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Battling Addiction

University of Dayton

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The University of Dayton Research Institute has won a $10,000 Ohio Opioid Technology Challenge award for a program that will teach people with opioid addictions how to reduce their cravings by regaining control of their brains.

UDRI software engineer Kelly Cashion, who wrote the winning proposal and will lead the program, will develop and use a system of neurofeedback therapy designed to help people "recover control of their minds and bodies and accelerate the path to recovery," Cashion said.

Cashion's was one of five winning proposals — two from Ohio, two from Massachusetts and one from Utah — selected for funding by the Ohio Third Frontier from entries submitted by researchers, service providers and other individuals and organizations from nine countries. The Ohio Opioid Technology Challenge was developed to help engender solutions to the nation's growing opioid addiction crisis, which has hit the Midwest particularly hard. In 2016, Ohio was second only to West Virginia for the number of overdose deaths related to opioids, according to the Centers for Disease Control.

Opioids — heroin, fentanyl and other natural and synthetic opiates — are highly addictive, and the 90- percent relapse rate is as much as double that associated with other addictions, according to the National Institute on Drug Abuse. Opioid use becomes abuse — and ultimately addiction — by shutting down the brain's ability to naturally release dopamine and endorphins, so that the absence of opioids creates feelings of intense anxiety and other severe symptoms of withdrawal. Those symptoms will continue long after a person who is addicted stops using the drugs, which contributes to the high relapse rate, Cashion said.

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"When a person initially consumes opioids, the experience creates a sense of euphoria caused by a release of chemicals in the brain. The pathways in the brain that are part of that experience grow stronger — forging an addiction — while other pathways grow weaker," she said. "Over time, use of the drugs stops creating positive feelings, and their absence creates painful symptoms of withdrawal, so that a person with an addiction needs to use the drugs just to achieve a sense of normalcy.

"Using neurofeedback, we'll work with our volunteers to help them learn to regulate activity in the part of their brain associated with cravings and rewire some of those pathways, allowing them to reduce their cravings and experience a more 'normal' state even without opioids."

Neurofeedback is a type of biofeedback where sensors are used in conjunction with a brainwave monitoring method, such as electroencephalography (EEG), to help the wearer see his or her brain's electrical activity in real time. The sensors — typically noninvasive and attached to the scalp in the form of a wireless headset or a more traditional "shower cap" style with wires — also let the wearer see if and when certain behaviors alter their brain's electrical activity.

In her program, Cashion will show volunteers a graphics display — which she likened to a simple video game — on a computer monitor. By giving the volunteers tasks that require a shift in focus or other interaction with the game, they will see which activities most positively impact the signals associated with cravings. After a series of training sessions, volunteers will have learned the tasks they will need to perform to reduce cravings, even without use of the technology.

Cashion said neurofeedback is showing promise in the treatment of nicotine addiction, depression, chronic pain, post-traumatic stress syndrome and other physiological disorders.

"We'll build on that body of research and transfer known protocols to the domain of opioid addiction treatment," she said.

Cashion said neurofeedback is not meant to be a substitute for, but a supplement to, current addiction therapies, which include medication assisted treatment and behavioral counseling.

National and international organizations recently recognized the University of Dayton's Division of Student Development for its community policing, alcohol prevention, residential learning and student training programs, and annual report.

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"Current treatments are not always sufficient, and medication is not always sufficiently available because of the demand on treatment centers. Even when it is, some patients reject 'step-down' medications, such as methadone, because they view it as replacing one addiction with another. For those patients, neurofeedback can be another avenue for recovery," she said.

For patients who are transitioning to recovery with the use of medication, neurofeedback can provide additional insight into the changes enabled by the medication, Cashion added.

At the outset of her program, Cashion will work with health care professionals and other experts to help establish a baseline of neurological signals and identify which signals are associated with cravings. She'll work with other researchers in UDRI's software systems group to use mathematical algorithms to map the 2-dimensional baseline signal imagery to a 3-dimensional map of the brain.

"From there we'll be able to tell which parts of the brain the signals are coming from," she said.

When she is ready to begin testing, Cashion will work with health care professionals and agencies which serve people with opioid addictions to help identify potential volunteers. As the program progresses, Cashion will continue to consult with technology experts within UDRI and external medical specialists to validate results and make program adjustments as necessary.

"Ultimately our goal is to develop and demonstrate a neurofeedback system that uses off-the-shelf hardware along with software developed here at the University of Dayton Research Institute, then work with local medical technology companies to commercialize the product and make it available to treatment centers," Cashion said.

For media interviews, contact Pamela Gregg at pamela.gregg@udri.udayton.edu or 937-229-3268.

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