Can new technologies prevent relapse?

“Body monitoring” technologies hold promise for helping people in recovery

by BRET R. SHAW, PHD

Relapse following treatment for drug and alcohol addiction is common. Indeed, relapse rates in addictive diseases usually are in the range of 50 to 90%. Fortunately, research indicates many of these relapses are predictable and ultimately preventable if people in recovery are provided the proper support and tools.

Researchers from a new initiative called Innovations for Recovery at the University of Wisconsin–Madison are exploring how technology can improve addiction treatment outcomes. One of the areas researchers are examining is how body-monitoring instruments can be used to prevent relapse.

“New applications for body-monitoring technology could proactively prevent relapse rather just stop it once it has already begun,” says David Gustafson, PhD, professor of engineering UW–Madison and the leader of Innovations for Recovery, which is funded by the Robert Johnson Foundation. “One of our goals is to identify promising body-monitoring technologies, assess appropriate physiological measures so we can more effectively provide people the support they need to stay clean.”

Wearable Biomonitoring Instruments

Body-monitoring technology could be used to detect when someone is experiencing anxiety or stress related to a specific situation that could lead to relapse.

“We know that stress is the most accurate predictor of relapse, and relapse is often preceded by stressful episodes characterized by feelings of strong negative moods,” says Timothy Baldelli, PhD, professor of psychology at UW–Madison. “This suggests that autonomic nervous system activity associated with stress and distress can be used to detect such stressful episodes which is important since laboratory research shows that individuals may actually be unaware when they are becoming stressed or experiencing negative moods.”

Indicators of stress, such as heightened skin conductance of electric current and increase in rate, pulse, and muscle tension, usually accompany higher states of arousal, and these physiologic indicators can be measured by wearable technology available today. Such systems offer different measurement capabilities and come in forms such as shirts with integrated sensors, removable patches, or sensors that attach to fingers. BodyMedia (www.bodymedia.com) is one of the leaders in creating easy-to-wear monitors that collect physiologic information needed to measure arousal and incorporate integrated wireless transmission and Web-based interfaces for interpreting results.

Consider the following scenario of how such wearable technologies might be used to impact treatment and recovery: A husband (in recovery from alcoholism) and his wife are at a party. The couple begins to argue, and the physiologic sensors the man is wearing record an increase in arousal. An application sends a message to his mobile phone asking if he needs any support.
Likewise, the sudden increase in stress triggers text messages to be sent to the mobile phone network, such as a peer sponsor and a therapist, who immediately check to make sure he is managing the stress appropriately (i.e., not drinking).

Biomonitoring devices have some limitations despite their many possibilities. First, the microchips used in these devices can be relatively costly. Although costs can be expected to decrease over time as the technology becomes more widespread, they indicate general arousal rather than specific emotional states such as anxiety or depression. An elevated heart rate or pulse rate or drop in the resistance of skin to the passage of electric current can be associated with emotional or physiologic arousal but does not indicate whether the arousal is positive or negative. A person may be aroused because he is craving alcohol or drugs—or because he is flirting or watching his favorite football team score a touchdown.

Despite these shortcomings, general arousal data could be used to trigger automatic “check-ins” to confirm if a person is doing okay or to cross-check physiologic data against his schedule. People objectively discuss routines or situations that may relate to negative arousal and increase the likelihood of relapse.

**Embedded Microchip Sensors**

Another type of body-monitoring device that offers the potential to prevent relapse involves microchip sensors (with wireless capabilities) implanted in the body. Embedded sensors can assess rising cortisol levels that indicate cumulative stress over a person’s day rather than immediate stress that comes from a moment of high risk for relapse. Research indicates that a pattern of gradually rising distress levels is a significant predictor of relapse. This suggests that information on gradually emerging stress levels may be useful in the timing of intervention.

“If a pattern of escalating stress could be short-circuited, this might give people in recovery resilience to resist addictive impulses as they arise,” says Dr. Baker. Rising stress levels, measured by the implanted microchips and transmitted to reporting devices such as computers and phones, could alert the person in recovery that he should implement some healthy management strategies such as exercise or meditation, or inform treatment providers and sponsors that additional support may be needed.

Microchips could be designed to trigger the release of implanted pharmaceutical agents to reduce cravings for alcohol or other drugs when overall daily stress levels surpass a given threshold.

Zarlink ([www.zarlink.com](http://www.zarlink.com)) is among the early innovators developing wireless microchips that could be integrated with a specialized, implanted medical device to monitor hormonal stress levels or other physiologic indicators to assist in preventing relapses for individuals in recovery.

One limitation of the current technology is that the monitored individual needs to be in close proximity to a data-collection station for the data to be transmitted wirelessly and subsequently acted on.

Implanting sensors might raise privacy concerns and strike some as being too intrusive. “We are very sensitive to the ethical issues involved in considering these types of technologies and believe they could only be used on an opt-in basis,” says Dr. Gustafson. “Yet when we see addiction as a chronic illness similar to other conditions that require a proactive disease management regimen such as diabetes, asthma, or hypertension, we believe many people choose such an option if it could improve their health, prolong their lives, and reduce the associated with addictive disorders.”

**Brain Imaging**

Current and emerging brain-imaging methods could detect specific brain activity that might indicate a high-risk relapse event. These technologies include functional magnetic resonance imaging (fMRI) or positron emission tomography (PET), which show indirect measures of cerebral blood flow. Studies using imaging technologies to measure blood flow in the brain do indeed indicate that specific emotions and addictive cravings can be tracked using these technologies. If such technologies could pinpoint the activation of addictive cravings or other emotional states that could precede relapse, triggering appropriate supports as needed.

Brain-imaging technologies’ current limitations restrict their near-term deployment to improve addiction treatment outcomes. First, pinpointing areas of the brain involved in specific emotions

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or impulsive cravings is still an inexact science with significant variability in brain activation patterns across different people. Brain-imaging equipment is expensive and complex. Though common models are about the size of a coffin, imposing significant restrictions on mobility, are certainly not wearable.  

More mobile brain-imaging technologies such as infrared spectroscopy are under development but cost and mobility restrictions likely will be obstacles to wide deployment of brain-monitoring technology to improve addiction treatment and recovery outcomes for at least the next three years.

**Wearable Alcohol and Drug Detectors**

Wearable body-monitoring technology to track alcohol and drug intake has been used primarily by the criminal justice system to support treatment and enhance supervision of offenders of substance abuse-related crimes (e.g., driving while intoxicated). Alcohol Monitoring Systems ([www.alcoholmonitoring.com](http://www.alcoholmonitoring.com)) offers one of the most advanced and widely used of these technologies with its SCRAM (Secure Continuous Remote Alcohol Monitor). A bracelet strapped to an ankle tests imperceptible emissions of sweat about once an hour. Once a modem downloads the data to Alcohol Monitoring Systems’ servers, and a person's data is viewed via a Web interface. If the person had any alcohol—even mouthwash—it shows up.

These devices are used primarily in the context of criminal justice, but they might have potential as an opt-in solution for individuals with a history of unsuccessful transitions from residential treatment and other continually failed efforts to maintain abstinence. People in recovery might choose to wear such a device as a way to assure higher levels of accountability to therapists or loved ones when entering high-risk situations. Wearing such a visible device, however, might have a stigmatizing effect.

**The Bottom Line**

The potential for using body-monitoring technology to prevent relapse is an exciting one. The table summarizes the pros and cons of the technologies profiled in this article. At the end of the day, the most significant factors affecting whether these technologies are adopted is whether they improve outcomes and if providers are reimbursed for using them with their patients. “We can demonstrate outcomes for these technologies to be adopted,” says Dr. Gustafson. “Our interest is to run pilot tests to assess their feasibility and then demonstrate measurable benefits from their use. Ultimately, decision makers will want to see that these technologies provide a tangible return on their investment.”

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