Wrist-worn mobile alcohol sensor may boost real-world alcohol-use research

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The BACtrack Skyn is an example of a wrist-worn alcohol sensor that could help researchers studying alcohol more unobtrusively, according to scientists. Credit: SKYN

A wrist-worn sensor that gathers data on alcohol use in a less obtrusive manner than current methods could one day pave the way for real-time

interventions, among other benefits, according to a team of researchers.

In a study, the researchers reported that wrist-worn alcohol sensors collected data that agreed with information gathered by both ankle-worn devices and self-report, which are the methods more typically used by researchers investigating alcohol use today, according to Jimikaye Courtney, assistant professor and A. Donald and Billie J. Stallings Fellow at the University of North Carolina.

"Until this wrist-worn BACtrac Skyn monitor came out, the primary way to capture daily alcohol use was through an ankle-worn device called the SCRAM, or the Secure Continuous Remote Alcohol Monitor," said Courtney, who is the first author on the study and a former postdoctoral scholar at Penn State. "It was developed mainly for law enforcement reasons. For example, people who were arrested for DUI would be required to wear it. However, it didn't have the features that I needed to be able to ask some of the research questions I had."

Self-report, another way researchers currently study alcohol use, requires people to estimate their own patterns of alcohol use. This also has limitations, said Michael Russell, assistant professor of biobehavioral health, Penn State.

"Self-reports are great because they are easy for participants to provide, but they have important limitations. For example, it's difficult for people to know how many servings of alcohol they consume with each drink—so one strong IPA or mixed drink could end up being two or three servings—and this won't be captured in standard self-reports."

Perhaps because wearing wrist devices—such as fitness trackers and smart watches—is more commonplace and less stigmatized than ankle bracelets, the researchers suggested that participants who used the wrist-worn device might be less likely to drop out of studies.

"One of the really important findings of this particular study was that participants are willing to wear this device for a really long time period—in this case, about 28 days—in someone's natural environment, and that they greatly preferred it to that ankle-worn monitor that looks a little like a house-arrest anklet," said Courtney.

All of these advantages, along with the mobility of the device, mean that researchers could do more than passively monitor and record data, but also potentially design interventions that reach users when they need help the most, said David E. Conroy, professor of kinesiology and human development & family studies, Penn State.

"This approach allows real time data transmission so the sensor can sync up to a smartphone on demand when the user opens the app," said Conroy, who is also an affiliate of the Institute for Computational and Data Sciences. "Accessing that information in real time opens up a whole host of new possibilities for monitoring and detecting risk states and outcomes. Also, if we can understand when a person has started drinking—not relying on them to tell us—but rather picking up the signal that a person is eliminating alcohol, we could possibly do some interesting things with respect to predictive modeling of risk and just-in-time intervention to mitigate that risk."

Eventually, the researchers suggest that interventions could include messages to, for example, advise users to reduce their alcohol intake or even connect them with a rideshare service for safe transport home after consuming too much.

Conroy also said that interventions could be designed to help people recover from drinking too much.

"Let's say somebody has had a big night out and we're trying to help them increase activity levels: The morning after is probably not the best

time to encourage them to go on a run when they are still a bit sick and have wobbly legs," said Conroy. "So, we could use this as an indicator of availability to help us identify times when we shouldn't ask people to be more active and, instead, when we need to prioritize recovery. It could be used to tailor messages to drink water and rehydrate instead."

How the system works

According to Courtney, the device uses a sensor—about the size of a nickel—that can detect alcohol that has been eliminated through the skin—transdermal—of the wrist. About 1% of alcohol is expired through the skin, Courtney added.

The data collected by the sensor is then wirelessly transmitted to the user's smartphone, which can then pass this information on to the cloud—a computational network for storing and managing data.

"It can detect that transdermal alcohol concentration and we get that information," said Courtney. "It may not be 100% analogous to the blood alcohol concentration, but it still gives us an objective marker of biological alcohol exposure."

For the initial study, the researchers recruited people who consumed alcohol at least twice a week. Out of the initial pool of 20 participants 15 qualified, and 11 subjects successfully completed the study. One participant withdrew due to physical discomfort caused by the ankle-worn device used in the research.

The study lasted 30 days and included several phases: a base- line visit, device-training visit, 28-day field protocol with midterm survey collection, and a follow-up survey and interview.

A lot of work remains before this device could be used for real-world

alcohol monitoring, according to Courtney. While this pilot study had a small number of participants, researchers would need to organize larger studies to bring the device into everyday use, she added.

The researchers published their findings in the journal *Alcohol*.

More information: Jimikaye B. Courtney et al, Acceptability and validity of using the BACtrack skyn wrist-worn transdermal alcohol concentration sensor to capture alcohol use across 28 days under naturalistic conditions—A pilot study, *Alcohol* (2022). DOI: 10.1016/j.alcohol.2022.11.004

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