations that address their ability to connect with other people and opportunities; stay engaged in their communities; be safe; and manage their health and well-being (**see Exhibit A**). Looking at each category, starting with the upper left puzzle piece, these are the categories that matter:

1. **Communication and Engagement.** The devices change, but their purpose remains the same – help older adults stay connected to others – through email, online text and video chat, searching the Internet, participation in forums, playing games, finding people with shared interests, and just as important, finding services and resources that meet changing needs. Today, while 59% of the 65+ population have access to the Internet and 27% have smartphones, both percentages drop off noticeably at age 75. According to Pew Research, only 12% of adults aged 75+ have smartphones.
2. **Safety and Security.** The most fundamental technology in this category is a home alarm system that can monitor and alert about fire, temperature, and excessive moisture in the

Technology for Aging in Place

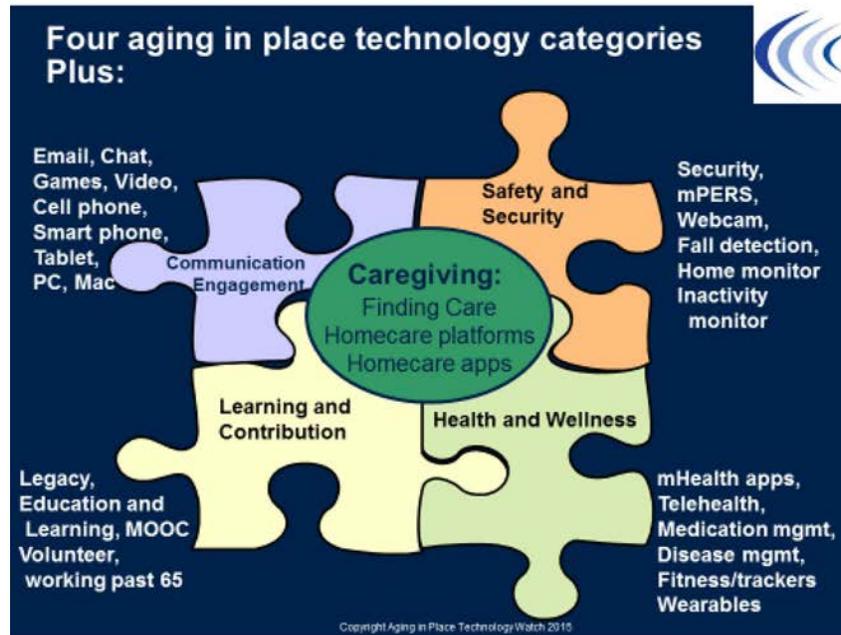
home. Without it, the other technologies are just nice-to-haves. Other useful technologies include personal emergency response system (PERS) pendants, ideally those that enable use away from the home (called Mobile PERS). Also useful are devices with fall detection and home-based motion sensors – sometimes called activity monitors, even the ability to monitor inactivity. Increasingly, information from devices will be combined to detect changes in patterns over time, perhaps noticing gait changes that signal decline -- which may precede a health incident.

3. **Health and Wellness.** These include the growing number of mobile devices and apps, plus wearables, sometimes placed in the mHealth or mobile health category. In addition, Digital Health is the new term for sharing, accessing, and using health information online. Technology to support physical and cognitive fitness has received great attention. And telehealth is the category of technologies used to remotely monitor chronic diseases – and in some cases, consult with the patient and other doctors about those diseases. New software has been developed to help with dementia care; support health care coordination; or help find home care workers. And a variety of new devices are available to assist those with vision and/or hearing impairment.
4. **Learning and Contribution.** This category includes the technologies to help older adults leave a legacy of information about their own history; participate in volunteer organizations; find work; acquire certifications and degrees; and learn new skills both leisure and work-related – all online. Much of this online training is free. Many forums are available to find expertise and ask questions about nearly every topic, including guidance on using new devices. Online access today is expensive – it is available through mobile device data plans (average cost \$60-80/month) and WiFi access – think coffee shops and libraries. Otherwise, older adults need to have high speed Internet access (\$50/month or more) enabled in their own homes.

As people age, all four categories are enhanced by inclusion of the role of the formal or informal caregiver. For the formal (or professional) caregiver, there are newer technologies that not only track time and attendance, but also note the care recipient status for activities of daily living, communications with family members, mobility, eating, and cognitive function. More of these platforms are emerging.

The future market potential includes greater availability of smart phone features, in-car technologies, and even robotics – it has been sized at \$20 billion by 2020. In the future, you will see fewer special-purpose offerings for seniors. There will be more examples of standard hardware/device platforms with customizable software to meet the specific needs of the user. That concept, called ‘Design for All’ can be seen today in the customizable features in cars, tablets, smartphones, televisions, and other consumer electronics.
Thank you very much for your time.

Exhibit A



Testimony Before the Senate Special Committee on Aging
Aging-in-Place
Carol Kim, Ph.D.
Vice President for Research, University of Maine
May 6, 2015

Good afternoon Chairman Collins, Ranking Member McCaskill and Distinguished Members of the Senate Special Committee on Aging, my name is Dr. Carol Kim, and I am appreciative of the opportunity to share with you the technologies that the University of Maine is developing to allow older individuals to age and thrive in place. It could not be timelier. We are convinced that the aging and thriving in place movement is destined to benefit greatly from the rapid deployment of technologies, products, and devices that: maximize human performance; improve mobility, navigation, home environments, and intelligent living; improve emergency detection; and contribute to older adult falls prevention, mitigation, and response. The University of Maine has launched a major cross-campus aging research initiative in partnership with community agencies and organizations and has established an interdisciplinary research incubator, **from social work to engineering to disabilities studies**, that is responding to major public health issues that affect aging Americans.

In the area of **Home Safety Optimization and Falls Prevention** we are developing technologies to promote mobility, avert falling, increase contrast sensitivity, promote outdoor exercise, and improve balance.

(Edge Detection) NEXT SLIDE

One of the most common challenges that occurs with age is a loss of visual contrast sensitivity. This can be extremely dangerous for older adults as it turns commonplace low-contrast features, such as cement stairs, curbs, or benches into falling hazards. Our goal is to improve safety and reduce falling via a cost-efficient solution that can be implemented without any infrastructure build-out. **NEXT SLIDE** To do this, we are

exploring the use of computer vision as a means to detect low-contrast edges in the environment and improve their visibility. **NEXT SLIDE** This technology is likely to reduce the falling problem because it is optimized to address known perceptual and cognitive changes that occur with age.

(Assistive Jogger)

NEXT SLIDE Although walkers, crutches and canes have long been available, these are minimally functional for outdoor exercise, and are perceived as stigmatizing and inconvenient. The assistive jogger was created to fill an unmet need for populations who, without adequate mobility support, would be less likely, unable, or unwilling to participate in ambulatory exercise. The assistive jogger is an aesthetically designed, convenient, foldable, actively steered, three-wheeled standing support device that provides balance and weight bearing assistance during walking, jogging or running. It is fitted with biofeedback and innovative load sensing technology, and is currently in the early phase of commercialization.

In the area of **Falls Mitigation and Impact Minimization** we are developing advanced energy-absorbing clothing technology.

(Head protection) NEXT SLIDE

A team at the University of Maine is currently working to develop non-stigmatizing protective gear to mitigate injury for individuals at risk from falls. The Maine company Alba-Technic, a UMaine corporate partner, has developed a highly effective impact-resisting material system and offers a headgear option for older adults that can be integrated into fashionable headwear, while providing protection against head injury. This technology is lightweight and can be incorporated into caps, scarves, and hats. Performance tests demonstrated a significant potential for reduction in head injury.

Hip protection **NEXT SLIDE**

In 2013, 258,000 people over the age of 65 were admitted for treatment of hip fracture. The Hip Project expands our current work with headgear to innovative, wearable hip protection for elders. UMaine researchers are collaborating with Alba-Technic, to design aesthetically pleasing hip protection consisting of undergarments and a changeable shell that will be regularly worn by elders at risk from falling.

In the area of **Falls Response** we are developing wireless networking technologies with wireless detection and vital sign sensors to assist first responders.

(Indoor Navigation) **NEXT SLIDE, NEXT SLIDE (need to click twice)**

Loss of sensory, cognitive, and motor function that occurs as people age can lead to many safety risks for an older adult living independently. Current responses to this concern involve installation of expensive and obtrusive video monitoring. We have recreated a typical apartment setting for testing a new extensible system that makes use of minute and low-cost technology, such as RFID tags and microcontrollers. RFID tags can easily be embedded into the physical structure of an apartment — under carpets, behind the paint on walls and ceilings. Our RFID reading device is small and designed to be worn comfortably by an individual. The system tracks the user's location as they move about their home and sends an alert if there is a problem. This system will help to reduce in-home falls and improve safety, efficiency, and independence.

NEXT SLIDE Finally, I would like to thank the Committee for the opportunity to describe some of the exciting and necessary technologies that researchers at the University of Maine are pursuing to improve the quality of life for our older population.

**STATEMENT OF
DR. MAUREEN McCARTHY
DEPUTY CHIEF PATIENT CARE SERVICES OFFICER
VETERANS HEALTH ADMINISTRATION
DEPARTMENT OF VETERANS AFFAIRS
BEFORE THE
SENATE COMMITTEE ON AGING**

May 6, 2015

Chairman Collins, Ranking Member McCaskill, and Distinguished Members of the Senate Committee on Aging, thank you for the opportunity to discuss the high quality care and support the Department of Veterans Affairs (VA), Veterans Health Administration (VHA), Telehealth Services programs are providing to our Veterans.

VA Telehealth Services

VA is recognized as a world leader in the development and use of telehealth. Telehealth services are mission-critical to the future direction of VA care to Veterans, and they are one of VA's major transformational initiatives aimed at ensuring care is convenient, accessible, and patient-centered. Telehealth in VA provides innovative services that help Veterans to live independently in their own homes and local communities.

We are committed to increasing access to care for Veterans by placing special emphasis on those in rural and remote locations. Telehealth increases access to high quality health care services by utilizing secure information and telecommunication technologies to provide health care services when the patient and practitioner are separated by geographical distance. In Fiscal Year (FY) 2014, VA provided care to more than 717,000 patients (12.6 percent of our enrolled Veterans) through telehealth modalities. This amounted to over 2,123,000 telehealth episodes of care. Forty-five percent (45 percent) of these Veterans lived in rural areas and may otherwise have had limited access to VA health care services.

In FY 2014, telehealth was implemented in over 900 sites of care and is available for over 45 specialty areas of care. The number of Veterans receiving care via VA's

telehealth services grew approximately 18 percent in FY 2014 and is anticipated to grow by approximately 28 percent in FY 2015. Of course Veterans can elect to have traditional in-person care instead of telehealth. Otherwise, providers determine patient appropriateness for telehealth. We train over 11,400 staff in telehealth annually, and in FY 2014, we provided 271 training sessions for physicians and other clinicians. We also conduct annual competency testing. Telehealth training is provided virtually across VA in order to effectively use VA resources to meet training needs in a timely and efficient manner.

VA Telehealth Modalities

Operating the Nation's largest integrated health care system, VA uses a wide variety of technologies to ensure excellence in care delivery. New technologies are revolutionizing health care. VA utilizes the following three telehealth modalities to deliver care to Veterans:

Clinical Video Telehealth

Clinical Video Telehealth (CVT) is the use of real-time interactive video conferencing, sometimes with supportive peripheral technologies, to assess, treat, and provide care to a patient remotely. Typically, CVT links the patient(s) at a clinic to the provider(s) at another location. CVT can also provide video connectivity between a provider and a patient at home. CVT encompasses more than 45 clinical applications in VA such as in specialty and primary care.

Home Telehealth

Home Telehealth (HT) is a program for Veterans that applies care and case management principles to coordinate care using health informatics, disease management protocols, and technologies such as in-home and mobile monitoring, messaging, and/or video technologies. The goal of HT is to improve clinical outcomes and access to care while reducing complications, hospitalizations, and clinic or emergency room visits for Veterans in post-acute care settings, high-risk Veterans with chronic disease, or Veterans at-risk for placement in long-term care.

Store and Forward Telehealth

Store and Forward Telehealth (SFT) is the use of technologies to asynchronously acquire and store clinical information (e.g. data, image, sound, and video) that is then forwarded to or retrieved by a provider at another location for clinical evaluation. VA's national SFT programs cover services that provide this care using a clinical consult pathway and a defined information technology platform to communicate the event/encounter between providers, as well as enabling documentation of the event/encounter and the associated clinical evaluation within the patient record. Teleretinal imaging to screen for diabetic retinopathy is the first such program, and along with Teledermatology, has increased access to care for almost 2 million Veterans.

Home and Community Based Care Programs for Older Veterans

Home-Based Primary Care (HBPC) began in 1970 and provides long-term primary medical care to chronically-ill Veterans in their own homes under the coordination of an interdisciplinary treatment team. HBPC has led to guidelines for medical education as well as use of emerging technology in home care and improved care for Veterans with dementia and their families who support them. In 2015, HBPC programs were located in 157 VA medical centers and more than 165 Community-Based Outpatient Centers (CBOC). HBPC is provided through our Geriatrics and Extended Care Services and partners well with Telehealth Services.

VA Telehealth Outcomes

VA Telehealth Services has delivered many positive outcomes. It has increased access to primary care and specialist consultations leading to reduced wait times. It has improved patient outcomes resulting in reduced utilization of inpatient care. For example, in FY 2014, Veterans receiving HT services for non-institutional care needs and chronic care management had a 54 percent decrease in VA bed days of care and a 32 percent decrease in VA hospital admissions compared to the same patient data prior

to their enrollment in HT. Veterans receiving mental health services via CVT (TeleMental Health) had a reduction in acute psychiatric bed days of care of 35 percent.

In addition, VA Telehealth Services programs reduce the necessity for Veterans to travel to VA facilities for care. CVT and SFT have been shown to result in an average cost-savings of \$35 to \$40 per patient, per consultation. HT has also decreased costs for VA and non-VA care and has been shown to reduce VA net patient costs by \$2,000 for Veterans that were receiving telehealth for a year.

Lastly, in FY 2014, Veteran satisfaction scores have rated high with 94 percent approval for CVT, 88 percent approval for HT, and 93 percent approval for SFT.

Conclusion

In conclusion, VA is transforming health care services from being provider-centric to being Veteran-centric, reducing or eliminating the time required to travel to a VA medical facility. VA's Telehealth Services programs revolutionize this travel time challenge by changing the location where health care services are routinely provided, improving access to care for Veterans, and helping Veterans take a more active role in the management of their health and well-being. We are proud of our accomplishments in telehealth, and we strive to expand our virtual medical modalities to enhance high-performance, patient-centered care for Veterans.

Mr. Chairman, this concludes my testimony. My colleagues and I are prepared to answer any questions you, or other Members of the Committee, may have.

**Oral Testimony for Marjorie Skubic, Ph.D., Professor,
Electrical & Computer Engineering, University of Missouri
US Senate Hearing, Special Committee on Aging
May 6, 2015**

I want to tell you a story about Eva, who lived at TigerPlace, an Aging in Place senior housing facility in Columbia, MO with 54 independent apartments. Residents can stay there through the end of life. If they need extra help, services are delivered to them. A private corporation, Americare, built TigerPlace and operates the housing, housekeeping, and dining. Clinical operations are handled through the Nursing school at the University of Missouri. Dr. Marilyn Rantz, a nursing professor at MU, set up TigerPlace to investigate new ways to help seniors age in place. We started testing technology there in 2005.

Back to Eva - Eva had a history of congestive heart failure and was in a cycle of re-hospitalization as her condition worsened, got better, and then worsened again. She volunteered to be a participant in our sensor study. We installed motion, bed and chair sensors in her apartment. One day, the sensor data showed changes in Eva's patterns. When Marilyn saw this, she knew that Eva's health was again worsening. If we didn't act now, she would have to go to the hospital again. In this case, it meant changing her medication. Eva's doctor was resistant to this request, because Eva had not gained enough weight yet to satisfy his standard protocol. However, his one-size-fits-all protocol did not work for Eva. She needed a medication change now. Marilyn finally convinced the doctor to change Eva's medications, and she never went back to the hospital for heart failure again. This broke the cycle of re-hospitalization! The sensors in Eva's apartment picked up subtle changes before Eva even noticed it.

Since then, we have developed a clinical decision support system with automated health alerts. The sensors now include a bed sensor that captures pulse, respiration, and bed restlessness, a fall detection system, and a walking gait analysis system. Sensors are discretely mounted in the environment and operate without requiring the resident to wear anything or do anything special. For example, the bed sensor is installed under the bed mattress; two sensors can be installed in the same bed for couples. To respect the seniors' privacy, no surveillance cameras are used. Instead, we use depth images that produce shadowy silhouettes. The sensor system observes the seniors, learns their typical patterns, and sends alerts to clinical staff when there are signs of health problems. We have detected early signs of pneumonia, urinary tract infections, pain, delirium, and hypoglycemia. We can even track changing walking patterns when there is more than one person living in the home. In one case, we were able to recognize changes in walking speed and stride length of the husband in the home, that corresponded to his early dementia, even with his wife living there and many visitors. In the case of a fall, alerts are sent to staff with a link to a depth video so they can see what happened leading up to the fall. Residents

get help immediately! Pictures and links are included in my written testimony so you can see what these look like.

I have another story about my mother-in-law, Yvette, who did not have these sensors in her home. She got up in the middle of the night, fell down, and broke her shoulder. My father-in-law, Andy, was sleeping soundly without his hearing aids, so he did not hear her call. She lay on the floor for hours, in pain. The next morning, Andy found her, but by then, the damage had been done. Her shoulder never healed properly, and she was in constant pain for the rest of her life. Yvette had a large family and enjoyed cooking for them. With her damaged shoulder, her mobility was severely limited. She couldn't cook or bake anymore or pick up her great-grandchildren. And the constant pain was a drain. Even though she survived the fall, her quality of life was drastically diminished. I can imagine a different outcome if she had had our sensors in her home and had gotten help immediately.

Research studies have shown that the in-home sensor technology works. Seniors with the sensors have better health outcomes. Seniors with sensors have a longer stay at TigerPlace compared to those without sensors – by nearly two years. We now have a commercial partner, Foresite Healthcare, that is bringing this technology to seniors. Many of my colleagues at other universities have developed impressive technology to help seniors. The research results are clear. The technology works! And if the funding were not so hard to get right now, you would see many other researchers working in this area, because we want to help.

So why are these systems not in every senior's home? In my opinion, it is policy, not technology, that is holding back widespread adoption. This technology has the potential to yield enormous cost savings. Detecting health problems early so that early treatment can be offered is cheaper and will help keep seniors healthier so they can stay in their own homes. We have seen this work at TigerPlace. I'd like to see it used throughout our country so that others can benefit, including my mom and dad, and your loved ones too!

United States Senate Special Committee on Aging

Benefits of Aging-In-Place Technologies

Testimony of Charles S. Strickler

May 6, 2015, 2:00 PM,
Dirksen Senate Office Building

Good afternoon Chairman Collins, Ranking Member McCaskill and members of the Committee. On behalf of caregivers of aging parents thank you for the opportunity to testify before you today.

Preface

Finding the right assistive technologies to help our parents fulfill their aspirations to "age-in-place" in a home environment, has been a long and arduous journey. It has required a significant amount of research, extensive networking, frequent trial and error, dogmatic persistence as well as a sense of humor. The process has been filled with disappointments and frustrations derived from a wide variety of issues, such as products and services that created false expectations or simultaneously dealing with multiple solutions because singular solutions were inadequate. However, our perseverance to find useful and appropriate technology aging-in-place solutions has paid huge dividends, that are fulfilling our parents hopes, providing caregivers and family "peace of mind," while conserving resources and helping to provide an optimal quality of life for our aging parents.

Throughout this statement I may discuss "working with various companies" in order to develop/innovate solutions, address problems or issues, or explore various technology alternatives. Other than being a customer/consumer I have no current affiliation, contract, or agreement (other than a customer service agreement) with anyone in the alarm/security or Personal Emergency Response System (PERS) industry nor have I received any discount, free goods or services or any other form of compensation.

For the sake of full disclosure, I should report that I have been considering investing in a business venture in this industry, because I believe more needs to be done to meet the

growing need for Aging-in-Place Technology Solutions. However, that decision has no impact or bearing on my testimony.

Background

My wife and I both have widowed mothers who are 85 and 76 respectively. Both have always expressed a very strong desire to live at home as long as possible. We are centrally located between both of our mother's homes, which are about 2 hours in opposite directions. For those of us trying to lookout for our aging parents it's a challenge to stay in tune with their state of mind, their safety and well being while respecting their spirit of independence and privacy. This is even more of a challenge when you are trying to do this living several hours apart.

One of the solutions for our family has been to adopt technologies that assist us in this complex endeavor. This has not been an easy or straight forward process. We discovered many things that did not work as advertised, that were a waste of money or simply inadequate for the task at hand. Fortunately, after a bit of trail and error we have been able to zero in on solutions that worked even better than we had expected and we have found companies that listen to our request and continue to innovate in order to better meet our needs.

Our Experiences with Aging-in-place Technologies

My mother is still very independent, quite frequently on the go, yet living at home alone. She has extensive gardens around her home that she continues to enjoy tending. While she enjoys having her adult children and grandchildren visit she doesn't want us hovering or to feel like she is a burden on us. She has been very proactive on many issues, in order to stay at home longer. Over the years she modified her home to accommodate single level living, making it more accessible with a ramp, incorporating automatic lighting, and adding a security system. When we became concerned that she could fall, we tried to get her to add a panic button, however, she said she always had her cell phone on her, so she could call if she needed help. After she fell, dislocating her rotator cuff and tearing the labrum, she was unable to access her cell phone. At that point, she recognized the value of having a push button pendant. Today she uses a cellular pendant, so she can remain independent and yet have the security of an alert system that enables her to summon help at the touch of a button. In the event of a fall where she could not active the button, it can also automatically notify someone to summon assistance, no matter where she goes.

Unlike most people with pendants, she is diligent about wearing her pendant. However, we know PERS systems have been ineffective for the vast majority of users for many

reasons. The reasons include: 1. not wearing the pendant 2. responding that things are ok even when they they really need help 3. fall detection not activating an emergency response 4. drained batteries 5. seniors worried that emergency responders will knock their door down if the resident cannot get to the door to open it, as well as a variety other reasons. We had first hand experiences like these with my mother-in-law, but her biggest complaint, aside from not wanting to wear a pendant, was that she simply didn't want to "talk to an unfamiliar voice in a box."

My mother-in-law has experienced a much different aging scenario than my mother. She was always quite independent, working as a realtor well into her 70's because she enjoyed visiting with people and helping them find homes. We did not recognize it at the time, but around age 75 she started to experience some mild signs/symptoms of dementia. She was still working as a realtor and was able to hide these issues for several years from everyone including family. They did not really come to light until my wife started helping with her finances. At first, the progression of decline was fairly mild and slow and not really noticeable, until about 5 years ago. At that time she was able to live at home with her adult children looking in on her and bringing her some prepared meals to ensure she was eating healthy. After arriving at her home and finding the toaster oven had been left on for over 24 hours, it was apparent she needed more assistance and we needed to have her closer to us.

In late 2011/early 2012 we modified a guest cottage next to our home, to incorporate a walk in tub and handicap accessibility features (on grade access, wide doors, etc). It already had a security system with door sensors and motion detectors. She started brief visits to the cottage in June of 2012 and moved in full time in September of 2012. Our home security system would alert us to doors opening and detect motion in each of the 4 rooms of the cottage. We set alerts to let us know when she opened the doors and by looking at the motion detector sensor history we were able to know when she was active.

As the dementia progressed we became more and more concerned about falls, we tried several different Personal Emergency Response Systems, she refused to use the pendants. When we tested them she absolutely would not respond to the "voice in the box". In short, these solutions were a waste of money and failed to solve our concerns.

We worked with our home security company to find some alternative technologies that would be a better solution to help keep her safe and yet still remain somewhat independent. We installed bed sensors, chair sensors, a toilet sensor, a refrigerator sensor and three big easy buttons to summon help. Incorporated in with the existing

door sensors, this system enabled Lib to have some independence and privacy while we were able to monitor her normal schedule or get alerts when patterns changed, deviated from the norm, or issues arose that required immediate assistance. We were able to set parameters that allowed us to be alerted via our cell phones to potential falls or wandering alerts, so we could immediately check on her. It was comforting to know when she fell and couldn't summon help, that we were getting timely alerts. The bed sensors would enable us to know how often she got up at night and recognize changes in her sleeping patterns. With the refrigerator sensor we were able to recognize when she would forget to eat. The toilet sensor enabled us to recognize higher than normal usage rates and have her checked and treated for a urinary tract infection proactively, avoiding what could have been a costly and traumatic hospitalization. Before she had full time assistance, she would press the help button to summon one of us to help her. In those early stages of dementia, it enabled us to stay close without hovering over her, a practice that would raise her ire.

While the system provides many of the alerts based on individual sensors, it also has data summary tools that make it much easier to see trends and patterns. Additionally it provides a comprehensive "wellness" overview. All of these user friendly graphics makes it easy to see and understand what is gradually changing in Lib's lifestyle. Thus the system has enabled to us to know when to layer in additional levels of assistance and care, matching it to her state of health as her capabilities decline.

The system we are now using for my mother-in-law has also been very robust and reliable, almost flawless. Other systems we have used for home automation did not have this level of reliability, in fact they would "crash" and need to be restarted, which is unacceptable for situations that are critical for life safety.

My wife and her twin sister who are the two primary caregivers, will tell you the two biggest benefits of the system are first and foremost that, "The system provides a tremendous "piece of mind," assuring us Mom is safe, even allowing us to check on her even when we are not in her cottage." The second major benefit is that "The "peace of mind" experienced with this technology is a priceless gift enabling us to honor Mom's request to stay at home and live as independently as she is capable." They were concerned with the setup in the nursing homes they visited and were certain that due to the volatile nature of the dementia she was experiencing, that environment would have been particularly difficult for their mom.

My wife also said, "Financially, it has been a relief to be able to preserve her resources allowing us to be able to provide the best possible one-on-one care now that she needs it." Had we moved her into assisted living, the costs would have been astronomical. So far the cumulative cost for 2 1/2 years, moving into an average Virginia nursing home would have been \$223,000 plus an additional \$104,000 for homemaker/health aid services, (based on the Genworth 2013 Cost of Care Survey). In contrast, the cost of our system was \$2,189.24 plus a monthly fee of \$59. While we have still needed to supplement our own caregiving efforts with contracted home care support, the nominal investment in technology has clearly provided a huge cost savings. But more importantly, we think she has been able to enjoy a higher standard of care in a more comfortable environment.

Since a stroke last October, and her higher fall risk due to orthostatic hypotension, we have supplemented our care giving efforts with professional care givers. This ensures that someone can be with her around the clock. While the system is not as critical, it is still useful to monitor her health patterns, summon help, and assure that she has the attentive care she needs. The system also helps us be aware when outside caregivers may not be as attentive as we expect.

I am grateful we were able to be a beta site, (we were the first wellness consumer site with the bed, chair, toilet and easy button sensors). It was also gratifying to be invited on many occasions to provide feedback and suggestions that continue to make our system even better. I am happy the company we are working with has continued to innovate and now our system has even more capabilities that would have been very useful for our family when Lib was more mobile. Specifically, they now offer a stove sensor that will send an alert to caregivers when the stove is left on for a prolonged period. As you can imagine this is a disconcerting problem we dealt with on several occasions, at the time our only recourse was to either remove the stove and toaster oven or cut the circuit breakers off. Another challenge we had was trying to make sure she had the thermostat set at an appropriate level. In addition although we had automatic night lights, we were concerned that she would not turn on enough lights when she needed them so that she could move around safely. Our system now allows caregivers to control the thermostat and the lights remotely so that you don't have to call or make a special trip to check on it. Additionally our motion sensors can activate lights when someone is up and about at night. Another problem we have been concerned about is access, specifically unlocking the door. Our existing solution is a lock box next to the door, which needless to say, takes time to access and has been a less than ideal solution. They have also addressed this problem with locks that can be unlocked by a senior pressing a pendant or a caregiver unlocking it remotely. This solution enables

anyone responding to an emergency faster access to a residence to provide rescue services, as well as avoiding the significant cost of replacing or repairing a front door that could have otherwise needed to be forced open. Another challenge and concern we had from the outset was how Lib could have stayed connected when she was away from home. They are in the process of adding mobile PERS functionality to their app so that seniors are protected at all times, even when they leave their homes. With a simple tap on their mobile device, they can let their loved ones and emergency services know that they are in trouble and exactly where they are located. While each innovation may seem small, they are really important solutions for primary caregivers like my wife and her sister who needed help solving each of these sometimes very stressful issues.

Summary Conclusion

In summary, with our wellness monitoring system we were able to avoid moving my mother-in-law to a nursing home, it extend her assisted "independence" by several years with a nominal cost and a significant cost savings, it also helped provide a high standard of care and living. Most importantly we are honoring her plea to "live at home rather than a nursing home."

Had we been able to install a wellness monitoring solution like the one we have today in my mother-in-law's home a decade ago, we may have been more attuned to changes in her abilities and the onset of her dementia. We still may not have been able to find any medical intervention to slow or alter the course of the disease, but we definitely would have had an objective narration tool to help with the "difficult conversations" that are sometimes needed to assure a loved ones safety and welfare.

Aging-in-place technologies are not a silver bullet solution that will solve the problems of cost effectively caring for our aging population, but from our experience, they can be a very integral part of the solution. These technologies can be objective narration caregiving tools, that can prolong independence and help guide assistance intervention, all in a very cost effective and non-intrusive manner, affording both caregivers and their aging loved ones excellent lifestyle choices.

Questions for the Record

U.S. Senate Special Committee on Aging
 "Aging in Place: Can Advances in Technology Help Seniors Live Independently?"
 May 6, 2015
 Questions for the Record
 Ms. Laurie Orlov

Senator Robert P. Casey, Jr.

Question:

Aging in place is a simple but deeply important goal that can improve seniors' care and quality of life while driving down healthcare costs. What are your top recommendations for steps the government can take to facilitate the development and widespread use of safe and effective aging in place technologies?

Response:

- **Innovation Grant.** Create a program that seeks and funds independent living/aging in place technology innovations. These should be partnered with implementing organizations with the power and reach to help deploy them – as was done with [CMS Innovation](#) awards launched a few years ago.
- **Provide incentives** and work with Verizon, AT&T and Comcast to create new discount programs for lower-income seniors so that broadband in their homes becomes financially feasible.
- **Sponsor a 'Got Internet' campaign** that invites multiple for-profit and nonprofit stakeholders to contribute marketing dollars.
- **Protect identity.** Present a bill for a national effort to replace easily-stolen Social Security numbers with a new identifier and processes to manage that information and protect it from hackers.
- **Market tech-enabled remote health services.** Actively promote and incent remote health services (telehealth/aka digital health) that can be accessed online or by phone.
- **Get Secure.** Promote a 'Get Secure' initiative to help find innovations that keep seniors' information secure and their identities protected – not just for Social Security.

Question:

Technology has transformative power, but sometimes the pace of change can lead to unintended consequences. Mr. Strickler's testimony referenced the "trial and error" his family had to go through before finding systems that worked consistently and accurately. Without taking away from the major advances that have been made in this space, we also need to make sure that progress does not come at the expense of safety. What role does the government currently play in making sure these products are safe and used effectively? As these products help families find

alternatives to institutional care, how do you see this role evolving or expanding over time as new technologies are used more widely?

Response:

- **Create a national registry, sub-contract to a national organization.** Unless an offering must be HIPAA-compliant re: data sharing or FDA-compliant because it is considered a drug, the government plays little role in ensuring that technologies work as described. The government could create a national registry of new products, but managing that and keeping it current is difficult and must be sub-contracted to an organization with the appropriate mission (AARP? NCOA?).
- **Aggregate information centrally.** As families keep aging relatives at home longer, today's mechanics (search the Internet) are too ad-hoc for providing them information about support services (like home care) and related technologies (like home monitoring). A good analogy is Medicare's [Nursing Home Compare](#) site. **Aging Tech Compare** could be sub-contracted to organizations that already aggregate products – [firstStreetOnline](#) or [Amazon50+](#), or possibly [AARP Products](#) for example.
- **Provide a hotline for questions.** Once information is aggregated, a hotline should be created that outsources the task to whichever organization created the government **Aging Tech Compare** site.

U.S. Senate Special Committee on Aging
"Aging in Place: Can Advances in Technology Help Seniors Live Independently?"
May 6, 2015
Questions for the Record
Ms. Marjorie Skubic

Senator Robert P. Casey, Jr.

I appreciate the opportunity to respond to your questions. The responses are a joint effort with my team at the Center for Eldercare and Rehabilitation Technology at the University of Missouri, and a result of our experiences for over ten years in developing and testing new technology and care models in TigerPlace, a true aging in place housing facility. In particular, the following professors contributed to the responses:

- Marilyn Rantz, PhD, RN, FAAN, Curators' Professor, Sinclair School of Nursing
- Lanis Hicks, PhD (Health Economist), Professor Emerita, Department of Health Management and Informatics

In addition to responding to Senator Casey's questions, we also include a cost analysis in response to Senator McCaskill's question during the hearing.

Respectfully,
Marjorie Skubic, PhD
Professor, Electrical and Computer Engineering
Director, Center for Eldercare and Rehabilitation Technology
University of Missouri, Columbia, MO

Question:

Aging in place is a simple but deeply important goal that can improve seniors' care and quality of life while driving down healthcare costs. What are your top recommendations for steps the government can take to facilitate the development and widespread use of safe and effective aging in place technologies?

Response:

Our top three recommendations are listed below.

- We agree that aging in place (AIP) offers tremendous potential for improving care and quality of life while decreasing healthcare costs. We recommend Medicare/Medicaid reimbursement of AIP technology together with nursing care coordination to ensure proper use of the technology and interpretation of the data. Based on our research at TigerPlace, the combination of technology and care coordination offers a huge potential for saving government-reimbursed costs. See the cost analysis below (question #3).

- Effective and safe application of the AIP technology and care coordination requires an adequate infrastructure. The lack of technology and networking infrastructure has hindered the adoption of AIP technology, for example, lack of IT staff, computers, electronic health records, and connectivity among different entities. We recommend that policies be enacted to incentivize adoption of technology and networking infrastructure.
- More research is needed to determine the type of AIP technology needed for different health conditions and different population groups to achieve an optimal safe and cost-effective approach. For example, there is a strong potential for AIP technology to help residents in HUD housing, while saving costs. We recommend the funding of large scale studies to test the effectiveness and costs associated with the use of the AIP technology. In particular, the AIP technology should be tested in HUD housing.

Question:

Technology has transformative power, but sometimes the pace of change can lead to unintended consequences. Mr. Strickler's testimony referenced the "trial and error" his family had to go through before finding systems that worked consistently and accurately. Without taking away from the major advances that have been made in this space, we also need to make sure that progress does not come at the expense of safety. What role does the government currently play in making sure these products are safe and used effectively? As these products help families find alternatives to institutional care, how do you see this role evolving or expanding over time as new technologies are used more widely?

Response:

There are regulations already in place. For example, existing UL regulations address the general safety in the electronics systems. Also, there is a regulatory process already in place for Home Health/Home Care agencies that are likely to deploy AIP technologies in the home. Rather than adding more government regulations, we recommend allowing and encouraging more innovation at this stage, so that new ideas may easily be developed and tested. For example, incorporating FDA regulations to home-based AIP technology will likely result in decreased innovation and development. Instead of a government regulatory process, an independent consumer-based process would be more appropriate at this stage. The work done by another hearing witness Ms. Laurie Orlov in her blog, *Aging in Place Technology Watch*, serves to inform the public about the advantages, limitations, and cautions of AIP technology. This is done without government costs and without constraining new development. As more AIP technology is adopted, additional services will emerge to fill this need.

COST ANALYSIS QUESTION DURING HEARING

How much cost savings can we expect with the in-home sensors and early illness detection?

Response:

Our research at TigerPlace shows that seniors living with in-home sensors and early illness health alerts stay at TigerPlace in independent apartments 1.7 years (621 days) longer, on average, compared to TigerPlace seniors receiving normal care without the sensors [1]. Note that all TigerPlace residents receive excellent nursing care, including care coordination. Thus, the extra 1.7 years of stay is due to the effect of the AIP technology added to the care coordination. See also [2] [3] for more information.

We have used this finding to make two different cost comparisons. First, we compute the average cost to the consumer for the additional 1.7 years of stay at TigerPlace with the added cost of the in-home sensor system. This cost is then compared to 1.7 years in a skilled nursing facility, using the average cost across the U.S [4]. See **Table 1**. For seniors living in their own homes, this cost savings could be substantially more, depending on their housing and food costs at home, even after adding the yearly care coordination costs of \$1800.

Table 1. Cost comparison of TigerPlace (independent living) vs. skilled nursing for 1.7 years

Projections	Components	Total
Average yearly cost at TigerPlace	\$60,000	
Yearly sensor cost	\$2,400	
Total yearly cost	\$62,400	
1.7 years independent living		\$106,080
Average yearly cost in skilled nursing [4]	\$80,000	
1.7 years skilled nursing		\$136,000
Cost savings per person		\$29,920

Secondly, we estimate the potential government cost savings to Medicaid-funded long-term care if seniors are able to stay in their own homes for an additional 1.7 years. We project the cost savings, assuming that the AIP technology (in-home sensor system) and the care coordination are reimbursed. As seen in **Table 2**, these costs are relatively small compared to the average cost of long-term care paid by Medicaid. For comparison purposes, we use the average Medicaid cost in Missouri [5].

Table 2. Reimbursement cost comparison of aging in place in your own home with technology and care coordination vs. Medicaid-funded long-term care

Projections	Components	Total
Yearly sensor cost	\$2400	
Yearly care coordination	\$1800	
Yearly cost AIP in your home	\$4200	
1.7 years AIP in your home		\$7,140
Average yearly cost of long-term care paid by Medicaid in Missouri (\$152/day) [5]	\$55,480	
1.7 years long-term care		\$94,316
Cost savings per person		\$87,176

References

- [1] Rantz M, Lane K, Phillips LJ, Despina LA, Galambos C, Alexander G, Koopman RJ, Skubic M & Miller M. (in review). Enhanced RN Care Coordination with Sensor Technology: Impact on Length of Stay in Aging in Place Housing. Nursing Outlook.
- [2] Center for Eldercare and Rehabilitation Technology website, University of Missouri. <http://www.eldertech.missouri.edu>
- [3] Aging in Place website, University of Missouri. <http://www.agingmo.com>
- [4] Genworth 2014 Cost of Care Survey, Genworth Life Insurance Company. Available online at https://www.genworth.com/dam/Americas/US/PDFs/Consumer/corporate/130568_032514_CostofCare_FINAL_nonsecure.pdf
- [5] Rate List of Nursing Facilities Participating in MO HealthNet as of 06/01/15. Available on-line at <http://dss.mo.gov/mhd/providers/pages/nfrates.htm>

Statements for the Record

Technology for Aging in Place



2015 Market Overview

January 2015

Laurie M. Orlov
Principal Analyst

Aging in Place Technology Watch



FORWORD



What is the line between a distinct product market and tech customization? In 2009 when the original Market Overview was published, the search began to identify the small group of entrepreneurs focused on serving seniors – from the AirGuru SV1 Video Phone and Big Screen Live all the way to WellAware and Wellcore. Why note such a market, you might ask? All of those companies and many others had the heart and focus to try to craft something usable by and for an older adult. In many cases these were inventions compensating for a gap in care and oversight, but most often filling a gap in internet access and/or usability of devices and software.

And the search is still on. Both heart and innovator enthusiasm have skyrocketed, as you will see by a recent market sizing and also with investor interest in the growing aging demographic numbers. Arguably the most significant device invention for seniors was the introduction of the iPad in 2010 -- which cast a pall on the utility of PCs. Now that very same iPad seems impossibly heavy and awkward. While researching the 36 technology additional entrants into the 2015 Market Overview, it appears that a corner has turned. As this market opportunity has become interesting to investors and inventors, innovators recognize that customization (think Easy Mode), re-purposing, and training on broadly available technologies may be as useful as creating a brand new device from scratch.

What happened along the path from 2009 to today? Let us count the ways. Foremost – costs jumped for health care and prescription drugs. The older population aged 65+ ballooned from 39.6 million to 47.9 million projected for 2015. Life expectancy averages moved from the early 80s now up to 88.8 for women. As of 2013, nearly half of women who are aged 75+ lived alone. While Internet access was expanded in some geographic areas, adoption has not kept pace with the pace of change in society. Physical locations like banks, Social Security offices, retail stores and pay phones have disappeared. Wearable technology innovation investment has skyrocketed, particularly in fitness/activity tracking and disease/wellness monitoring – yielding a nearly unlimited variety of fitness and health-related devices that are relatively inexpensive compared to the \$1200 Intel Health Guide so-called portable telehealth unit of 2008.

Moving from niche market to the way things should work. In January, 2011, the first baby boomers began turning 65. Surprise -- marketers noticed. One day you look around a pharmacy like CVS and the store has better lighting and more chairs. Then Amazon launches a website that leads with adult diapers. Oops. Make that Active & Healthy Living. AARP introduced the RealPad in 2014, arguably on the late side, as consumer tablets go and have gone. The organization's Health Innovation@50+ team has estimated the opportunity for 100 million people aged 50+ to be \$2.7 trillion and dubbed the related businesses as the Longevity Network. As the pace of tech change inevitably accelerates, the older population will need ever more training on how to use their tablets and smartphones -- just as much as they (still) need affordable broadband access. And as bank branches close, paper checks disappear, the movie theaters empty in favor of Netflix, and visits with doctors move online, that training on new technology needs to be both pervasive and -- let's hope -- persuasive.

Laurie M. Orlov, Founder, Aging in Place Technology Watch

**WHO SHOULD READ THIS REPORT?**

This report was most recently revised in January, 2015, right after the 2015 Consumer Electronics Show, updating products, services, websites, and apps. It serves as a market overview with a single purpose: it is intended to describe the need for, and the current market of, offerings to help aging adults live full lives in their homes of choice. As such, it is relevant to:

- Vendors within or entrepreneurs considering marketing to baby boomers and seniors
- Social networking sites targeting baby boomers or seniors
- Advocacy and tech training groups like AARP TEK, OATS' Senior Planet
- Retirement Communities that serve independent adults
- Assisted Living Facilities (ALFs)
- Senior housing developers
- Home care agencies
- Home health care agencies
- Geriatricians
- Hospitals and integrated service delivery networks
- Government agencies and policy makers
- Geriatric care managers (NAPGCM)
- Naturally Occurring Retirement Communities (NORCs)
- Virtual Villages and their national network (VTVNetwork.org)
- Intentional Communities and Co-housing advocates
- Startup incubators like Aging 2.0, Startup Health, and Rock Health
- Caregivers, seniors, and family members



AGING IN PLACE: AN EXPECTATION FUELING A TECHNOLOGY MARKET

"Before the tech revolution, the village took care of you. Now it is an electronic village."

Eighty percent of older people today live in their own homes – with one-third of the 65+ and 46% of those 75+ living alone.¹ Not surprisingly, the majority of them would like to stay in their homes of choice – and if they move, according to AARP, it will be to another private home.² The desire to live at home dominates the minds of baby boomers who are becoming seniors (age 65) at a rate anywhere between 8,000 and 10,000 per day, and that desire has reshaped markets that provide products and services to them.³ Further, after the 2011 housing market crisis, many who would move to more appropriate settings did not, pushing up the average age of assisted living move-in where it is now -- in the mid-80s.⁴

Within that context, aging in place reflects the ability to successfully age and remain in one's home of choice, whether it is a private home, condo, apartment, or group home. And the opportunity is further underpinned by the very recent growth of incubators and investors in the mature market – like **Aging 2.0**, **Link-age Ventures**, and **StartUp Health**. That's because:

- **Successful aging means independence.** Nobody wants to think about becoming old -- but improved medical treatment and growing life expectancy has resulted in the 80-plus becoming the fastest growing demographic.⁵ For example, the Society of Actuaries recently updated life expectancy for women aged 65 – on average, they can expect to live until nearly 90.⁶ When asked what's important for successful aging, seniors rank as the most important: 'being in good health, having the ability to do things for myself, having friends and family there for me, and feeling safe and secure.'⁷ And studies have shown that older persons who live independently have more positive self-esteem than those who are institutionalized.⁸
- **Cost of long-term care is ever more daunting.** Even when assisted living would be a good option, price is a barrier. MetLife pegged the average cost of an assisted living facility (ALF) apartment in the US in 2012 as \$43K/year, with nursing homes at \$87K/year.⁹ Meanwhile, their cost projections show average ALF cost growing to \$51K by 2015 – but in some states, Massachusetts for example, that number was already exceeded in 2012.¹⁰ Unlike nursing homes, which can be covered under Medicaid, more than 90% of assisted living costs are paid out of pocket, which at least partially explains the rising average age of residents who are deferring move-in. Further, for the very frail, ALF staffing may need to be supplemented by private duty care. According to NPDA, the cost of private duty home care, one of the 10 fastest-growing job categories in the US, has risen to an average of \$20/hour.¹¹



- Care capacity will reach crisis proportions.** As people age, the numbers of chronic conditions and related care requirements grow. Care of the aging population has begun to migrate from nursing homes to assisted living and increasingly to home-based care.¹² But it is clear from age-related trends that there will not be enough caregivers to help seniors age at home if they need substantial care.¹³ The care gap results from the convergence of senior population growth, increase in life expectancy to 88 for otherwise healthy 65-year-old women and a flat growth rate among younger women -- still the primary source for home care, assisted living, and nursing home aides (see **Figure 1**).¹⁴

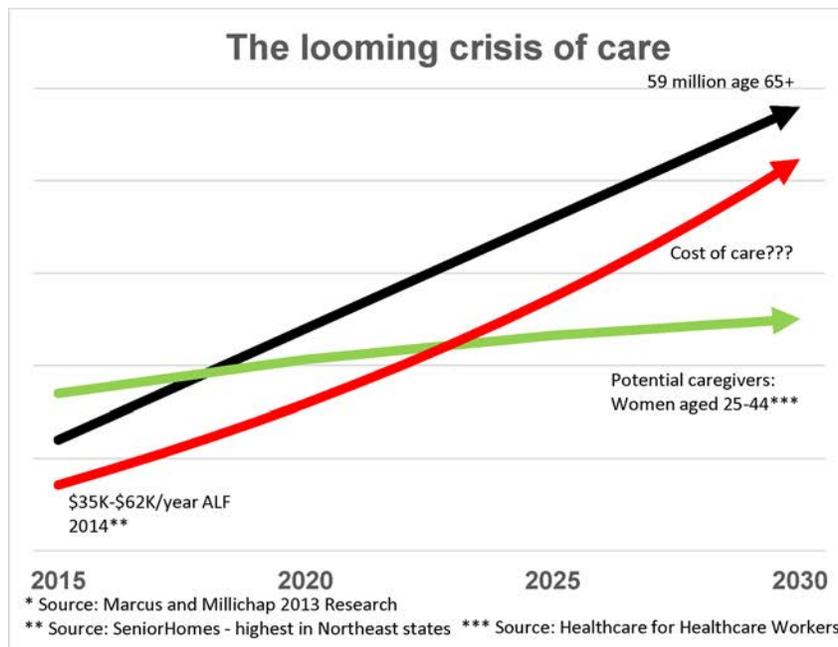


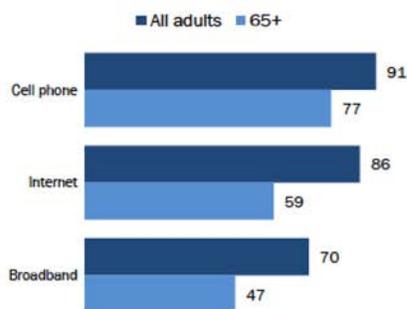
Figure 1



- Brick-and-mortar services and paper are replaced by online and phone.** The Social Security Administration (SSA) eliminated paper checks in 2011, pushing seniors to receive them by direct deposit only. Despite the large baby boomer population reaching Social Security ages, they subsequently closed 64 offices, shut 533 mobile offices and reduced hours – and did so regardless of accessibility of the remaining locations.¹⁵ Meanwhile, banks have shuttered 2,599 branches during 2014 alone, based on the premise that customers are online and banking that way. But only 47% of the 65+ online population also banks online, according to Pew Research in 2013.¹⁶ And following the SSA switch to online banking, debit cards could be obtained through their portal. But by 2013, SSA had to acknowledge widespread scams and fraud.¹⁷
- Technology capabilities exist – and seniors are willing, if not all yet connected.** Every year technology to help age at home becomes more available at a lower cost. Platform adoption of cell and smart phones, tablets, high speed Internet and video is enough to merit tentative but steady entrance of new and existing vendors. Next, baby boomers make up the majority of adult children and own more tech than any previous generation. Because of their access, it is the first time we can connect multiple generations of families with each other -- and with their care providers. Baby boomers, the oldest is now 68, are increasingly online and active (See **Figure 2**).¹⁸ But studies show that while older seniors and caregivers are interested, according to Pew, only 21 percent of the 75+ population has broadband.¹⁹ A consolidated look at Pew Research findings from 2013, however, revealed that technology access still eludes older seniors (see **Figure 3**).

Seniors continue to lag in tech adoption

Seniors vs. all American adults 18+



Pew Research Center's Internet Project July 18-September 30, 2013 tracking survey.

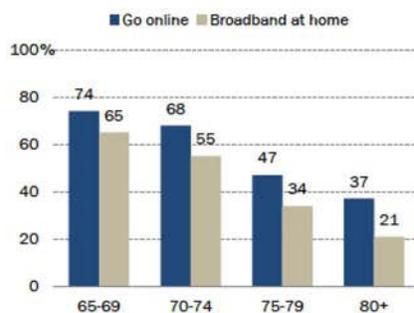
PEW RESEARCH CENTER

Figure 2 Adults 65+ compared to population, Pew Research, April, 2014



Among seniors, internet and broadband use drop off around age 75

% within each age group who ...



Pew Research Center's Internet Project July 18-September 30, 2013 tracking survey.

PEW RESEARCH CENTER

Figure 3 Adults 75+ compared to population, Pew Research, April, 2014

What Will It Take to Successfully Age in Place?

More than a third of those aged 65+ live alone and the percentage rises with age.²⁰ Many of the adult children of today's oldest seniors worry with good reason about their parents – and struggle with them over whether they should be living on their own. And the National Institute for Nursing Research states that “one third of informal caregiving occurs at a distance with family members coordinating provision of care, maintenance of independence, and socialization for frail elders living at home.”²¹ What do these families need?

- **Better communication.** Seniors living alone and away from informal caregivers are at risk of cutting themselves off or being cut off from others – whether due to vision issues, hearing loss, or other inability to leave their homes.²² Their long-distance family members struggle to know what's going on -- and healthcare providers, focused on their own IT projects, still offer few mechanisms for communication.²³ The result can be frustration, anxiety and unplanned moves closer to family or into senior housing.
- **Improved safety and monitoring.** Many seniors struggle to take care of themselves, to accomplish activities of daily living (ADLs) due to mobility issues or worsening dementia. And many homes are danger zones of stairs, rugs, and bathing and cooking hazards. As a result, 31% of people age 65+ suffer a fall that permanently affects their



mobility – whether it involves adding a cane, walker, or wheelchair to their lives.²⁴ Even with hazards removed, remaining in the home after a fall can be frightening.

- **Greater focus on wellness and prevention.** Seniors are too often forced out of their homes or into greater levels of care as a result of hospitalizations.²⁵ Depending on the nature of the resulting illness or complication, doctors may determine if living safely at home is still feasible. And sped-up hospital discharges (“sicker and quicker”) are now complicated by rising readmission penalties, which may push more seniors back into the hospital or into nursing homes, when with proper support they might be able to function at home.²⁶
- **More opportunity to participate in society.** According to the Bureau of Labor Statistics, one in five seniors continue to work past the age of 65.²⁷ And 24% offer their services as volunteers.²⁸ But even becoming frailer at home shouldn’t imply a hard stop for contributing to life outside the home.²⁹ One study by AARP noted 34% of senior responders reported limits on basic physical activities, two in five reported low vision or hearing impairments, and fifteen percent reported problems learning, remembering, or concentrating.³⁰ But at the same time, 66% felt it was very important to stay involved with the world and with people, and 57% said it was very important to continue to learn new things.



Aging in Place Spans a Triangle of Relationships

A critical enabler for aging in place is a functional set of relationships and connections between seniors, their families (both caregiver and long distance) or proxy caregivers, and providers of services to seniors and their families. This triangle of relationships should be reinforced with smart use of technology to enhance communication, but still suffers from one-sided, weak or no connections: these are too ad-hoc, too phone- or paper-based, too labor-intensive, and too narrowly conceived (see **Figure 4**):

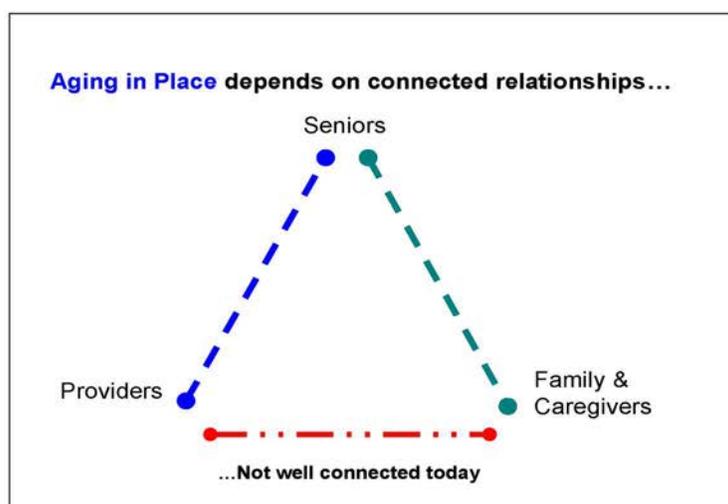


Figure 4

- **The real seniors – older than 65.** It's true that baby boomers will skew the population distribution and change how we age. This began in 2011 when the oldest began turning 65. Today there are more than 43 million seniors age 65+, exceeding 13% of the US population.³¹ And with growing life expectancy for those with more income and education, plus baby boomers' denial of aging and expectations of working longer, the real 'senior' is likely be those 18 million of who are aged 75 and beyond.³²
- **Family & caregivers.** Family caregivers often take an interest in and provide some sort of oversight for these seniors – either spouse or parents – in fact, as many as twenty-five percent of families today care for someone outside the home.³³ In a survey of caregivers who use technology, two-thirds believe that web-based and mobile technology (see Vendor Appendix in this version) would be helpful to them. In 2014, Parks Associates found that 41% of caregivers in U.S. broadband households currently use a digital health device as part of their caregiving routine (**Figure 5**).³⁴



Appeal of Technology Use As Caregiving Aid

Current and Future Caregivers in U.S. Broadband Households

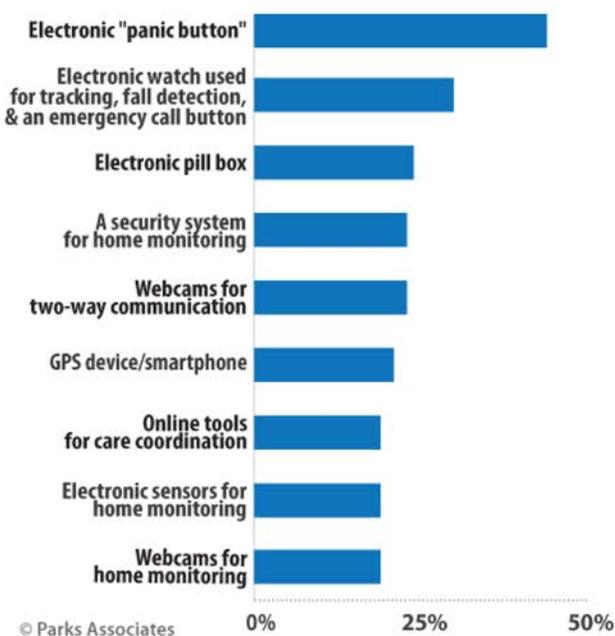


Figure 5 (Parks Associates, December, 2014)

- Providers of services.** Those with direct contact with seniors and families include: social services, hospitals, doctors, nurses, councils on aging, assisted living, and home care companies. This is the weakest technology link in the triangle. Today 74 percent of doctors, for example, have adopted electronic health record systems (EHR), the basis for sharing personal health information from seniors or with families.³⁵ EHRs include basic diagnosis and drug information at hospital discharge (often to a nursing home/rehab). As of 2014, the most recent data available, more than 70% of home and hospice care organizations use EHR.³⁶ But in a senate hearing in June, 2013, industry experts acknowledged that despite deployment, many barriers remain – noting that EHRs are only one aspect of improving healthcare quality.³⁷ And an EHR does not include any data about the Activities of Daily Living (ADLs) that are basic to preserving quality of life.³⁸



TECHNOLOGY FOR AGING IN PLACE TODAY – ENABLED RELATIONSHIPS

Successful aging and remaining at home can be substantially improved today by simply sharing information and creating linkages between participants. Consider this scenario made possible with technologies that exist and can be mixed, matched, purchased or used *today* (see **Figure 6**):

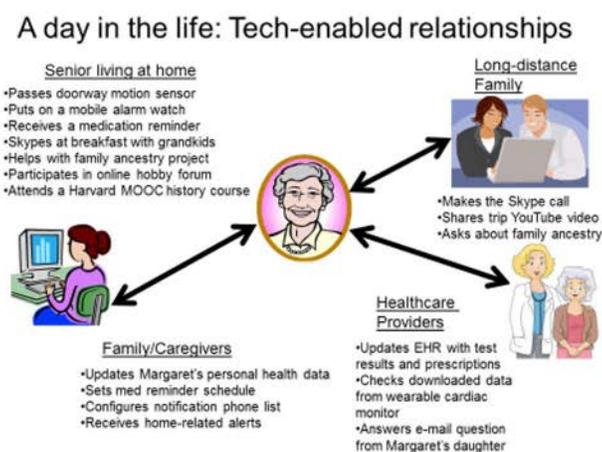


Figure 6

- **Senior living at home.** Margaret, an 88-year-old widow, lives alone in a senior housing development in Florida. She rises in the morning, passes a doorway motion sensor that remotely updates a security system configured to alert caregivers if it is not activated by a specific time. She puts on her mPERS watch, receives a call on her cell phone that reminds her of a morning medication, presses a button on the 7-day pre-loaded pill canister, takes her pills, and a message is sent to caregivers. Later that day, she receives a Skype call from her grandchildren and tells them a bit more about her family history for their online ancestry project. She signs on to request an evening ride, and then settles down with her favorite online hobby forum -- using her new tablet. At the senior center she participates in an exercise session and after dinner, signs on to one of her several online college courses.
- **Family/caregivers.** Margaret's adult daughter Irene lives an hour away and visits weekly to take her to doctor appointments. In consultation with her mom, she configures the medication reminder schedule and through her own tablet, sets automated check-in phone calls while she is at work. Before taking her mom to the doctor, she ensures that her mom's personal health record is up-to-date and sends an e-mail question to the nurse. Irene and her mom have agreed that home care aide Julie and Irene will receive only exception-based alerts about her mom's comings-and-goings and medication use.



- **Long-distance family.** Other long-distance adult children of Margaret's are alerted in the event that Irene or Julie is unavailable. These family members use Skype, e-mail, chat, and phone conference calls to stay in touch with Margaret between in-person visits. They post photos and family videos that Margaret views online.
- **Healthcare providers.** Margaret's primary care nurse practitioner, Suzanne, knows her and her family – and makes sure that referred specialists and her primary care doctor have the most up-to-date electronic health record. The health center where Suzanne works is up to date with the latest EMR systems and online prescriptions, communicating directly with Margaret's pharmacy. Margaret has a history of cardiac problems and with the help of caregivers she is regularly checked with home-based diagnostic devices whose data is transmitted to the doctor's office as needed.

What are the Aging in Place Technology Categories?

The above scenario is **not a vision for the future**. It is feasible with awareness and training to use in-market technology – examples listed separately in the Appendix and discussed at www.ageinplacetechnology.com. These technologies promise to help tighten and grow care provider relationships, improving the ability to age more successfully, remain at home longer and more safely, and better weather change over time (see **Figure 7**):

Four aging in place technology categories today

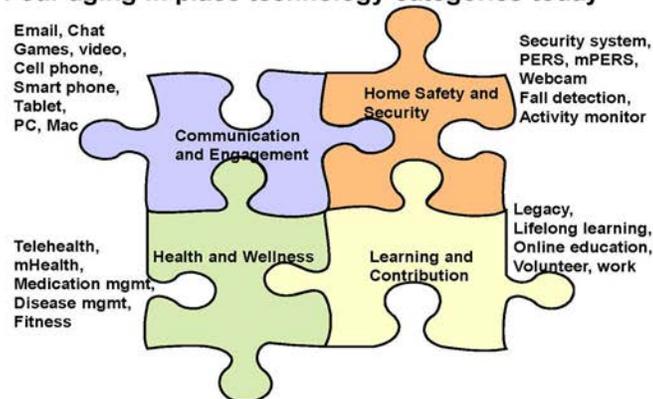


Figure 7

- **Communication and Engagement.** For baby boomers and younger, life is unthinkable without e-mail, chat, web surfing, Facebook, Smartphones, video games, Skype, and texting. Yet the majority of seniors age 75+ are unaware of these 24x7 ways to be in



touch and in the know.³⁹ And many older people are intimidated by tech like PCs and overly complex smart phones – and rightly worry about data security. Simplified tech – like AARP’s **RealPad** (for baby boomers) or **GrandPad** (for aged 75+) provide modified tablet interfaces. Easier-to-use smart phones like **GreatCall’s Jitterbug Touch 3** or **Samsung Galaxy’s Easy Mode** help make these experiences feasible and gratifying.⁴⁰ Training is critical – including refreshers from the carrier or company that provided the device/plan.⁴¹ Once online, seniors and long-distance grandchildren can text, chat, or enjoy reading books together, sharing a project or a visit using Skype on a tablet.

- **Safety and Security.** The ability to remain at home depends first on whether the home is free from obstacles and dangers – and whether those risks are addressed. Homes can be attractively retrofitted to be barrier-free by a Certified Aging in Place specialist (CAPS).⁴² Security systems, mobile PERS offerings like **GreatCall Splash** or combined with passive fall detection like **Lifeline with Auto Alert** or **MobileHelp**, sensor-based home health monitors/hubs (from **Independa**, **Healthsense** -- or new entrants like **Onköl** or **Sen.se**) can help monitor and reassure seniors and caregivers.
- **Health and Wellness.** The risks associated with obesity and lack of exercise only worsen with age, so it’s no surprise that **WiiFit** has become popular with boomers and seniors.⁴³ Today, Microsoft **Kinect** is also finding its way into senior centers.⁴⁴ Online tools like **MyFitnessPal** or **Spark People** help guide and motivate exercise and weight loss. For chronic disease management, vendors like **Care Innovations** or **Ideal Life** offer systems for remotely monitoring chronic diseases like diabetes or congestive heart failure.
- **Learning and Contribution.** In 2006, Joseph Coughlin of MIT’s AgeLab applied “Maslow’s Hierarchy of Needs” to Aging in Place.⁴⁵ This seminal document noted that once the basic needs of communication, safety, and health are addressed, people have both the need and capacity to continue to learn, stay active in and knowledgeable about society, contribute to it through volunteering and continued work, leaving a legacy of stories, not just money, for those who love them. Seniors can sort among online programs and auditable courses found through sites like **SeniorNet.org** or **edX**, the growing MOOC movement or look for work on **WorkReimagined.AARP.org**.⁴⁶

Family and Professional Caregiver Links Overlay Categories

Family, professional caregivers and their clients are beginning to expect that they will, along with the senior, participate in the use of technology categories (see **Figure 8**).



Four aging in place technology categories today

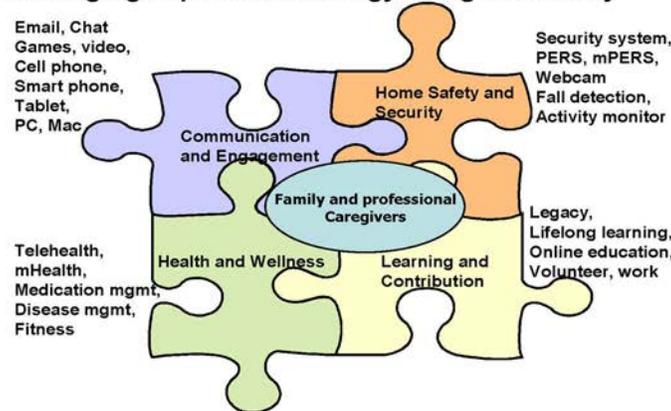


Figure 8

- **Family members have growing expectations for connectedness.** Today, picture sharing, social networks, video chatting, and text messaging are the mainstream mechanics for families – who will succeed at including aging parents in the loop of one or more of them. And when home monitoring and PERS devices are purchased, family members may be both the purchaser and rule configuration administrator for who to notify about what pattern changes or emergency alerts, with or without a call center intermediary. For example, **Caring.com**, **Lotsa Helping Hands**, and **CareLinx.com** provide tools for caregivers to find and/or share care.
- **Professionals, health, GCM, and companion agencies will link in families.** A national Geriatric Care Management organization trains its staff to use Skype to connect clients to families – that is a signal of hope: professionals believe they must link families into their process.⁴⁷ These offerings will likely not be revenue generators, but rather added to standard home health systems to enable providers to update all family members at once, much in the way that **CaringBridge** enables families to provide patient updates on a private website versus spending an hour or more on the phone each day providing status.

Requirements for Aging in Place Technology Market Success

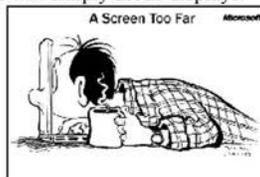
Across all these categories, a number of common requirements are emerging that will grow in importance as the market grows. Customers will demand products that are as attractively designed and easy to use as a game or tablet, ubiquitous as a cell phone, and as extensible as a computer. For this market to further mature and reach its full potential:

- **Technologies must be intuitive and well-supported.** Most people, at every age, have a laundry list of frustrations with technology. AARP's survey about seniors and technology



asked responders if they were concerned about the availability of customer service reps. No surprise – most said yes. Training and service (online, telephone, remote) is an essential ingredient in a go-to-market strategy. And iPad-like ease of use must mean ease of setup as well as use. Remote configuration must be a major part of the offering – or doom the user and family to frustration and the product to failure. Focus groups and home trials reveal greater technology resistance and concerns than any ‘what-if’ surveys.

- **Device vendors must be capable of integration and extension.** Despite standards initiatives like the Continua Health Alliance, many of today’s gadgets still don’t communicate – into or out of the home, but especially with each other. So mHealth devices, apps or medication reminders are useful, but touch a tiny aspect of the whole person. Those who care about seniors like Margaret must know that she responded to the reminder and -- if she has opted in and is willing to share -- how her mood as well as her behavior changes over time. To provide valuable integrated solutions, device software will create and use common standards to communicate to caregivers and providers and feed analytics and decision tools.
- **Costs to consumers must be affordable.** As tech becomes more usable and useful, consumers will look for ways to acquire it. This may occur through payers, but is more likely through adult children and family. Higher income consumers will come to realize that in-home bandwidth for their aging parents enable Skype/ webcams as well as chronic disease monitors that provide value, just as essential as the cell phone plans, GPS services, cable TV and many other monthly fees that are now part of their technology vocabulary.
- **Products must be available on widely adopted platforms.** A growing number of retirement communities are adopting **Nintendo’s Wii** or **Microsoft’s Kinect**. Up next, stay tuned for more gesture-based interaction from **Microsoft’s Windows 10** and **Intel’s RealSense** platforms that may eventually appeal to senior-focused organizations. What’s a platform anyway? It is software with programming interfaces that thousands of software writers believe will help them get distribution. But too many interfaces are one-off designs -- unique even within a single vendor – like the differences between Apple’s Mac OS and iOS.
- **Upgrades must be more seamless than today.** Consumers already gravitate towards applications that work with ones they already use, including Gmail, Facebook, FaceTime, YouTube or Skype – regardless of device. In the future, hope for upgrade processes less painful than today’s ‘No Going Back, You Must Upgrade or Else!’ approach. Tech vendors will make it easier to use personalized user interfaces (like Amazon and Netflix) that are recognizable across multiple devices, coined in an AARP report as **Design for All**.⁴⁸ Perhaps one day a single device like a tablet, smart phone or TV will drive interaction and content, and other devices in the home will simply act as displays.





COMPETING PLATFORMS FOR AGING IN PLACE TECHNOLOGY

An aging in place technology platform battle is underway – vendors are deploying among:

- **Computer- and tablet-based access to the cloud.** The PC, Mac and now tablets – with unfettered access to the Internet and multiple app formats – offer the broadest device access to help seniors remain in their homes, whether it’s searching for health information from **WebMD**, home retrofitting tips from **AARP**, or caregiving tips from **Caring.com**. Furthermore, the closing of physical locations like Social Security offices or bank branches is driving the urgency of helping offline seniors to move online (see **Figure 9**).

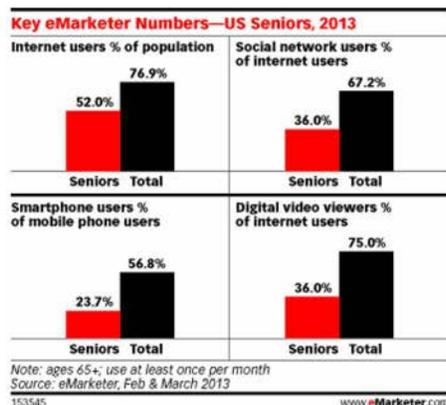


Figure 9

- **Wearables, smart phones and tablets.** In today’s market, expect wireless devices to augment or serve both in-home and out-and-about needs. Good market penetration and simple operation is attractive, especially for reminders, alerts, simple Internet search, texting, and even GPS location applications. For baby boomers and their smart phones and tablets, health apps for the iPhone (**SugarTracker** and **BP Buddy**), Android (**MyFitnessPal** and **Absolute Fitness**) are multiplying like weeds. Meanwhile wearables like **Withings Activité Pop** (up to 8 months without recharging) or **Microsoft Band**, smart phones like the iPhone or Samsung’s **Galaxy Note 4** and tablet counterparts like the **iPad** or senior-targeted tablets like 2014’s **AARP RealPad** or startup **GrandPad** can be information delivery platforms, perhaps eliminating consumer purchases of PCs over the coming decade.⁴⁹
- **Game platforms.** The video game industry, propelled by mobile gaming, is expected to grow to \$102 billion by 2017.⁵⁰ **Sony** sold 10 million Playstation consoles in 2014 and while the video game industry is shrinking, the social game industry is booming (\$7.3 billion) and 29% of gamers are over age 50.⁵¹ As Jane McGonigal, author of “Reality is Broken” notes: “Research has shown that games consistently provide us with the four ingredients that make for a happy and meaningful life: satisfying work, real hope for success, strong social connections and the chance to become a part of something bigger than ourselves.”⁵²



- **Televisions:** CES 2015 brought more Internet-enabled and curved phones and large TVs – and of course their TV set-top boxes brought an explosion in voice and gesture-based controls.⁵³ Because of the broad base of deployed game controllers, expect a greater number of useful applications (not games) to be introduced, for example, Kinect’s use in rehabilitation settings.⁵⁴ DVD players, **Roku** and now **Amazon** provide streaming video-on-demand and new Internet-enabled televisions could become an access point for senior applications like **Independa**’s integration with an **LG TV**.

ADVICE TO VENDORS TODAY: MOVE FROM PRODUCTS TO SERVICES

Probably the biggest issue that keeps more of today’s technology out of the homes of seniors is the difficulty of marketing to both them (“We are not old!”) and to their afraid-to-interfere adult children, while selling through knowledgeable channels, appropriate websites AND pricing right for resale and white labeling. Vendors and service providers can close that gap of awareness, offering solutions for each stage of independence (see **Figure 10**). Vendors must find:

- **The right customer – baby boomers and their roles.** But some marketers pick a target audience that shares a common role – for example, caregiver role-based boomer sites **Caring.com** (acquired in 2014 by Bankrate.com) offer aging in place vendors a ready audience of baby boomers with shared interest in caring for their aging parents.
- **The real need – a service problem solved.** Seniors and their adult children will not imagine on their own what to do with sensor networks, web cams, or set top boxes. Someone needs to explain benefits. Instead of offering point products out of context, vendors should fit their offerings into solution descriptions, service provider relationships, and senior support processes along the continuum of needed care. This includes a grasp of the decision points that spike interest in a product. Finding an independent living assessment can be a useful tool for boomers and seniors wondering if it is feasible for a parent to remain at home.⁵⁵



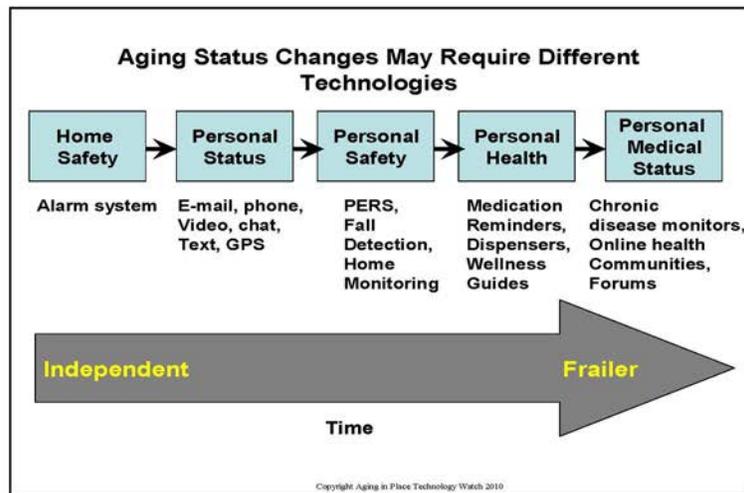


Figure 10

- **Identify the right channel – it's about an ecosystem and indirect selling.** The right channel depends on the complexity of the product and the target user. And less is more – remembering that 20% of channel partners typically contribute 80% of revenues. Channel utilization should primarily be indirect, either because of extensive reach, configuration or local service needs. For example, PERS vendors like **Philips** may market through multiple regional service providers at local price points. Others will gravitate to a larger and branded ecosystem selling devices through retail (**AARP RealPad at Walmart**), via direct-to-consumer ads (**GreatCall** and **MobileHelp**), home care agencies, pharmacies, senior housing organizations or insurance partnerships.

Ten Steps for Vendors and the Aging in Place Technology Market

Find the channel partners that present products and services in the context that's appropriate, whether it's AARP or Walmart – or at an annually occurring event like Life Long Tech at CES (formerly Silver Summit) that focuses on boomers and seniors within this giant consumer product showcase.⁵⁶ To those within or contemplating entry into the boomer and senior market – here are 10 steps to consider:

1. **Create a boomer-and-senior aware website.** Make the site useful from a PC screen as well as a phone – too many app vendors today think searches are ONLY done on phones. Mention the target audience by name: “How this product can make seniors feel safer” rather than hoping prospective customers will figure it out. Make the site friendly to those with diminished vision Add a very brief video of a pleased user that is worth 1000 words.



2. **Test usefulness with the target audience.** So much of the R&D effort in university programs fails to produce any useful product. And vendors often jump in with no confirmation beyond the needs of their grandmothers. Consider trials with senior centers, area aging groups, or health centers – halt rollout if response is negative or indifferent.
3. **Narrow scope, but broaden messaging.** Products that serve a narrow purpose can still be described within holistic context (or solution) like a day-in-the-life scenario. Early on, co-market with partners' products or service messages that deliver more of the scenario.
4. **Be wary of box obsolescence.** Avoid being part of the back-room junk pile of products-gone-by. Recognize the progressive nature of the service needs of the consumers and attempt to pre-engineer or source extensions (a tablet that complements the phone or vice versa), new upgrades, related devices and future feature integration into the product.
5. **Give away the device and sell service.** Device prices are a barrier to lucrative and long-term service to boomers and seniors. Yet many vendors have devices listed for more than \$100, with service fees beyond the price tolerance noted in surveys like AARP's. Note that AARP's own RealPad in Walmart at \$189 exceeds their survey price tolerance.⁵⁷
6. **Offer the free trial.** Try with option to buy is such a time-tested strategy -- it is interesting to see how rarely it is used in this market, though it should be popular with low-priced or free smart phone apps that need testers ("Free to the first 100 signups!").
7. **Add related and useful value.** Offer content -- advice about problems faced by prospective consumers – including links to criteria for assessing needs and services, like a link to '20 questions for long-distance caregivers' from the National Institute on Aging.⁵⁸
8. **Add the community to the product.** E-mailed customer testimonials are nice but they are inadequate to build buzz from early success. Moderated communities (or blogs with comment) can become willing sources of product feedback and ways to grow loyalty.
9. **Monitor reputation on consumer websites.** Vendors should be wary about deteriorating service reputation by regularly checking blogs and forums -- improving their responsiveness accordingly – or closing down defunct sites. It is ridiculous to make the web searcher check dates in 'News About Us' to see if the firm is still in business.
10. **Cultivate members of other markets early – before launch.** Be the first in your space to actively seek out healthcare organizations, geriatric care managers, home renovation providers, assistive technology, and assisted living communities.

HOW DOES THE AGING IN PLACE TECHNOLOGY MARKET EVOLVE?

The marketplace of products today is fragmented into a cottage industry comprised largely of startups, challenged by both channel complexity and end user resistance. But with its fragments assembled into an overall puzzle, this business for boomers and beyond has been estimated by some to grow to \$20 billion by 2020 or even \$30 billion by 2017.⁵⁹ Between now and 2020,



based on growing boomer awareness and their own aging, and radically change with the growing availability of in-car technology, mobile PERS, wearable fitness and health devices, in-home hubs and smart phone apps. And by 2020, the broader technology market will increasingly support customizations for all people, regardless of age (see **Figure 11**):⁶⁰

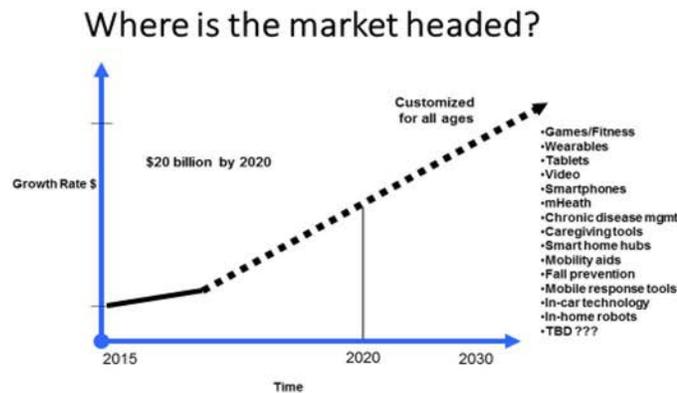


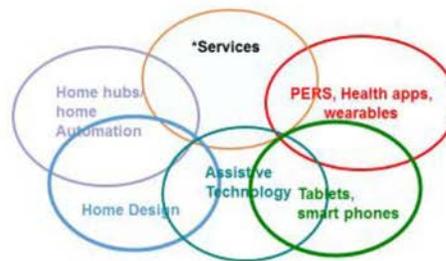
Figure 11

1. **Health and wellbeing hubs will do battle and grow.** Aging in place technologies are beginning to gravitate to hub-and-spoke portals that show how roles (like caregiver, senior, and provider) relate to needs (like social, home monitoring, and medication reminders). As portals and products mature, they will offer services and enable searchers to find targeted solutions (see **Amazon50+**). Consider role-based hubs like **CareZone Senior** or **Caring.com**, and health-specific hubs like **DiabetesMine** and **PatientsLikeMe**. Partner spoke vendors (like **Fitbit with Walgreens** or **Spark People with Pebble**) may advertise or even connect directly to these sites. In the future, some platform vendors may become important as hubs -- like **Mayo Clinic**, **WebMD**, and **Everyday Health** in healthcare. Social networks want to become hubs -- like **Facebook** or **LinkedIn**, or local hubs like **NextDoor**.
2. **Aging in place provider silos must overlap (home design, healthcare, services).** In the future, hubs will force associations and/or convergence of aging-related categories. For example, Assistive Technology (part of the healthcare market) overlaps with Healthcare -- and those in that market see little link to aging services. Service-based providers -- like assisted living, nursing homes, and home care all serve the same senior, but in different and still largely tech-free ways. And markets that should overlap don't: Home care and geriatric care management groups must accelerate their pace in discovering and in deploying technology that could help family members know what's happening with loved ones. The home automation hub and custom installer market -- filled with tech experts -- could be an aging in place enabler, but acts like separate niche market (see **Figure 12**).



3. **New developments and remodels will offer aging-in-place technologies.** Some new senior housing developers are pre-wiring housing with broadband, security monitors, and motion sensors – in addition to wall backing for grab bars, standard wide doorways, and alternative kitchen counter heights. As boomer housing needs grow, other senior housing options will be upgraded or retrofitted with a must-have tech list. Boomers who remain in their homes will add home networks, web cameras, and voice-activated security for personalized emergency response – and aging in place vendors will leverage them to build more sophisticated and connected applications. To reduce energy use, building codes will mandate environmental sensors, users will want smartphone-controlled reset of temperature as the home is entered or exited. Automatically lit paths from bed to bath can be enabled with inexpensive nightlights.

Market silos will recognize connection opportunities



* Example services: Home care, transportation, geriatric care management, training

Figure 12

4. **Vendor standalone market entries will morph into solutions, designed for all.** Today's one-off innovations will be replaced with integrated low-cost solutions; and the evolution of hubs (both on- and off-line) will force vendors to find customers through them. Unique functionality may garner adoption by the most technically adept seniors, but for the majority of the aging population, a consistent underlying platform that is designed for all, not simply for the elderly, will be preferred -- and channels of distribution that interact with them will be the preferred sources. Professional caregivers and health providers will use smoothly connected tablet/PC-smart phone platforms to gain visibility, which will propel solution-aware vendor offerings into mainstream usage, facilitated by training offered by national efforts like **AARPTek**.⁶¹ Local integrators, drawn from ex-IT workers, security companies, senior housing, electronics dealers, or remodelers or home care, are the right players to travel the last few feet into the home.



WHAT CONSUMERS AND SUPPORT SERVICES SHOULD DO TODAY

Although the market is still young, a useful set of offerings exists – and should be explored by seniors and their families, caregivers, and service providers. Helping seniors and the-soon-to-be-senior be safer, connected, healthy and fulfilled is too important to await full market evolution and shakeout – ultimately to combine into the designed-for-all consumer market. Market awareness yields better products and services – and vice versa. It’s time to:

- **Assess the family along a tech literacy continuum.** Not everyone grows older in Silicon Valley – one newspaper letter quotes a senior subscriber who plaintively noted that advertisers keep mentioning websites, not phone numbers. Even the Social Security Administration introduced statements that can only be viewed online. If your family member sees the Web or smart phone as impenetrable, don’t give up. That’s why there is still a market for one-button answering machines, easy-to-use cell phones, tablets or computer interfaces, as well as an opportunity to create straightforward and easy-to-use applications layered on top of more complex devices.⁶² And family caregivers are increasingly online – looking for what they need to provide better care.⁶³
- **Research technology for today’s need with an eye to the future.** Family members and providers who observe the absence of technology for loved ones should be energized into asking: why not – where is it?⁶⁴ Why are medical alarms so different from wearable fitness bands? Why can’t the latter keep a senior safe? Yes, inquire about the availability of fitness programs and good food in an assisted living facility, but also ask about wireless networks and devices with cameras for long distance family chats – as well as someone available to help with setup. Ask about improving safety or engaging family, and be sure to ask about technology that can improve life quality for those with increasing frailty or dementia.
- **Find a community of interest and support.** Look online first for shared interests in advancing the use of technology and related services for boomers and seniors. Ask what nationwide and visible organizations, like AARP, NCOA, ASA, WebMD or Caring.com are doing. Note less well-known associations like NAPGCM or Village to Village Network mentioned earlier in this report – can they provide more information on recent tech-enabled innovations and solutions? If not, why not? Find technical support communities, local ‘Geek’ squads, training programs and ‘Genius’ bars that will service boomers and seniors where they live as well as online. Negotiate with cable providers to add a local ‘geek squad’ service to their offerings for a small recurring fee – when the phone upgrades on its own, let the service arrangement push out a getting-started video – like the “Read Me First” of yore. If consumers elevate their expectations, eventually vendors and providers will listen.

**About the Author:**

Laurie M. Orlov, a leading tech industry veteran, writer, speaker and elder care advocate, is the founder of **Aging in Place Technology Watch**, a market research firm that provides thought leadership, analysis and guidance about technologies and related services that enable boomers and seniors to remain longer in their home of choice. In 2014, she founded of **Boomer Health Tech Watch** to track adoption of Digital Health technologies by baby boomers. In addition to her years of technology background and years as a technology industry analyst, Laurie is certified in geriatric care management from the University of Florida, and has served as a long-term care ombudsman in Florida. She is the author of other market reports, including AARP-sponsored **Challenging Innovators (2014)**, **Next Generation Response Systems (2013)**, **Future of Home Care Technology (2012)**, and the **Link-age Technology Survey Age 65 to 100 (2011)**. She was a member of the Philips Think Tank on Active Aging and speaks regularly on the topic of technology and older adults.

In her career, Laurie Orlov has spent more than 30 years in the technology industry, including 24 years in IT and 9 years as a leading industry analyst at Forrester Research where she was often the first in the industry to identify technology trends and management strategies which have survived the test of time. She speaks regularly and delivers keynote speeches at forums, industry consortia, conferences, and symposia. She has served in an advisory capacity to leading organizations like AARP, J&J, Yahoo!, Microsoft, Novartis and Philips. Her blog posts are featured on numerous websites about topics related to boomers and seniors. Learn more and find all published reports at www.ageinplacetechnology.com.

About the Vendor Section:**Aging in Place 2015 Technology Categories and Vendors (Example vendors)**

For inclusion as a technology to facilitate aging in place, the vendor meets two of these criteria (those listed are only examples, not an exhaustive list). In addition, please note that ****** entries are new in this 2015 version of the Market Overview, though not necessarily brand new in the market.

- a) Incorporate messaging to and about boomers and/or seniors or their caregivers.
- b) Boomers and/or seniors have adopted the product.
- c) Is available across the US, not just in a single region.
- d) Be available free or for a fee, not only via insurance reimbursement.



Category	Sub-category	Purpose	Platform	Contact
Communication and Engagement				
	New items shown with **			
<i>Samsung Galaxy S5 with Easy Mode**</i>	Smart phone	Smart phone	Android	Amazon, others
<i>Clarity Life Ensemble**</i>	Tablet-telephone	Hearing assistance	Telephone-tablet	Clarityproducts.com
<i>GreatCall Jitterbug Touch3**</i>	Smart phone	Added services	Android	GreatCall.com
<i>Clarity Pal</i>	Cell phone	Amplified cell phone	cell phone	Clarityproducts.com
<i>ReSound LiNX**</i>	Hearing	Link hearing aid to phone	iPhone	ReSound
<i>Breezie**</i>	Senior Boomer tablet	7. in, multi-touch	Tablet app	Breezie
<i>AARP RealPad**</i>	Senior Boomer tablet	7.85 in, multi-touch	Tablet	Walmart
<i>iPad Air 2**</i>	Wi-Fi Tablet	9.7 in, multi-touch	Tablet	Amazon.com
<i>grandPad**</i>	Senior Boomer tablet	7 in, LTE in USA	Tablet	grandpad.net
<i>ooma Safety Phone**</i>	Wearable phone-pendant	2 speed dial buttons	Pendant	Amazon.com
<i>Sony Xperia Z3**</i>	Smart phone	Water resistant	Android	Verizon
<i>Sprint Active Senior ID Pack**</i>	Apps for seniors	Easy to use applications	Android	Sprint
<i>StartPage**</i>	Search without tracking	Internet	Search engine	startpage.com
Home Safety and Security				
<i>Philips Lifeline GoSafe**</i>	mobile PERS	Waterproof	Pendant	lifelinesys.com
<i>GreatCall 5Star Urgent Response Lively Safety Watch**</i>	mPERS	Multiple add-ons	Health related	GreatCall.com
<i>Blue Star Veterans Network**</i>	PERS, health	Reseller for Vets, by Vets	Health related	Bluestarvets.us
<i>Qmedic**</i>	PERS	Notes inactivity	Wearable	Qmedichealth.com
<i>Care Innovations Health Harmony**</i>	Health	Remote monitoring	Monitor platform	Careinnovations.com



Category	Sub-category	Purpose	Platform	Contact
<i>MobileHelp Fall Button</i>	mobile PERS	Consumer	Wearable	MobileHelp.com
<i>BioSensics</i>	Safety, health	Gait analysis	Multiple sensors	Biosensics.com
<i>Independa AnyTV Companion**</i>	Safety, health	Remote monitoring	Monitor platform	Independa.com
<i>Lert.ly**</i>	Emergency	Campus-wide, voice	Low-power Wifi	Lertly.com
<i>grandCARE Systems</i>	Safety, health	Remote monitoring	Monitor Platform	Grandcare.com
<i>Evermind**</i>	Safety, health	Remote appliance monitoring	Monitor platform	evermind.us
<i>Mother**</i>	Family home hub	Sensors	Hub and sensors	sen.se
<i>Honeywell Life Care Solutions**</i>	Seymour	Digital Health/analytics	Health platform	Honeywelllifecare.com
<i>Healthsense</i>	Safety, health	Remote monitoring	Wifi sensors	Healthsense.com
Health and Wellness				
<i>Dakim Brain Trac**</i>	Cognitive fitness	Monitor users of Dakim	PC-installed	Dakim.com
<i>Lumosity</i>	Cognitive fitness	Brain fitness program	Mobile device	Lumosity.com
<i>FitBrains</i>	Cognitive fitness	Brain fitness program	Mobile device	Fitbrains.com
<i>Trainer**</i>				
<i>PositScience</i>	Cognitive Fitness	Brain fitness programs	PC	Brainhq.com
<i>Nonin**</i>	GO ₂	Monitor oxygen level	clip	Nonin.com
<i>MyFitnessPal</i>	Track food and exercise	Portal plus app	Integrates trackers	Myfitnesspal.com
<i>SparkPeople</i>	Track food and exercise	Portal plus app	Integrates trackers	Sparkpeople.com
<i>Loselt**</i>	Track food and exercise	Portal plus app	Integrates trackers	Loseit.com
<i>Microsoft Band**</i>	Fitness tracking device	Wearable on wrist	Email, UV	Microsoft.com
<i>MedMinder</i>	Medication management	Consumer	Pillbox, Internet	Medminder.com
<i>AdhereTech**</i>	Medication adherence	Pharma-consumer	Appliance	Adheretech.com
<i>MediSafe**</i>	Medication management	Consumer	Appliance	Medisafe.com
<i>MedFolio Wireless pillbox</i>	Medication dispenser	Consumer: dispensing	Appliance	Medfoliopillbox.com



Category	Sub-category	Purpose	Platform	Contact
Learning and Contribution				
AARP TEK**	Train on tech tools	Regional classes	In-person, online	AARP Tek
Grandparents.com	Portal	Discounts	Internet	Grandparents.com
Stage of Life/Grandparents	Portal	Discounts	Internet	Stageoflife.com
After Steps	End of life documents	Checklist and doc storage	Internet	Aftersteps.com
Ancestry	Legacy	Family tree, history	Internet	Ancestry.com
LifeBio	Legacy	Produce a book based on template	Internet	Lifebio.com
MyHeritage**	Legacy	Family tree, history	iOs, Android	MyHeritage.com
FirstStreet Online	Product Catalog	Multiple products	Internet	Firststreetonline.com
CourseTalk	Directory	MOOC reviews/ranking	Internet	Coursetalk.org
SeniorNet.org	Education and Learning	Technology training	Internet	Seniornet.org
edX**	Education and Learning	Download courses	Internet	edx.org
RetiredBrains.com	Education and Learning	Directory of online courses	Internet	Retiredbrains.com
Senior Center Without Walls (California)	Education and Learning	Telephone-based courses	Internet	Seniorcenterwithoutwalls.org
OATS (Older Adult Technology Services)	Education and Learning	Senior Planet Technology Center in NYC	Center/Service	Oats.org
Caregiving Tools				
CareLinx	Non-agency home care	Family caregivers	Portal, directory	CareLinx.com
Lotsa Helping Hands	Schedule sharing care	Shared caregiving	Portal	Lotsahelpinghands.com
LindyCare**	Careplan, find care	For caregivers	Portal	Lindycare.com
Caring.com	Caregiver portal and directory	Family caregivers	Portal, directory	Caring.com
Care.com	Find home care	Support to caregivers	Portal, directory	Care.com
Caremerge	Care management	For senior care	EHR	CareMerge.com
Open Placement	Care Transitions	For discharge	Tools to find care	OpenPlacement.com
CareTreeMe	Home Care Management system	For care professionals	Care mgmt	Caretree.me



Category	Sub-category	Purpose	Platform	Contact
<i>eCaring</i>	Home care management system	Professional caregivers	Family, workers	eCaring.com
Caregiving apps				
<i>Caregiver's Touch**</i>	Share caregiver info	Sync web info to iPhone	Web + phone	Caregiverstouch.com
<i>Balance: for Alzheimer's Caregivers</i>	Caregiving coordination	National Alzheimer Center, Inc.	iPad, iPhone	Apple iTunes
<i>Clevermind**</i>	Alzheimer's	Consumer, Alzheimer's	iPad	myclevermind.com
<i>CoroHealth Faith Mobile</i>	Music, Faith	Customized content	iTunes	Corohealth.com
<i>Healthspek PHR</i>	Personal health record	Opt-in sharing health info with doctors	iPad with iPhone viewer	Healthspek.com
<i>Comfort Zone Check-in</i>	Track Cell phone or wearable device	Alzheimer's Association	iPad, iPhone	Alz.org
<i>Care Partners Mobile**</i>	Task organizer	Shared calendar	Multi-device	lifelinesys.com
<i>Gerijoy</i>	Talking pets	Dementia care service	Tablet	Gerijoy.com
<i>Personal Caregiver</i>	Caregiver coordination	Medication & refill reminders	iTunes	Personalcaregiver.com
<i>MedCoach</i>	Health and Wellness	GreatCall	Android	GreatCall.com
<i>SingFit for Seniors</i>	Engagement	Music care recipients	iTunes	Singfit.com
<i>CareZone Senior**</i>	Care Coordination	Share tasks, manage meds	Android	Carezone.com



References:

- ¹ http://www.aoa.gov/Aging_Statistics/Profile/2012/docs/2012profile.pdf
- ² <http://www.aarp.org/home-garden/livable-communities/info-11-2010/home-community-services-10.html>
- ³ <http://online.wsj.com/article/SB10001424052748704013604576104394209062996.html>
- ⁴ <http://www.kaiserhealthnews.org/Stories/2011/August/22/housing-crash-assisted-living.aspx>
- ⁵ <http://www.census.gov/prod/cen2010/briefs/c2010br-03.pdf>
- ⁶ <http://www.wsj.com/articles/rising-u-s-lifespans-spell-likely-pain-for-pension-funds-1414430683>
- ⁷ AARP Healthy@Home 2008 survey ranking by 907 65+ individuals
- ⁸ Lewis, Aging: The Healthcare Challenge, 2002
- ⁹ Costs shown are rounded up. Nursing home cost is for a private room.
<https://www.metlife.com/assets/cao/mmi/publications/studies/2012/studies/mmi-2012-market-survey-long-term-care-costs.pdf>
- ¹⁰ <https://www.metlife.com/assets/cao/mmi/publications/studies/2012/studies/mmi-2012-market-survey-long-term-care-costs.pdf>
- ¹¹ <http://www.abundantpersonalcare.com/pdfs/NPDA-FactSheet.pdf>
- ¹² Number of nursing home beds, ALF, and CCRC flat, incremental growth curves. LeadingAge.org
- ¹³ http://www.aarp.org/content/dam/aarp/research/public_policy_institute/ltc/2013/baby-boom-and-the-growing-care-gap-insight-AARP-ppi-ltc.pdf
- ¹⁴ <http://phinational.org/sites/phinational.org/files/clearinghouse/HCHCW%20Women%20FactSheetRev.pdf>
- ¹⁵ <http://www.aging.senate.gov/press-releases/senate-aging-committee-to-examines-the-effects-of-shuttered-social-security-service-offices-on-seniors>
- ¹⁶ <http://www.pewinternet.org/2013/08/07/51-of-u-s-adults-bank-online/>
- ¹⁷ <http://www.usatoday.com/story/news/nation/2013/07/28/social-security-benefits-scam/2594675/>
- ¹⁸ <http://www.creativepr.com/baby-boomers-online-behavior-infographic/>
- ¹⁹ <http://www.pewinternet.org/Reports/2012/Older-adults-and-internet-use/Summary-of-findings/Findings.aspx>
- ²⁰ <http://www.census.gov/prod/2013pubs/p20-570.pdf>
- ²¹ Family Caregiver Alliance (<http://www.caregiver.org/caregiver>)
- ²² <http://research.gallaudet.edu/Demographics/deaf-US.php>
- ²³ <http://medcitynews.com/2012/07/the-emr-technology-and-meaningful-use/>
- ²⁴ <http://www.cdc.gov>



-
- ²⁵ As of 2006, 38% of all hospital inpatients were individuals age 65+.
- ²⁶ <http://online.wsj.com/news/articles/SB10001424127887323838204578654152046151798>
- ²⁷ <http://www.cnbc.com/id/100424018>
- ²⁸ <http://cdn.umb.edu/images/volunteering.pdf>
- ²⁹ <http://www.ncoa.org/national-institute-of-senior-centers/nisc-news/senior-centers-reach-the.html>
- ³⁰ http://assets.aarp.org/rgcenter/il/healthy_home.pdf
- ³¹ <http://www.cdc.gov/nchs/fastats/older-american-health.htm>
- ³² http://www.nytimes.com/2012/09/21/us/life-expectancy-for-less-educated-whites-in-us-is-shrinking.html?pagewanted=all&_r=0
- ³³ <http://www.caregiving.org/data/04finalreport.pdf>
- ³⁴ http://www.unitedhealthgroup.com/news/rel2011/eConnected_Family_Caregiver_Study_Jan_2011.pdf
- ³⁵ <http://www.informationweek.com/healthcare/electronic-medical-records/chr-adoption-grows-as-docs-bid-for-incen/240006440>
- ³⁶ http://www.fazzi.com/tl_files/documents/Fazzi%20State%20of%20the%20Industry%20Study%20Report.pdf
- ³⁷ <http://www.healthcareitnews.com/news/senate-hearing-underscores-healthcare-quality-health-it-woes>
- ³⁸ ADLs are Activities of Daily Living, including feeding, toileting, dressing, bathing, grooming
- ³⁹ Internet adoption falls to 47% and broadband adoption falls to 34% among 75-79 year olds.
- ⁴⁰ <http://www.foxbusiness.com/personal-finance/2014/08/11/what-seniors-should-look-for-in-phone>
- ⁴¹ <http://aarp.geeksquad.com/tech-tips>
- ⁴² CAPS, National Association of Home Builders, <http://www.nahb.org/page.aspx/category/sectionID=686>
- ⁴³ Eight-six percent of the American population is predicted to be overweight or obese by 2030. <http://www.newsweek.com/id/153309>
- ⁴⁴ <http://www.aarp.org/home-family/personal-technology/info-10-2012/microsoft-aims-to-kinect-with-seniors-gaming.html>
- ⁴⁵ Cathedral Builders Wanted, Coughlin & Lau 2006 http://agingsociety.org/agingsociety/publications/public_policy/previous.html
- ⁴⁶ <http://blog.socrato.com/4-sources-to-help-you-find-cool-moocs/>
- ⁴⁷ NY Times 5/27/2010 <http://newoldage.blogs.nytimes.com/2010/05/27/screen-time-with-mom/>
- ⁴⁸ http://www.aarp.org/content/dam/aarp/technology/innovations/2011_04/Connected-Living-for-Social-Change.pdf
- ⁴⁹ http://seattletimes.nwsourc.com/html/microsoftpri0/2014231113_mobile_world_google_ceo_says_the_phone_is_the_new.html



-
- ⁵⁰ <http://www.newzoo.com/insights/global-games-market-will-reach-102-9-billion-2017-2/>
- ⁵¹ <http://www.bigfishgames.com/blog/2014-global-gaming-stats-whos-playing-what-and-why>
- ⁵² http://weblogs.baltimoresun.com/health/2010/06/kinect_for_xbox_360_adding_a_1.html
- ⁵³ <http://www.gamesindustry.biz/articles/2014-01-14-mobile-gaming-to-push-industry-above-usd100-billion-by-2017>
- ⁵⁴ <http://www.techrepublic.com/article/gaming-health-care-how-microsoft-kinect-is-revolutionizing-the-future-of-rehab/>
- ⁵⁵ <http://www.lifelinesys.com/content/independent-living-assessment>
- ⁵⁶ <http://www.cesweb.org/Show-Floor/Marketplaces/Lifelong-Tech.aspx>
- ⁵⁷ <http://www.walmart.com/ip/RealPad-by-AARP-7.85-Tablet-16GB-Intel/38582722>
- ⁵⁸ <http://www.nia.nih.gov/HealthInformation/Publications/LongDistanceCaregiving>
- ⁵⁹ <http://www.ereleases.com/pr/revenues-aging-place-market-surpass-30-billion-2017-semico-research-173467>
- ⁶⁰ The PERS (and its mPERS subset) market has been estimated at \$1.5-2 billion and forecast at an 11.6% CAGR through 2012, www.marketresearchworld.net
- ⁶¹ <http://www.aarp.org/home-family/personal-technology/social-media-training/>
- ⁶² <http://assistedlivingtoday.com/2013/09/best-tablets-for-seniors/> and (2014) <https://insidersguide.vzw.com/tech-smarts/top-apps-for-seniors/>
- ⁶³ <http://www.pewinternet.org/Reports/2012/Caregivers-online/Summary-of-Findings.aspx>
- ⁶⁴ See Leading Age CAST Survey 2013 http://www.leadingage.org/uploadedFiles/Content/About/CAST/Resources/LZ100_Technology_Survey_2013.pdf



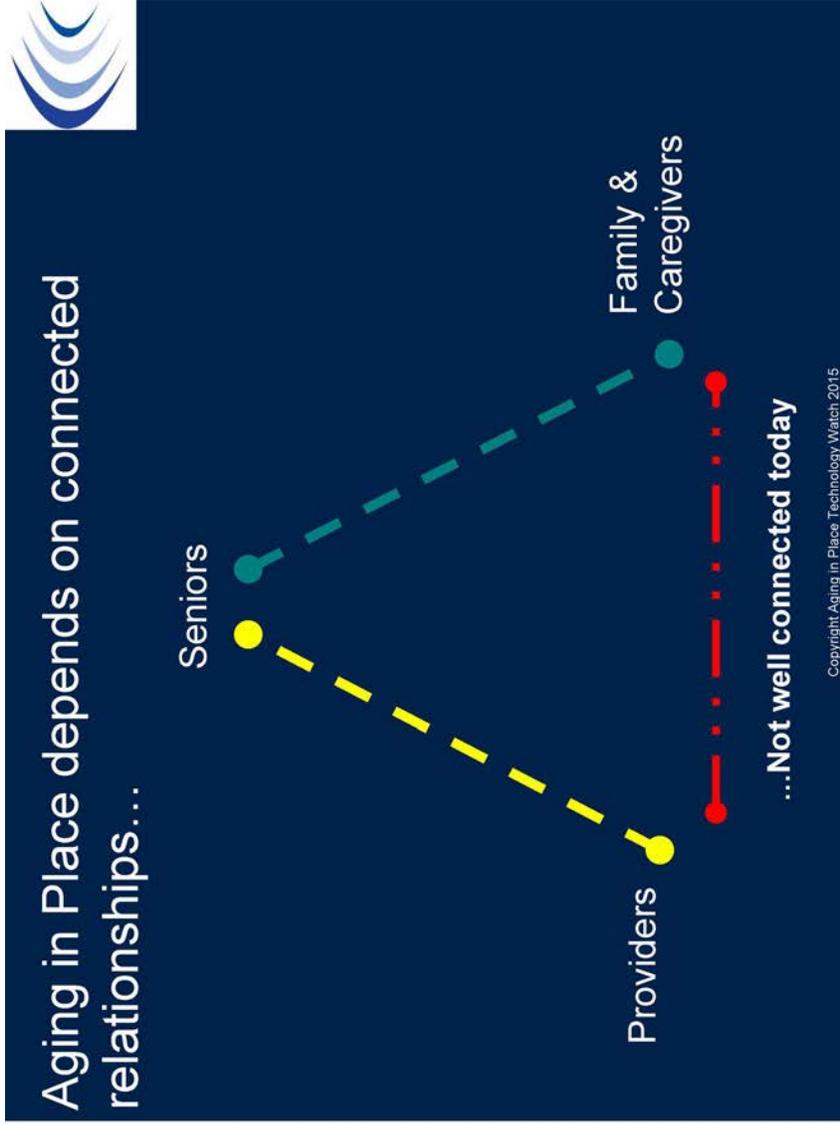
Aging in Place Technology:

Looking at 2015 and Beyond

Laurie M. Orlov

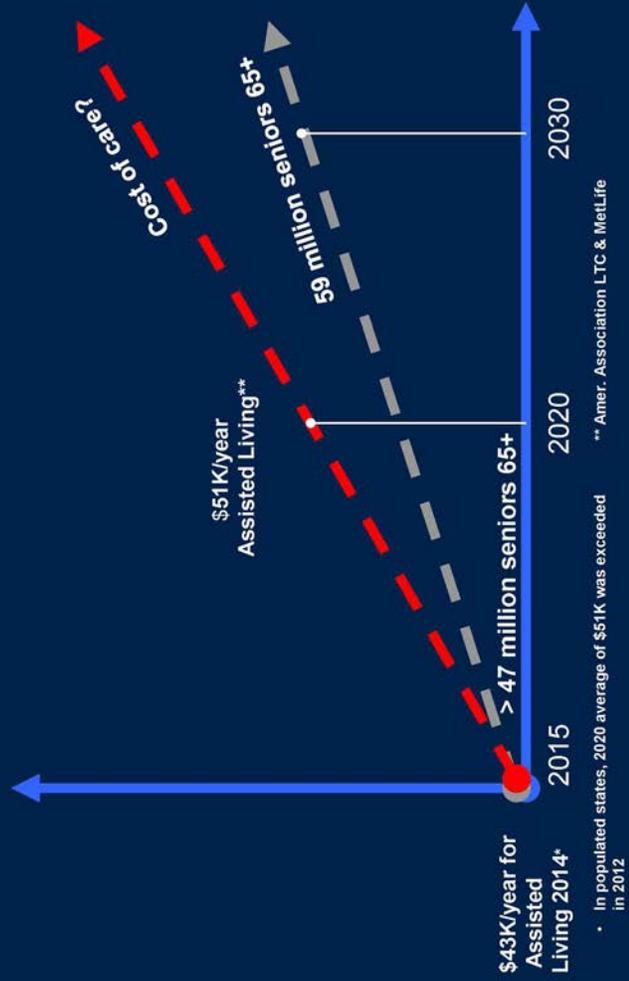
Aging in Place Technology Watch







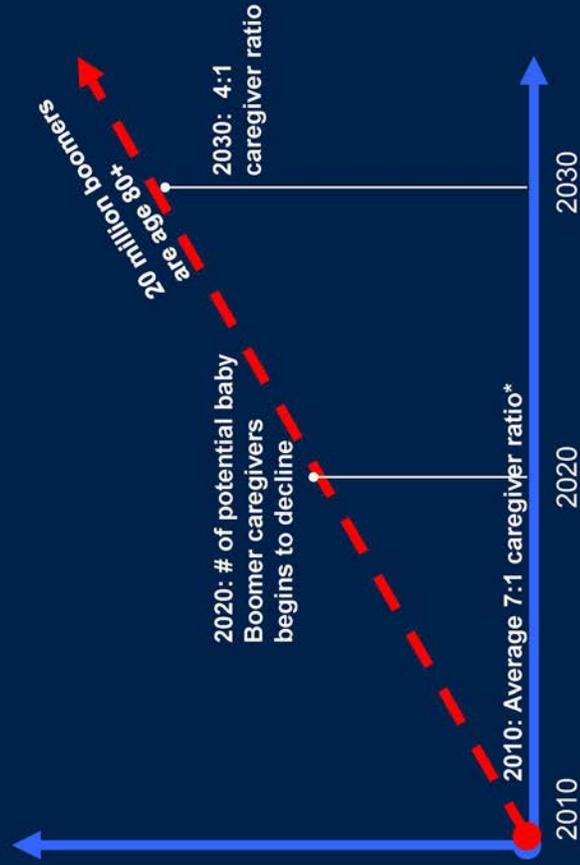
The looming crisis of care: what will be the projected cost?



Copyright Aging in Place Technology Watch 2015



The looming crisis of care: who will be available to provide care?



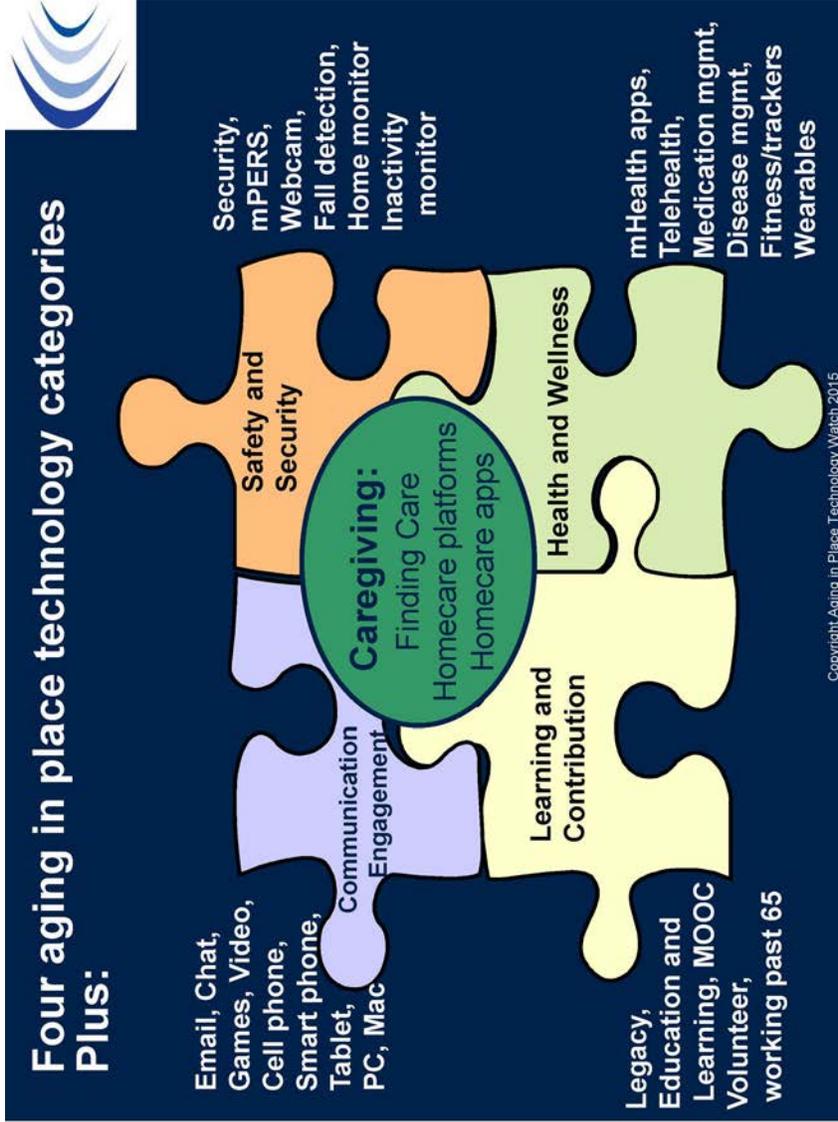
*Likely available caregivers for the 80+ population aged 45-64
Source: The Aging of the Baby Boom
AARP Public Policy Institute, 2013

Copyright Aging in Place Technology Watch 2015

Care is local – lowest ratios by population of the 80+



County	Care Ratio	80+ Population
Palm Beach, FL	3.4	103,120
Ocean County, NJ	3.8	39,365
Sarasota County, FL	2.8	39,076
Collier County, FL	3.5	23,959
Barnstable County, MA	4.3	16,159
Highlands County, FL	2.7	9,041
Moore County, NC	3.9	6,170
Kerr County, TX	3.4	4,025



A wave of technology exists to help seniors and care recipients...

The collage features several key technologies:

- GreatCall Splash**: A large, easy-to-use mobile phone.
- Vtech Senior Phone**: A multi-line mobile phone with large buttons.
- Healthsense**: A white rectangular device, likely for health monitoring.
- TV EARS**: A device for hearing assistance, with the tagline "The Revolutionary TV Listening Device".
- MedMinder**: A medication management system.
- carefree.me**: A green tree logo representing a care service.
- CapTel 800i**: A captioned telephone with the text "Click here for more information."
- Hamilton CapTel Care Innovations**: A service provider for captioned phones.
- INDEPENDA**: A service with the tagline "Redefining Independence™".
- GrandCare**: A software interface for a tablet or smartphone, showing icons for Music, Pictures, News, WebPages, Calendar, and Weather.
- MobileHelp**: A white mobile phone with the text "We Want to Hear from You. Click here to share your MobileHelp Story."

Example (only): technology for seniors and families



BrainHQ



Wii



Philips GoSafe



Telikin



Microsoft Kinect





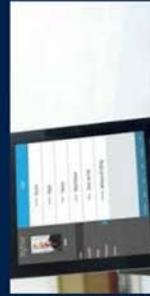
Examples only – new for 2014-2015



Sen.se Mother



Rosetta Stone FitBrains



Honeywell Seymour



Grand Pad tablet



CareMerge care coordination



Lively Safety Watch



Evermind



Clarity Ensemble

Copyright Aging in Place Technology Watch 2015



Where is the market headed?



Copyright Aging in Place Technology Watch 2015



Thank you!

Laurie M. Orlov
Aging in Place Technology Watch

www.ageinplacetech.com
laurie.orlov@gmail.com
772-345-3725





Aging in Place and Eldertech Research at the University of Missouri

Marjorie Skubic, Ph.D., Professor, Electrical & Computer Engineering
University of Missouri, Columbia, MO

The Aging in Place research and practice team in the MU Sinclair School of Nursing, initiated in 1996, has successfully developed and tested the aging in place model of care and conducted research on the cost and clinical outcomes. The Eldertech research team, initiated in 2003 and now led by the Center for Eldercare and Rehabilitation Technology in the College of Engineering, works with researchers from the Schools of Nursing, Medicine, Social Work, Health Management & Informatics, Health Professions, and others at MU. The Eldertech team is nationally and internationally recognized for their cutting edge interdisciplinary research on technological solutions for the complex problems facing elders as they want to age in place⁸⁻²³.

Background

Many senior citizens and their families, preferring to remain at home, want to postpone or even avoid nursing home care. The Aging in Place (AIP) project vision was developed in 1996 in the Sinclair School of Nursing with an interdisciplinary team to provide more and higher-quality services at home, allowing people to "age in place."

People get services when they need them, regain independence, and then services are limited or withdrawn so costs are controlled. State legislation in 1999 and 2001 enabled the construction of TigerPlace, built by Americare Systems, Inc. in 2004 and expanded in 2008: a state of the art independent living facility, built to nursing home standards, licensed as intermediate care so people can use long term care insurances, and operated as independent housing with services in Columbia, MO. Americare operates the housing, housekeeping, and dining operations at TigerPlace. Sinclair Home Care, under the MU Sinclair School of Nursing, runs the clinical operations, including the wellness clinic, clinical care coordination, and the exercise program.



Fig. 1. The TigerPlace Aging in Place Facility

Grants for Aging in Place and Eldercare Technology, led by principal investigators from the interdisciplinary Eldertech Team, totaling over \$12 million, include funding from the National Institutes of Health, the National Science Foundation, the Agency for Health Care Research and Quality, the Administration on Aging, the Alzheimer's Association, RAND Health, the Gerontological Nursing Interventions Research Center, and the Centers for Medicare and Medicaid²⁴⁻²⁵.

Early Interventions through Nursing Care Coordination AIP Research

The impact of AIP through clinical care coordination has been validated showing a cost savings to Medicare and Medicaid in the community with Aging in Place evaluations (\$1,591 per month for the nursing home comparison group, \$483 per month for the home and community based comparison group). In both the community and TigerPlace evaluations, RN nurse care coordination reduces adverse health events, improves care outcomes, reduces nursing home utilization, and is cost-effective. Costs for any TigerPlace nursing home eligible participant has never approached or exceeded nursing home care (average annual care cost for 2008 was \$7,331 plus the housing cost). For those not eligible for nursing homes, the annual average care cost was \$2,591. These cost savings represent nearly \$9 billion for those in the community and over \$3 billion in nursing homes if RN care coordination were implemented for only 10% of our nation's elders.

About 10 million people need long term care in the US². Of these, about 4.6 million are older than 65 and live in the community. These 4.5 million represent a potential \$89 billion in cost savings if everyone had access and participated in the RN nurse care coordinator intervention that has been tested at MU³⁻⁷. This is more than 40% of all dollars spent on people with long-term health needs in the US. Nurse care coordination, coupled with technology, has huge potential to help older people stay at home, where they want to be, safely and more cost-effectively. Technology can aid in the early detection of health problems so that they can be addressed early while health problems are more manageable and can be treated with less cost, and health outcomes are better (Figure 2).

By 2030, one in every five Americans will be 65 or older, growing from 35 million in 2010 to 71.5 million in 2030¹. Most older adults also have one or more chronic health conditions that require self-management or

assistance in managing, and more than 40% need assistance with one or more activities of daily living.¹ RN care coordination, health promotion, and early illness recognition and interventions through the use of technological

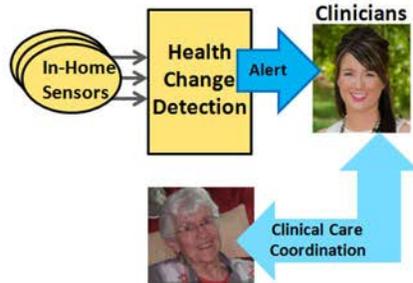


Fig. 3. The in-home sensor system with health change detection functions as a clinical decision support system. Early health change alerts are sent so that early interventions can be offered.

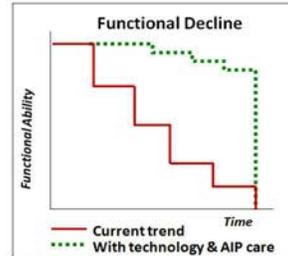


Fig. 2. Squaring the Life Curve with Detection of Early Illness and Functional Decline

innovations can address these needs while reducing costs.

Clinical Decision Support: In-Home Sensor Networks for Detection of Early Illness and Functional Decline

Sensor networks have been installed in TigerPlace apartments since Fall, 2005. The initial suite of sensors included motion sensors, chair pads, a stove sensor, and a bed sensor capturing restlessness, and low, normal, and high pulse and respiration rates. We have developed an integrated intelligent monitoring system that functions as a clinical decision support system (Figure 3), reliably capturing data about the residents and their environment in a noninvasive manner while balancing the needs of health, safety and privacy. We have developed algorithms to extract patterns of activity from the collected sensor data and generate alerts that indicate a potential health change, evaluated the usability of the interfaces, and investigated the acceptability of the technology by seniors. Figures 4 show an example of a sensor data display that illustrates changes in sensor data patterns due to health changes.

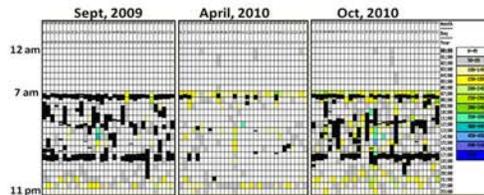


Fig. 4. Motion density maps showing a changing lifestyle due to decline and then improvement after an intervention¹²

In a recent NIH study, we showed statistically significant differences in health outcomes between a control group and an intervention group in which health alerts (based on sensor data) were automatically sent to nurses¹¹. Nurses rated the clinical relevance of the alerts and their potential in aiding early interventions; this information has been captured in a database for refinement of the health alert algorithms¹³. We are now conducting a large randomized clinical trial for people living with the sensors and

nursing staff receiving automated health alerts based on in-home sensor data.

Passive Fall Detection and Gait Analysis for Fall Risk Assessment

One in every three people age 65 or older falls each year, making falls the most common cause of injuries and hospitalizations for trauma in older adults and the leading cause of death due to injury. Our approach to fall detection does not require the client to wear anything, push any buttons, or charge any batteries. Rather, we have been investigating sensing that can be embedded in the environment, including vision, depth images (e.g., from the Kinect), acoustic arrays, and radar¹⁴⁻¹⁷. Likewise, fall risk assessment is accomplished through daily monitoring in the home, also using sensing installed in the environment¹⁸⁻²¹, to capture gait changes that may indicate problems

in physical or cognitive health. Figure 5 shows a Kinect sensor installed in a TigerPlace apartment and an example of the 3D model constructed from the Kinect depth data. Gait parameters are extracted from the Kinect model to capture in-home walking speed, stride time, and stride length^{19,20}. Gait parameters are captured automatically as residents walk around the home in their normal, daily activities. Changes in gait are then tracked to observe trends and used for health alerts.

Sensing systems are rigorously studied in the lab with a motion capture system for validation before deployment in senior housing. Volunteers aged 20 to 90 have participated in validation studies. Fall detection systems have been developed using stunt actors, who are trained to fall in 21 different falls typical of older adults and then act out the falls for data collection. Figure 6 shows an example of an actual elderly fall captured in the home using the Kinect system.

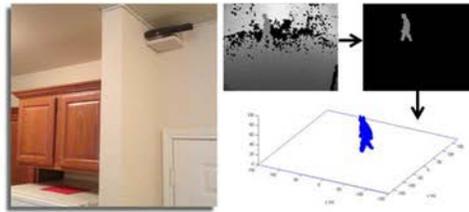


Fig. 5. A Kinect sensor installation with a 3D model constructed from the Kinect depth data

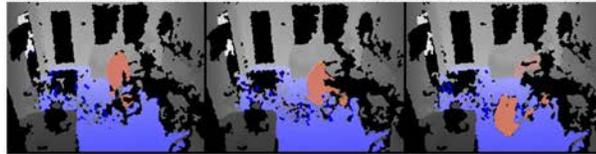


Fig. 6. A fall detected in a TigerPlace apartment. Blue shows the floor plane.

Physiological

The MU sensor that well as bed collected automatically respiration bed sensor is bed sensor changes in indicate



Fig. 7. The hydraulic bed sensor with 10 seconds of data. The high amplitude, low frequency signal is breathing. The high frequency component is the ballistocardiogram of the heart.

Contact

mail:

Monitoring with a Passive Hydraulic Bed Sensor

eldertech team has developed a new hydraulic bed captures quantitative pulse and respiration rates as restlessness²²⁻²³. Figure 7 shows the sensor with data while positioned under the bed mattress. Algorithms separate the ballistocardiogram heart signal from the signal to compute pulse and respiration rates. This now part of the health alert system. The hydraulic provides more detailed information for detecting sleep patterns and physiological signals that may changing health.

information:

- Marjorie Skubic, Director, Center for Eldercare and Rehabilitation Technology and Professor, Electrical and Computer Engineering, E-skubicm@missouri.edu
- Marilyn Rantz, Curators' Professor, Sinclair School of Nursing, E-mail: rantzm@missouri.edu
- Websites: www.eldertech.missouri.edu; www.agingmo.com (with links to videos²⁶)

References

1. Federal Interagency Forum on Aging Related Statistics. (2008, March). *Older Americans 2008: Indicators of Well-Being*. Washington, DC: U.S. Printing Office. Retrieved February 16, 2010, from www.agingstats.gov.
2. Rogers, S. & Kosimar, S. (2003). *Who needs long-term care?*: Georgetown University Long-Term Care Financing Project.
3. Marek, K.D., Stetzer, F., Adams, S.J., Popejoy, L., & Rantz, M. (2012). Aging in Place versus nursing home care: comparison of costs to the Medicare and Medicaid programs. *Research in Gerontological Nursing*, 5(2), 123-129.
4. Marek, K.D., Adams, S.J., Stetzer, F., Popejoy, L., Petroski, G., & Rantz, M.J. (2010). The influence of community-based nurse care coordination on costs to the Medicare and Medicaid programs. *Research in Nursing and Health*, 33, 235-242.
5. Rantz, M.J., Phillips, L., Aud, M., Marek, K.D., Hicks, L.L., Zaniletti, I., & Miller, S.J. (2011). Evaluation of aging in place model with home care services and registered nurse care coordination in senior housing. *Nursing Outlook*, 59(1), 37-46.
6. Marek, K.D., Popejoy, L., Petroski, G., Mehr, D., Rantz, M., & Lin, W-C. (2005). Clinical outcomes of aging in place. *Nursing Research*, 54(3), 202-211.
7. Marek, K. D., Popejoy, L., Petroski, G., & Rantz, M. (2006). Nurse care coordination in community-based long-term care. *Journal of Nursing Scholarship*, 38(1), 80-86.
8. Alexander G.L., Rantz M.J., Skubic M., Koopman R., Phillips L., Guevara R.D., & Miller S. (2011). Evolution of an early illness warning system to monitor frail elders in independent living. *Journal of Healthcare Engineering*, 2(2), 259-286.
9. Skubic, M., Alexander, G., Popescu, M., Rantz, M., & Keller, J. (2009). A smart home application to eldercare: current status and lessons learned. *Technology and Health Care*, 17(3), 183-201.
10. Rantz, M.J., Skubic, M., Alexander, G., Popescu, M., Aud, M., Koopman, R., & Miller, S. (2010). Developing a comprehensive electronic health record to enhance nurse care coordination, use of technology, and research. *Journal of Gerontological Nursing*, 36(1), 13-17.
11. Rantz, M.J., Skubic, M., Alexander, G., Phillips, L., Aud, M., Wakefield, B., Koopman, R., & Miller, S. (2012). Automated technology to speed recognition of signs of illness in older adults. *Journal of Gerontological Nursing*, 38(4), 18-23.
12. Wang, S., Skubic, M., and Zhu, Y. (2012). Activity Density Map Visualization and Dis-Similarity Comparison for Eldercare Monitoring. *IEEE Journal of Biomedical and Health Informatics*, 16(4): 607-614.
13. Skubic, M., Guevara, R.D., and Rantz, M. (2015). Automated Health Alerts Using In-Home Sensor Data for Embedded Health Assessment. *IEEE Journal of Translational Engineering in Health and Medicine*, vol. 3.
14. Anderson D, Luke RH, Keller JM, Skubic M, Rantz M, & Aud M. (2009). Linguistic summarization of video for fall detection using voxel person and fuzzy logic. *Computer Vision & Image Understanding*, 113(1):80-89.
15. Liu, L., Popescu, M., Rantz, M., Skubic, M., Cuddihy, P. and Yardibi, T. (2011). Automatic Fall Detection Based on Doppler Radar Motion Signature, In *Proc. of the Pervasive Health Conf.*, Dublin, Ireland, May, *Best Poster*.
16. Li Y, Ho KC & Popescu M. (2014) Efficient Source Separation Algorithms for Acoustic Fall Detection Using a Microsoft Kinect. *IEEE Transactions on Biomedical Engineering*, 61(3):745-755.
17. Stone E & Skubic M. (2015). Fall Detection in Homes of Older Adults Using the Microsoft Kinect. *IEEE Journal of Biomedical and Health Informatics*, vol. 19, no. 1, pp. 290-301.
18. Stone E.E. & Skubic M. (2011). Evaluation of an inexpensive depth camera for in-home gait assessment. *Journal of Ambient Intelligence and Smart Environments*, 3(4), 349-361.
19. Stone E & Skubic M. (2013). Unobtrusive, Continuous, In-Home Gait Measurement Using the Microsoft Kinect. *IEEE Transactions on Biomedical Engineering*, 60(10):2925-2932.
20. Stone, E., Skubic, M., Rantz, M., Abbott, C., and Miller, S. (2015). Average In-Home Gait Speed: Investigation of a New Metric for Mobility and Fall Risk Assessment of Elders. *Gait and Posture*, 41: 57-62.
21. Wang, F., Skubic, M., Rantz, M., Yardibi, T., and Cuddihy, P. (2014). Quantitative Gait Measurement with Pulse-Doppler Radar for Passive In-Home Gait Assessment. *IEEE Trans on Biomedical Eng.*, 61(9): 2434-2443.
22. Heise, D., Rosales, L., Skubic, M. & Devaney, M.J. (2011). Refinement and Evaluation of a Hydraulic Bed Sensor, *Proc., IEEE Eng. in Medicine and Biology Conf.*, Boston.
23. Rosales, L., Skubic, M., Heise, D., Devaney, M.J., & Schaumburg, M. (2012). Heartbeat Detection from a Hydraulic Bed Sensor Using a Clustering Approach, *Proc., IEEE Eng. in Medicine and Biology Conf.*, San Diego.
24. www.agingmo.com
25. www.eldertech.missouri.edu
26. NSF Science Nation Video: <http://www.agingmo.com/index.php/resources/video/home-sensors-enable-seniors-to-live-independently-national-science-foundation-clip>