

# Living longer, falling harder

## As the risk of devastating falls grows with an aging U.S. population, ASU researchers work with volunteers to design safer bathrooms

By Steve Filmer, ASU News  
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Quick: Describe “coefficient of friction.” You have 250 milliseconds.

That fraction of a second is the average reaction time it takes to sort out what our brain is telling us and react to it.

If you’re falling, that’s the thin slice of time you have to do something to stop your slide. One quarter of a second. You’ll do better if you’re younger and progressively worse as you get older. If your foot is sliding on a wet bathroom surface — let’s say a bathtub — you risk injury, and even death.

Coefficient of friction is simply the science term that gives us a math-ready measurement of slipperiness. You’ll hear it a lot inside a biomechanics lab.

The U.S. Consumer Product Safety Commission says Americans are experiencing about 12 million falls per year. The nation’s population is aging, and the Centers for Disease Control and Prevention projects that by 2030 there will be 52 million falls annually.

That’s why a professor and his team at Arizona State University are teaming up with the CPSC to do something about this growing risk.

“When I see an older adult going into a bathtub, it worries me a great deal because that floor surface or bathing surface has not been carefully designed or carefully standardized,” ASU Professor [Thurmon Lockhart](#) says.

The surface friction standard is a measurement of how slippery, or dangerous, a tub or bathroom floor might be. Lockhart says that standard has been obsolete since 1978. Without it, manufacturers of flooring and bathroom fixtures have no benchmark — nor do architects who design layouts for bathrooms in homes, apartments and hotels.

Lockhart is the inaugural MORE Foundation Professor of Life in Motion in ASU’s School of Biological and Health Systems Engineering.

Over the next several months, his lab will begin asking older volunteers to strap into a full-body safety harness and step on wet surfaces. His team has cut and formed soft foam strips to the dimensions of an actual bathtub. This will protect the feet, knees or legs of the volunteers from being injured by striking the sides of a real tub.

A static line, like the kind developed for mountain climbers and rescue teams, “is what fully prevents you from falling over,” says Daniel Chu, one of the graduate students working on the study team.

## Surviving the test drive

Strapping in as a test subject means key points of your body are fixed with small reflective spheres. These mark hips, knees and other major joints. When you slip, an array of high-speed infrared cameras capture every whip and wobble of the sphere. These turn body movements into a live-action “movie” of the fall — a stick figure that can be played back and analyzed.

A volunteer test subject in the safety harness can wind up hovering just a few inches off the floor, heart racing, adrenaline pumping. It’s not hard to look at a slow-motion playback and see the kinds of injuries that *would* have happened: impacts to the legs, hips and head.

“With (an increase in the) older population in the next few decades, we’re going to be seeing a significant amount of this type of (injury),” Lockhart says.

A person may be fortunate to survive a fall on a slick bathroom surface with just a sprain or a broken bone. Especially for older people, there is the added risk of traumatic brain injury, or TBI. Lockhart says older TBI victims are less likely to recover or survive.

The work of his team with the CPSC starts with two hard facts: “No. 1, we have an older population ... increasing significantly in our country,” Lockhart says. “No. 2, there is not really much that we have done for the older adults in terms of reducing falls.”

With the help of brave, aging volunteers and the guidance of the CPSC, Lockhart and his team hope to create new, safer guidelines for tubs and bathrooms.

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## Interested in volunteering for the study?

Professor Thurmon E. Lockhart's lab is looking for volunteers, ages 18 to 105 years old, to participate in an experiment involving stepping in and out of the bathtubs and shower stalls to assess friction requirements for developing safety requirements. This project is funded by the U.S. Consumer Product Safety Commission.

The testing will take place on ASU's Tempe campus.

Volunteers will be asked to perform following tasks while wearing athletic, nonreflective clothing:

Standing balance testing.

Walking for about two minutes at a normal walking pace.

Sit-to-stand tests.

Leaning balance testing.

Walking into and out of the bathing surfaces.

Participant will spend a maximum of two hours for their visit, including about 10 to 15 minutes for answering a medical history for screening. Participation is voluntary. Eligibility will be determined by the medical history form.

If interested, please contact Lockhart at [thurmon.lockhart@asu.edu](mailto:thurmon.lockhart@asu.edu).

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## About this story

There's a reason research matters. It creates technologies, medicines and other solutions to the biggest challenges we face. It touches your life in numerous ways every day, from the roads you drive on to the phone in your pocket.

The ASU research in this article was possible only because of the longstanding agreement between the U.S. government and America's research universities. That compact provides that universities would not only undertake the research but would also build the necessary infrastructure in exchange for grants from the government.

That agreement and all the economic and societal benefits that come from such research have recently been put at risk.

Learn about more solutions to come out of ASU research at [news.asu.edu/research-matters](https://news.asu.edu/research-matters).

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*This story originally appeared on [ASU News](#).*

## Main image



ASU media relations manager — and the author of this story — Steve Filmer takes part in a biodynamics recording where the test subject steps into a slippery bathtub (this one made of foam) and the "fall" is recorded in a safe manner in the Lockhart lab on the Tempe campus on March 19. Photo by Deanna Dent/ASU

## Gallery



Volunteers in the study will be put in a harness and static line, like the kind developed for mountain climbers and rescue teams. Here, doctoral researcher Randy Essikpe (center) and ASU researcher Thurmon Lockhart get writer Steve Filmer hooked in on March 19 at the Lockhart lab on the Tempe campus.





Small reflective spheres mark hips, knees and other major joints as volunteers step onto a slippery surface inside a simulated bathtub. Foam sides are used instead of an actual bathtub in order to protect volunteers from injury when their feet and legs strike the edges.



When a volunteer slips, an array of high-speed infrared cameras capture every whip and wobble of the spheres attached to them. These turn body movements into a live-action “movie” of the fall — a stick figure that can be played back and analyzed.