An Airbag for Hip Fractures: *Standard Preventive Measures, and a New Approach Using 3-D Sensors*
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Among the elderly, the risk of hip fractures and related complications is much greater than younger age groups. In fact, people 85 and older are 10 to 15 times more likely to sustain hip fractures than are those aged 60 to 65.[1]

This risk is especially pronounced among women, who actually sustain three-quarters of all hip fractures.[2] The problem is related particularly to osteoporosis, a disease that makes bones porous and therefore much weaker and more susceptible to fracture.

While bone fractures are fairly common across the entire population, hip fractures among the elderly can lead to a loss of independence, with many ending up in nursing homes for a year or more. And, the event can also be quite deadly due to complications. One out of five hip fracture patients dies within a year of their injury.[3]

Standard Preventive Measures

The Centers for Disease Control and Prevention (CDC), lists a number of steps that anyone can take to prevent a hip fracture or lower their risk in the first place[4]:

To help prevent falls, older adults can:

- *Exercise regularly. It is important that the exercises focus on increasing leg strength and improving balance, and that they get more challenging over time. Tai Chi programs are especially good.*
- *Ask their doctor or pharmacist to review their medicines—both prescription and over-the counter—to identify medicines that may cause side effects or interactions such as dizziness or drowsiness.*
- *Have their eyes checked by an eye doctor at least once a year and update their eyeglasses to maximize their vision. Consider getting a pair with single vision distance lenses for some activities such as walking outside.*
- *Make their homes safer by reducing tripping hazards, adding grab bars inside and outside the tub or shower and next to the toilet, adding railings on both sides of stairways, and improving the lighting in their homes.*

To lower their hip fracture risk, older adults can:

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[1] Scott JC. Osteoporosis and hip fractures. Rheumatic Diseases Clinics of North America 1990;16(3):717–40.
[2] National Hospital Discharge Survey (NHDS), National Center for Health Statistics. Available at: http://205.207.175.93/hdi/ReportFolders/ReportFolders.aspx?IF_ActivePath=P,18External Web Site Icon
[3] Farahmand BY, Michaelsson K, Ahlbom A, Ljunghall S, Baron JA, Swedish Hip Fracture Study Group. Survival after Hip Fracture. Osteoporosis International. 2005;16(12):1583-90.
[4] Centers for Disease Control and Prevention. *Hip Fractures Among Older Adults*. Available at: http://www.cdc.gov/HomeandRecreationalSafety/Falls/adulthipfx.html

- *Get adequate calcium and vitamin D—from food and/or from supplements.*
- *Do weight bearing exercise.*
- *Get screened and, if needed, treated for osteoporosis.*

The Airbag Belt

The CDC notes that more than 95% of hip fractures are caused by falling, most often by falling sideways onto the hip.[5] Allentown, Pennsylvania- based ActiveProtective Technologies, with the help of Boston Device Development, has developed a belt-like airbag device that mitigates the risk of these hip and upper leg fractures related to a fall.

Drew Lakatos, the CEO of ActiveProtective, presented the company's airbag device at the TEDMED conference in 2014. In the video of this presentation, posted online[6], Lakatos likens the solution offered by his company to the automobile industry. With all of the protective measures taken by that industry, he explains that the United States now has the lowest highway fatality rate in 100 years.

The comparison with the automobile industry is an appeal for a strategic shift in policy and spending on "intelligent protection" of the elderly in much the same way that that such a shift was made to ensure the adoption of preventive technologies and practices for driving.

The ActiveProtective airbag belt, referred to by Lakatos as a "smart garment", contains 3-D motion sensors that are capable of detecting a fall in progress. Such falls instantly trigger an airbag that inflates to provide protection for the wearer's hips.

The company has done a great deal of practical research on what Lakatos calls "stereotypical human motion", having collected data on the typical motions of daily living. So, in fact, the airbag is not necessarily detecting a fall, so much as it is detecting "the absence of stereotypical human motion in order to determine the fall".

Lakatos showed a video clip of a man getting out of a chair with weak legs. On his first attempt, the man fell back into the chair, without triggering the airbag belt. On his second attempt, he moved into a "non-controlled ascent of his center of mass. The "hyper-aware" sensors in this instance are looking for "accelerations that are too long, too great, or simply don't fit that motion before they decide he's out of control and begin to deploy the airbags; which deploy in about 60 milliseconds."

According to the company's website, ActiveProtective has "demonstrated the ability to reduce impact force by 90% with our garments, which will eliminate the majority of hip fractures.[7]

Unlike many diseases, we know who is at risk for hip fractures, and we can consider solutions like this airbag. The same approach can mitigate the risk of sports-related concussions. Or, as Lakatos suggests, to protect postal workers when it's icy out. The same technologies are being used to protect military soldiers from Improvised Explosive Devices (IEDs).

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[5] *Ibid*.
[6] TEDMED Website. *TEDMED 2014: Drew Lakatos*. Available at: http://www.tedmed.com/talks/show?id=299413
[7] ActiveProtective Website. *Overview and Team*. Available at: http://www.activeprotect.co/overview-and-team.html

The benefits of confidence to stay active that a device like this can give to the elderly cannot be understated. The fear of another injury is often debilitating, resulting in a greater lack of mobility; thereby creating other health risks.