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A Soft Flexible and Stretchable Pressure Sensor Array Designed for the Prevention of Pressure Ulcer Formation

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Right now, I can assume with some confidence that most of you are either sitting down or lying down in bed watching me present.

As most of us, we have the feel and sensation to know when a position is getting uncomfortable. As some of you might have noticed that it is usually over bony prominences, such as the sitting bones when you are sitting down, or the side of the hip when you are lying down.

So, what do we do in these kinds of situations?
Well, we readjust ourselves. But what happens if we are physically unable to readjust, or have no sensation of discomfort, telling us when to readjust ourselves?
Well, millions of people around the world are affected by a complex chronic wound known as pressure ulcer. A wound costing global healthcare systems billions of dollars annually, and is associated with causing potential fatal infections.

So, what is it?
It is a localized pressure injury caused by prolonged pressure to the skin and underlying soft tissue. Basically, what happens is blood flow is being occluded, the blood that carries oxygen to the tissues, and if the tissue does not receive any oxygen, it slowly dies.
Most susceptible to this complex chronic wound are individuals immobile, confined to wheelchairs and/or beds due to injury, illness, or age.

Right now, there are no gold standards in treating or preventing pressure ulcers.
State-of-the-art pressure mapping technologies are trying to address this problem; however, they aren't able to measure pressure accurately over long periods of time, and are not designed or suitable for home use, and are not completely shape conformable.

And this brings me to my research. My research focuses on developing a prevention device for pressure ulcers. A device that can act as a secondary skin, that measures pressure accurately over long periods of time, and collects and wirelessly transmits the data to smart devices, showing and educating users, healthcare professionals, and care takers about the current situation and alerting them about potential risk areas with a prevention algorithm and system.

Currently, I have developed a soft, flexible, stretchable pressure sensor array that can be scaled up in size and resolution, is shape conformable, and can measure pressure accurately over long

periods of time in the desired pressure range. It uses capacitive sensing, much like the touchscreen on your smart phones and tablets – but bendable and stretchable. The data that I am collecting, I'm wirelessly transmitting to smart devices, where I generate pressure heatmaps in 2D and 3D for visualization purposes.
Right now, I am scaling up my pressure sensor array to a standard wheelchair seat area, conducting clinical tests to further improve and fine-tune my pressure-time curve and prevention algorithm to associate to each individual user and case.

With the success and envisioned use of my smart sheet, or pressure sensor array, I hope to provide power back into the hands of the inflicted individuals, giving them a peace of mind and control over their health, easing the financial burden, and ultimately preventing pressure ulcers from forming. Thank you!