



WEARABLE TECHNOLOGIES

HEALTH AND WELLBEING FEATURE

How wearable tech is bringing normality to the lives of diabetics

It's getting better all the time

Thursday

March 16, 2017

By [Hugh Langley](#)

[@hughlangley](#)

More than 29 million people in the US have diabetes, but a staggering one in four don't know they suffer. For those who do, how regularly they track their glucose data depends on the type of diabetes they have and the treatment required. Monitoring is commonly done by taking a drop of blood with a pinprick, but a lot of people track continuously with wearables that measure blood sugar at intervals and relay that information to a smartphone or other device.



The first option is unpleasant and often inconvenient; the second is costly, and usually still involves some hassle. But there is hope for less invasive, more comfortable ways for diabetics to live more normal lives.

Non-invasive testing, where the skin isn't penetrated at all, is the holy grail of glucose monitoring. Verily, the Alphabet subdivision formerly known as Google's Life Science, has an idea for a [contact lens](#) that would read levels of glucose found in human tears, and it's [not the only one](#). But the idea is yet to be shown working accurately.

At the same time, Verily has teamed up Dexcom, one of the biggest names in continuous glucose monitoring with devices used by 200,000 people worldwide. Dexcom's wearable tracker is made of two parts: a disposable needle that goes just under the skin to monitor interstitial fluid; and a patch that sits on top, housing the electronics that measure the sensor and transmit them to a Bluetooth device.

Most continuous trackers on the market read from this interstitial fluid, as blood glucose diffuses very quickly into it, making it highly indicative of exact levels at any given time. The latest Dexcom device, the G5, is worn on the upper abdomen and Dexcom boasts that it's the only one on the market that lets people make treatment decisions from the information. "They can look at the readings from the device and determine if they should eat carbohydrates or take their insulin," Jake Leach, senior VP

of research and development at Dexcom tells Wearable. "That's very unique because competitive devices don't have that same level of performance."



Leach says the G5 is primarily used for patients with Type 1 diabetes, or who intensively manage their diabetes with insulin, but that Dexcom is also starting to see some usage by Type 2 sufferers.

- 442 million people worldwide have diabetes
- Sufferers of type 1 diabetes have a lack of insulin production, while in type 2 the body gradually becomes resistant to the insulin it can make
- According to [WHO data](#), diabetes was the sixth leading cause of death globally in 2015

A connected contact lens isn't in sight for Dexcom - Leach says he thinks the idea might actually be "too invasive" compared to a band-aid like device for many people - but it's working with Verily towards smaller, more convenient wearables that will show up in the next few years.

Must-read: [The bionic humans are coming](#)

"[Verily] has brought the expertise they have on electronics and miniaturization of wearables," says Leach. "So we've taken advantage of the talent they have there. Combine that with the fact we have a very good understanding of how to test medical devices, how to validate them, and how to develop them to the point they can be

approved by the FDA and be used by millions of people."



Leach says it's important that continuous trackers get better at offering analytics and support that helps people make management decisions, while shrinking in size and growing in convenience. "As we continue to expand we need to make the product smaller and less of a footprint on the body".

Dexcom's G5 is currently only FDA approved for abdominal use, but could a [smartwatch](#) one day perform the same task? French company PKVitality believes so, and has a device called the KTrack Glucose in the works to prove it.



"Most people with diabetes are not checking themselves enough," says PKVitality general manager Minh Lê. "It should be a product that you can take with you. It's a product you can use to check yourself at a meeting without other people seeing it. And it won't add any pain."

It's a product you can use to check yourself at a meeting without other people seeing it

Like other CGMs (continuous glucose monitors) the watch penetrates the skin to the interstitial space, but with an interchangeable module, changed once a month, that sits on the back of the watch and pushes the biochemical sensors under the skin. PKVitality claims its watch is very accurate at $\pm 8\%$, however it is yet to get the clearance from health regulators to put it in the hands of consumers.

The watch is set to cost \$150, with a monthly \$99 for each capsule. That might seem a lot, but compared to the cost of other CGMs out there - including maintenance to keep them going - it's far more reasonable. [A 2013 study](#) found that people with diabetes incur medical costs about 2.3 times higher than those who don't suffer from the disease. For these people, a device like PKVitality's could be life changing. As Lê says, "complications are much more costly than prevention," and not only would such a device be cheaper over time, it would be less intrusive.

"We should enter into clinical trials sometime next year," Lê tells us. "We hope to have the product on the market in 2019."

Sweaty hope for non-invasive methods

While Verily's glucose contact lenses might be on hold for now, a team at Seoul National University in South Korea are offering another glimmer of hope for non-invasive believers. They [reckon](#) they have found a way to read glucose levels in skin sweat with a disposable wearable patch.

"The sweat contains a small amount of glucose which is derived from blood and interstitial fluid," Hyunjae Lee and Changyeong Song, the researchers on the team, tell us over email. "Because the sweat glands are distributed throughout the body and the sweat responses occur rapidly, the sweat could reflect dynamic physiological conditions of body."

Because the correlation of glucose in sweat is much lower than that in the blood, the team built highly sensitive sensors. But they acknowledge more work needs to be done to refine the technology to the point they can match the accuracy of a direct reading of interstitial fluid or blood. "The correlation between sweat and blood glucose also needs to be studied more thoroughly," they added.

The team also tested a wearable patch that automatically injected metformin, a Type 2 diabetes drug, into the bloodstream. The researchers say early testing on diabetic mice has produced promising results, but more work needs to be done here too. "We are experimenting with the goal of commercialization within three to five years". If the team manage this, it would be a significant breakthrough.

"Everyone who's tried things like that in the past has failed," says Dr. Jay S. Skyler, Deputy Director at the Diabetes Research Institute, and a leading researcher in the field. "You never know when someone will have a breakthrough, but I'm not counting on it. Speculation continues that Apple, Google and others are looking to produce non-invasive means to tracking glucose, but it seems unlikely it can do this without a significant leap in technology.

As for what the future holds, if the big breakthrough doesn't happen, Skyler sees the future of wearable glucose tracking being the miniaturizing of existing ideas: "I think we'll be looking at the same types of technology we have now but hopefully with the piece that's under the skin and on the skin getting smaller and maintaining the accuracy that it has at this juncture."

It's not just about glucose

For diabetics, there are other factors to consider than just keeping an eye on their blood. They're also at risk of neuropathy, the damaging of nerves, and more prone to foot injuries that don't easily heal. Early detection is therefore essential, and health tech startup Siren has come up with a simple yet effective solution: a pair of socks.

These aren't ordinary socks of course, but smart socks made for detecting early signs of injury. Our bodies respond to injury with inflammation, which causes heat; Siren's socks alert the wearer with a notification on their smartphone when they detect rising temperature in specific areas of the foot. The team is also working on a version for people who don't own a smartphone, to be released later this year.



"We can properly translate scientific research into a usable form factor to help people at home," Siren co-founder and CEO Ran Ma tells Wearable. "I think that's what key: it's the power of wearables so you can take your technology home."

They're people first... we want this to blend into their lives

Siren works on a subscription method. For proper diabetic foot care it's recommended people replace their socks every three to six months to avoid thinning, and so Siren ships a new pair to customers every six months. They're machine washable, and they don't need to be charged; it's just like buying a new pair of socks every six months.

"We've seen patients have lost a toe or have had multiple ulcers, and they and their partner get very emotional because they don't want this to happen again," he explains. "And they feel helpless because they don't feel pain."

This is all part of instilling a sense of normality into the lives of people who have this condition. Siren is currently doing a trial with patients and will be releasing the results later this year. Siren has already had lots of conversations with healthcare providers that have reached out about the socks, and of course a lot of interested outside of the US. "We have so much attention from around the world because everyone knows someone with diabetes," says Ma.

Siren is now looking at ways of making its socks even more comfortable, including special seasonal designs; it's just another way to help make the lives of diabetics feel wonderfully ordinary. "They're people first. We want them to enjoy having this product in their lives, we want it to blend into their lives."