

Professor improves wheelchairs to reduce injuries

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Brooke Slavens holds a geared wheel that her team is testing to see if it can help reduce injuries among wheelchair users. Credit: UWM Photo/Derek Rickert

Manual wheelchairs offer mobility and exercise to people who can't walk, but improper use can result in carpal tunnel syndrome, rotator cuff

tears and other injuries.

Brooke Slavens, an assistant professor in UWM's College of Health Sciences, studies how people move with wheelchairs in an effort to reduce injuries. She's also helping develop a geared wheelchair that—similar to a multispeed bike—could reduce strain on inclines and in other areas where injuries are most likely to happen.

A lot of people think a wheelchair is a pretty simple device. You need wheels and a seat. Other than motors, how much room is there for improvement?

Our study looks at different types of wheel systems. There is a wheel system developed by IntelliWheels that we're working with that uses geared mechanisms similar to bicycle gearing. It's applying some new technologies to change standard motions. The idea is that it would make it much easier for people to use and push, with less energy demands and hopefully less muscle demands, leading to less pain and injury. So that is what we will be looking at in our study. You can either change the chair or you can change how the person is using the chair. We're looking at both aspects of that.

Do most people receive instruction in how to use wheelchairs when they get them?

They usually receive some training. Occupational therapists and physical therapists—we educate both at the College of Health Sciences—are the big players in teaching someone new to a wheelchair how to use it.

How did you get started in this area?

We started in the pediatric world. We started with kids first because there's knowledge out there about adults. We know that long-term users of assisted devices—walkers, crutches, wheelchairs—typically have pain. Up to 73 percent of adult manual wheelchair users have pain in their shoulders. It's really well-documented. With children, it's not.

So, we have a grant right now looking at pediatric mobility to better understand when these injuries first occur. How long does it take for that to happen? Can we intervene before that's happening? Kids are very, very different from adults. Their musculoskeletal system is different from adults, plus their muscle masses are changing all the time as they're growing. So, we're working with the kids to better understand how we can intervene early before they start having pain, and especially as they start transitioning into adulthood. We want to provide better training, better recommendations for them.

At the same time, you're working with adults, right? With veterans?

Yes, we started with kids, and it morphed into applying some of these new technologies to adults, and then we started looking at how we can help veterans. It gives us a chance to test some of the technology we're working on with adults, who are typically easier to work with. They aren't changing musculoskeletally as quickly as a child. And then we can take the technology back to the children.

How did you get connected with the veterans?

That came through my collaborations with Dr. Vaishnavi Muqet at the VA. I've worked with her on a couple of other projects. She was a new attending physician at the time, really interested in research, and specializes in spinal cord injury and mobility. I thought that would be a

great application for us—to start with looking at the adults, specifically by recruiting from her patients. And we always team up with a physician to help provide that clinical drive and insight to know that all the work we're doing is going to be applied to make an important impact and change, not just engineer to engineer, but to be able to take what we're doing and provide it to someone in need.

So, you're looking at how people can better use wheelchairs, but you are also helping develop a new wheelchair. Do you have a prototype?

Yes, we're working with IntelliWheels, which is manufacturing and selling the Easy Push wheel. It has a single gear. The wheel specific to our project is actually a dual-gear wheel, so it has more than one gear.

Like a 10-speed bike?

Right. It has a lever that you can use to switch between the gearing. So we can have it in a mode where it would feel just like a normal, standard wheel, and we can also have it in a mode where you rotate the wheel and the hand rim movement at different speeds. You're moving your hand slower than the wheel is turning so you don't need to put in as much effort. So this is the prototype. This is what we're going to be testing with the veterans, along with pain and performance measures.

How many studies do you have going on right now?

Ten. We have multiple studies about the wheelchair mobility, wheels, walker and crutch mobility, amputee mobility, shoulder orthopedics, technology, design and research.

We have an adaptive sports project that we're doing with Dr. Ken Lee, a

doctor from the VA, and the team owner and manager of the Marquette Eagles wheelchair lacrosse team. Five students in my OT class are working on it, along with a resident and a medical student. The team is a mix of 22 able-bodied and [wheelchair users](#), 11 of which are veterans.

This is all very cutting-edge, but is any of it out there already? Are top Paralympic athletes using things like these?

Well, one of them is on our research team. Josh George at IntelliWheels is a multi-gold medal winner. But he benefits minimally from something like this because he's such a high-level performance athlete. Something like this would really be a bigger benefit to the average person or elderly.

Provided by University of Wisconsin - Milwaukee

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