Elderly Slips and Falls

How Technology Will Reduce the Tragic Consequences of Slip and Fall Incidents

By Tim Cassidy and Andrea Delius, August 2019.

Serendipity

In late February 2019, I attended the ICPHSO[1] (International Consumer Product Health and Safety Organization) conference in Washington, DC. On the final day at lunch CPSC (Consumer Product safety Commission of the USA) commissioner Adler[2] gave a talk. In his remarks he spent considerable time on the issues of safety for the elderly and remarked that slips and falls were the leading cause of injuries for this demographic. He was making a call-for-action to those in attendance to do what we can to help. I left the meeting intrigued by the Commissioners' remarks, but not sure there was anything I could personally do to answer the call.

I departed for home that afternoon. Ironically, I was seated next to a professor of bioengineering from Mayo Clinic, professor Kaufman[3]. He worked on slips and falls and has a laboratory dedicated to studying them. His work is focused on Wounded Warriors and advance prosthetics. We struck up a conversation, and I learned a lot from what he had to say. Imagine the likelihood of having just heard a call-to-action from Commissioner Adler, then being seated next to an expert in the subject area of interest!

To add a layer to the irony, Best Buy had just recently acquired Great Call, a company providing products and services aimed at improving the safety of the elderly, including products called PERS (personal emergency response systems). I contacted their technology experts within a few days of returning to see what they knew about the topic. They know quite a lot and gave me additional information on where technology is and where it's going. Below summarizes some of what I learned on this topic.

The Statistics Behind Falls

Falling seems as though it becomes inevitable as age increases. Falling just once, doubles your chances of falling again. Every year, millions of seniors–those older than 65–fall. One out of four seniors fall each year, but less than half actually tell their doctor. One in five falls cause a serious injury such as broken bones or a head injury. Three million seniors are treated in emergency departments for fall injuries each year and over 800,000 patients a year are hospitalized because of a fall injury. Additionally, more than 95% of hip fractures are caused by falling. Falls are also the most common cause of traumatic brain injuries.[4] These types of injuries can often result in death in the older populations which is why technologies mitigating these outcomes are the future of ensuring safety, peace of mind, and happiness for everyone involved in these people's lives. According to CDC (Centers for Disease Control and Prevention), death rates related to falls increased 30% between 2007 and 2016 from about 47 per 100,000 to about 62 per 100,000.

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[1] ICPHSO, www.icphso.org/

[2] Commissioner Adler bio, www.cpsc.gov/About-CPSC/Commissioners/Robert-Adler

[3] Professor Kaufman bio, www.mayo.edu/research/faculty/kaufman-kenton-r-ph-d/bio-00077935

Financially, falls resulting in injuries are no cheap expense. $50 billion was the total cost of fall injuries in 2015 ($29B Medicare; $12B private/out of pocket; $9B Medicaid). The financial impact for senior falls is expected to increase as the population ages and may reach $67.7 billion by 2020.[4] These are expenses that could be vastly reduced with the help of technology implementation into senior's lives.

Falls are a very real fear for seniors and changes the way they go about life. This fear causes seniors to no longer engage in certain actives which could result in various problems such as physical decline, depression, and social isolation among many other things. Technologies that are shaping the way people view falling would help seniors in aspects of life much greater than falling and getting physically hurt. The confidence to go through life without fear is a gift many take for granted and these technologies would give that gift back to many people.

The Mechanics of Falls

Things falling over, human persons or physical items, have a simple mechanical explanation. When the center of gravity is outside of the "footprint," they fall. Imagine you have a rubber band around the soles and heels of your shoes and your feet are spread to shoulder width. Looking down at the rubber band you see a rectangle outline made by the rubber band. Inside the rectangle area is the footprint. Because you are standing upright, your center of gravity is within the footprint area. Therefore, you are stable.

Now imagine you begin to lean backward. It will not take long before you realize that as you continue to lean backward you will reach a point of no return and you will fall. The same principle is at work with a television or a furniture item. If the center of gravity goes outside the footprint area, it will fall.

The television or furniture item has one key difference with you leaning backward. It cannot realize it is about to fall and therefore cannot take any corrective action. Humans can do both. So, if humans can take corrective actions, why do they fall?

Falls and Therapeutic Interventions

In our imaginary scenario we are leaning backward, realize we are in peril, and take a corrective measure. What measure do we take? We extend a foot causing our center of gravity to again be within the (new) footprint, thus alleviating the situation. Examining this series of actions further we see that "realizing" means our brain takes note of our equilibrium and directs our foot to take an action by sending nerve impulses (sorry, I'm neither a doctor nor a bioengineer, and this explanation may be less than ideal!). Where to place our foot and how quickly we need to move it are the result of our brain/body coordination. Breaking this down we have: realization of peril, strategy to overcome the peril, and motor action to meet the strategy. This process takes time even if we are not conscious of the time it takes. An athlete will execute these operations at a high rate of speed relative to the rest of us and we call that *agility*.

But there's more to it than that. Once we place the foot in the new spot, we must have the *strength* to plant our weight, including the momentum resulting from motion, to hold us upright and steady. Thus, we require both strength and agility to overcome an instability and prevent falling.

There are therapeutic methods to help elderly people regain or improve their ability to perform these functions. Improving our reaction speed and increasing our strength is possible for most elderly persons

when therapeutic interventions are deployed. The earlier these interventions occur, the more likely they will be successful. Conversely, late interventions seldom result in success. By success I mean extending the longevity of a person being independent and mobile; agile and strong enough to overcome a potential fall. The problem is, many elderly persons are reluctant to let caregivers or family members know when they first fall so that intervention may be delayed or not take place at all. Unfortunately, once falls begin to happen, they tend to repeat, ultimately leading to some catastrophic event where freedom and mobility are beyond recovery. But technology will help overcome this obstacle.

Technology and Intervention

Today's PERS devices can detect accurately when a person has fallen and initiate communications with the person who fell, or with emergency services providers.   Great Call[4] may also connect the person to therapeutic intervention services.   Service providers such as Great Call can also contact caregivers or family members (when permitted by the customer) to initiate conversation about interventions.

The detection technology is improving with the aim of not only *detecting* but *predicting* fall likelihood. Stability is being studied so that machine learning can be applied, and predictive technologies built that will accurately predict when intervention should be made to *prevent* falls. These technologies have the potential to both help maintain independent living and reduce costs in the healthcare system by reducing hospital stays or emergency room visits.

Optimism for the Future

Perhaps the most frightening thing for seniors is finding themselves in an environment depending on strangers for their daily care, unable to be mobile and cut off from the things they know and love.

In this paper we have been concerned with slips and falls resulting from the loss of agility and strength that accompany aging. There are plenty of other causes of slips and falls and technology will play a big role in improving those as well. But for these cases, optimism for the future is warranted. The technology of predicting susceptibility or the high likelihood of loss of stability for seniors is already emerging and will only improve in the near term. Systems to connect persons with therapeutics and other resources will be key to the practicality of the technologies successful application. Healthcare funding systems are seeking ways to reduce expenses and improve outcomes. Methods to increase agility and strength reduce healthcare costs. But more importantly, they provide a means for elderly persons to remain active and independent. This impact cannot be underestimated in importance as we all face the prospects of aging, and the desire to do so with grace and dignity.

Tim Cassidy is Product safety and Compliance Director for Best Buy. Andrea Delius is a Mechanical Engineering undergraduate student at the University of Minnesota and Risk and Compliance Team Intern at Best Buy.

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[4] Centers for Disease Control and Prevention, https://www.cdc.gov/homeandrecreationalsafety/falls/adultfalls.html
[5]Great Call PERS, www.greatcall.com/devices/lively-mobile-medical-alert-system