INSIGHT

TAPPING INNOVATIVE SOLUTIONS & TECHNOLOGY AT JOHNS HOPKINS MEDICINE

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Under Armour Taps Johns Hopkins Sleep Experts to Refine Performance App

Alan Schwartz hates exercising early in the morning. He used to wait until after work and dinner to hop on his treadmill or head out for a run. The problem: Afterward, he says, "it was hard for me to settle down and fall asleep."

If anyone knows about sleep, it's Schwartz, director of the Sleep Disorders Clinic at Johns Hopkins Bayview Medical Center. Now, Schwartz and other Johns Hopkins sleep experts are teaming with Under Armour, the Baltimore-based performance apparel, footwear—and now technology—company, to develop an app that delivers insights based on sleep information collected through wearable devices, like Under Armour's UA Band.

The bands are a popular way to gather data about a person's sleep, particularly the number of hours and amount of restlessness throughout the night. The app—named UA Record—will go further by giving users insights and prompts based on that information, says Schwartz.

Working with sleep physician and engineer Luu Pham, Schwartz and his team are developing classification systems and algorithms that can help people understand their individual sleep patterns.

For example, says Schwartz, the app would recognize, based on his weekend sleep patterns, that he is a night owl who adheres to an early-bird schedule during the work week. It would then provide information and prompts that could help him sleep and exercise better.

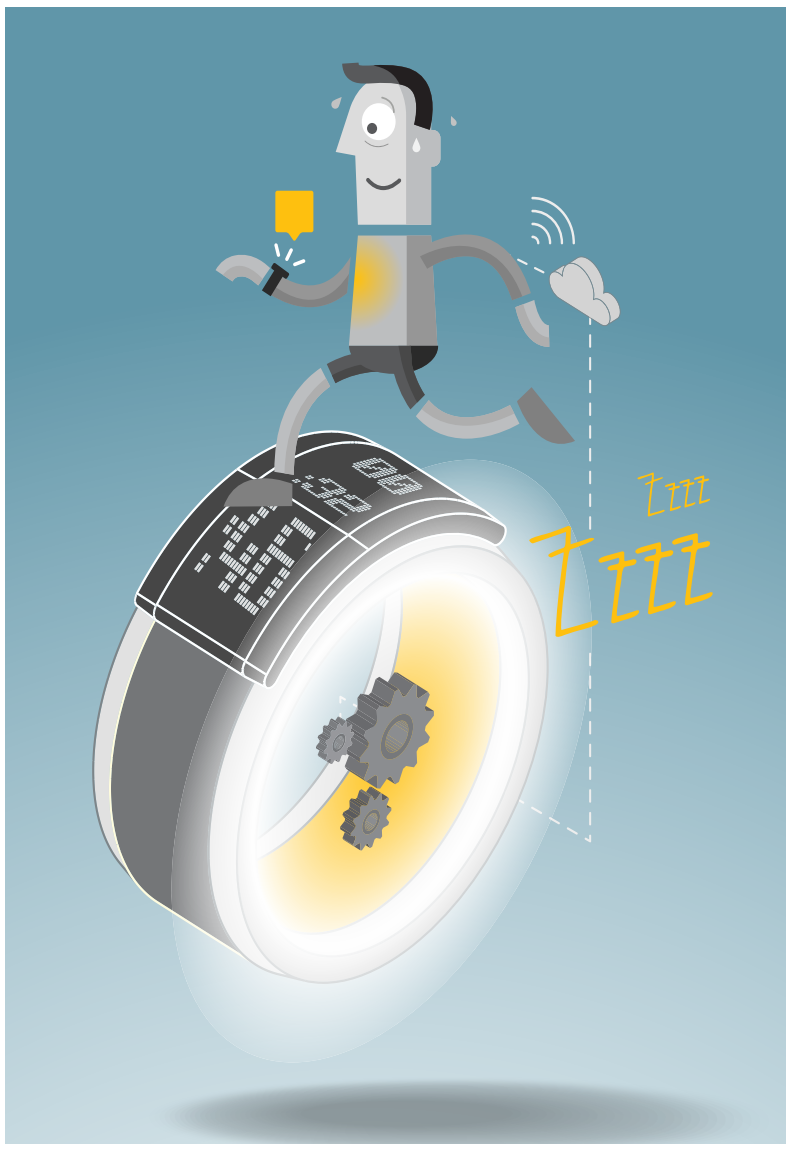
"By characterizing the sleep patterns and educating individuals as to what their sleep patterns are," he says, "you're in a better position to deliver some insights that can help."

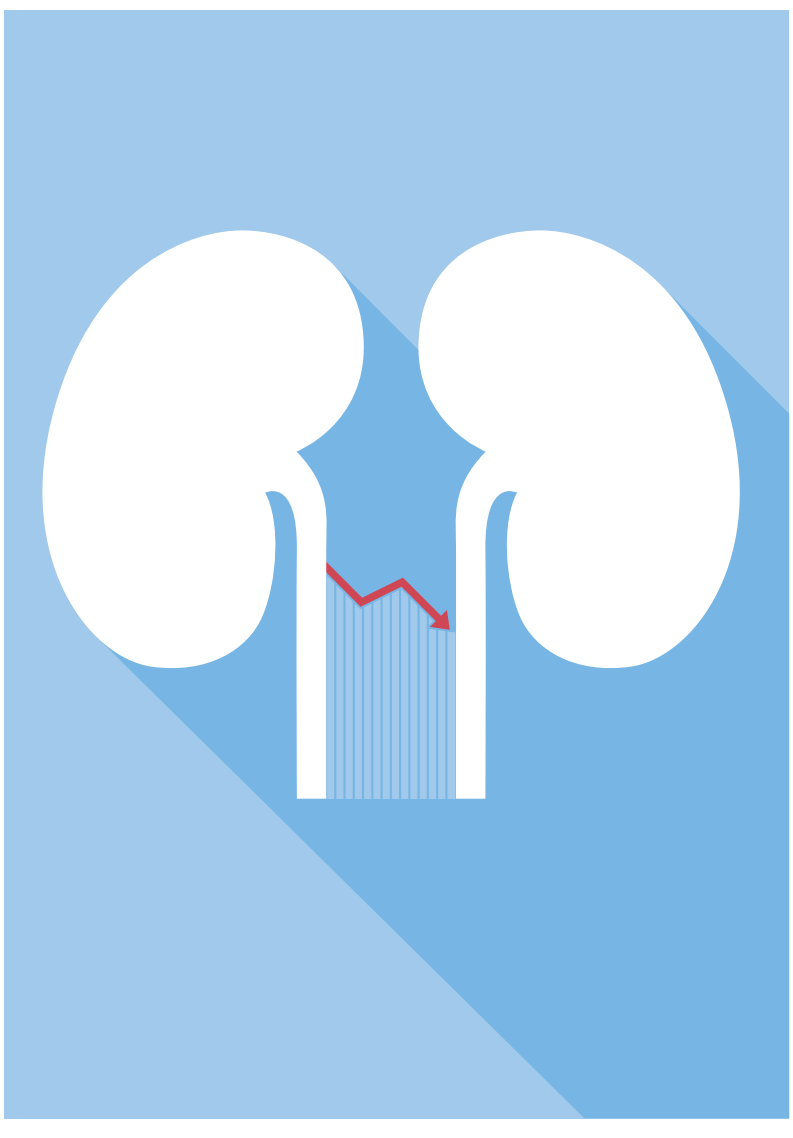
Studies show that insufficient sleep hampers athletic performance by slowing reaction time, decreasing stamina and increasing the risk of injury. Yet about a third of Americans don't get enough sleep, according to the Centers for Disease Control and Prevention.

Under Armour and Johns Hopkins began collaborating in 2015 on the UA Record app, which uses a phone, wristband or other device to measure exercise, nutrition, weight and sleep; Schwartz and Pham began developing sleep recognition algorithms in July 2016.

By the end of 2017, the sleep team's work is expected to be incorporated as upgrades to the free app.

The research has prompted Schwartz to change his own exercise habits. He now brings his workout clothes to his Johns Hopkins Bayview office so he can run in the afternoon or evening, before heading home for dinner. He's not sure his running speed has improved, but one thing is certain, he says: He's sleeping better.





New Device Aims to Reduce Kidney Injuries from Cardiac Surgery

Aaron Chang couldn't stop pondering a question after his rotation through cardiac surgery: What can be done to prevent patients undergoing heart procedures from developing kidney injuries?

Studies show that 15 percent of cardiac surgeries result in acute kidney injury (AKI), a sudden episode that leaves kidneys damaged or failing, partly because the organs don't receive enough oxygen. Doctors can prevent AKI by optimizing blood pressure and blood flow during cardiopulmonary bypass, but calculating a healthy blood pressure and flow for each individual patient is tricky business.

"In cardiac surgery, doctors rely on generalized guidelines to set parameters such as blood pressure," says Chang, a 2015 master's graduate from the Center for Bioengineering Innovation and Design. "If these guidelines don't fit the individual, the patient's kidneys essentially hold their breath for the one to three hours in which they are on cardiopulmonary bypass."

Though injury occurs during surgery, detection of AKI occurs 24 to 48 hours later. Patients who sustain a stage 1 kidney injury, the least severe of the three stages before kidney failure, become twice as likely to die within five years.

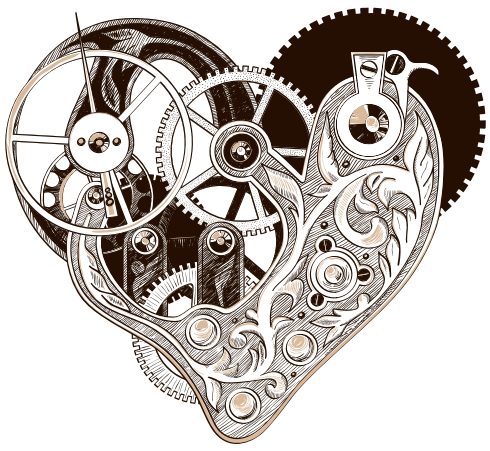
Chang founded Renalert, a startup in Johns Hopkins Technology Ventures' (JHTV) FastForward 1812 innovation hub, to develop a real-time urine monitoring device for the prevention of acute kidney injury. The device sits beneath operating tables and monitors patient urine, precisely measuring volume, while correlating these values with other vital signs to estimate renal perfusion.

Building off research by clinical collaborators in the Department of Anesthesia and Critical Care Medicine, Renalert's pilot study at The Johns Hopkins Hospital showed promising results in intraoperatively estimating which surgery patients would eventually develop kidney injury.

In addition to the Wallace H. Coulter Foundation, TEDCO's Maryland Innovation Initiative and a Johns Hopkins School of Medicine Dean's Faculty Innovation Award, JHTV has supported Chang's startup journey.

Such support has accelerated Renalert's development of technologies, and Chang hopes the innovation he produces can lead to products that reduce kidney injuries during other high-risk procedures.

A look at innovative developments outside the halls of Johns Hopkins Medicine



At the Heart of It

San Francisco-based iRhythm Technologies makes a 3-inch alternative to the conventional Holter monitor for diagnosing irregular heart rhythm. The device can be worn for up to 14 days to collect massive amounts of heart rhythm information. At the end of two weeks, iRhythm distills the data into a report for physicians.

A soft robotic sleeve developed by Harvard University and Boston Children's Hospital can encase a diseased heart and gently squeeze to keep it pumping. Made of soft materials including artificial muscles and silicone, the device mimics the natural movements of a heart by compressing, twisting and relaxing. The sleeve has been successfully tested in animals.

Scientists at the University of Michigan devised a new way to examine the carotid artery and gauge a patient's risk of a stroke or heart attack. Delivered by a scanning fiber microscope, lasers light up tissue for high-quality imaging to visualize the surface of the carotid artery and catch any plaques.

Handheld Device for Early Warning of Heart Failure

Heart failure is one of the most common causes of death in the United States, causing nearly one in nine deaths in Americans, according to the CDC.

Fluid congestion due to heart failure is the most common cause of hospital admissions, and the readmission rate is high—up to 25 percent by 30 days after hospital discharge. Now, a Johns Hopkins team led by cardiologist Harry Silber is working to help combat that problem by creating a device that noninvasively detects increased filling pressure in the heart—the condition that leads to fluid congestion in heart failure.

"This device could have an impact on the management of heart failure by identifying elevated filling pressure before symptoms appear," says Silber.

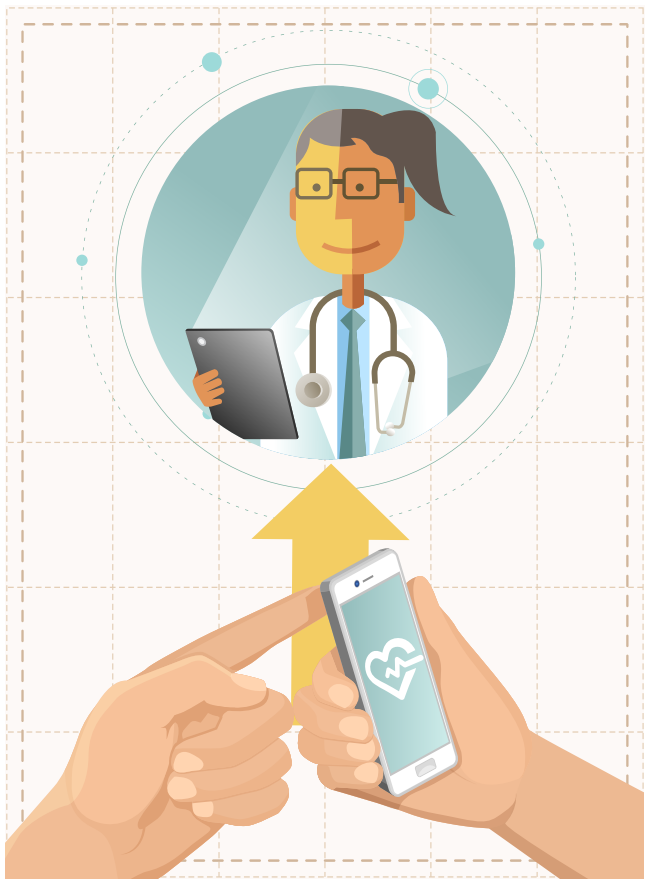
The Indicor records a pulse oximeter signal from a patient's index finger while the patient blows into a small tube. The change in the signal during the effort reflects the invasive measure of cardiac filling pressure, left ventricular end-diastolic pressure (LVEDP).

The result is displayed on an iPad screen and transmitted wirelessly to doctors' offices. The device is portable and can be used in homes, physicians' offices, nursing homes, emergency vehicles and hospitals. The assessment takes only a few minutes and is low risk, according to Silber.

Currently, the only common way of noninvasively detecting worsening congestion at home before symptoms appear is by measuring changes in a person's weight. However, weight fluctuations cannot always be attributed to a heart condition, which makes it difficult to gauge the cause of the fluctuation.

Research using the Indicor has been conducted on 300 patients to date, and so far, shows promise not just for cardiac applications, but also for managing fluid removal in dialysis.

Currently being developed under the company Vixiar Medical, Indicor is targeted for a late 2017 pilot launch.



WEB EXTRA: Watch a video about Indicor by clicking on this article at hopkinsmedicine.org/insight.

App and Website Link Teens and Providers to Health Resources

Adolescent medicine specialist Arik Marcell first heard about the San Francisco Adolescent Providers Guide while completing a medical fellowship at the University of California, San Francisco. The simple health and community services handbook served as the go-to resource for health care professionals and teens alike.

Marcell was surprised to learn no similar guide for Baltimore, Maryland, existed when he moved there in 2001. As of November 2016, that's no longer the case: With research and development help from the schools of medicine and public health, Marcell launched Y2CONNECT, an online guide for health and well-being services for young people.

Y2CONNECT consists of a website and mobile app with information gathered from roughly 250 local organizations on more than 50 topics. Teens, as well as health care professionals and parents seeking services for a teen, can find everything from clinics that offer STD testing or mental health treatment to organizations that arrange work apprenticeships.

"One of my clinical colleagues shared with me that they were searching for a crisis hotline, and our website was the first listing on Google with the site's information," says Marcell.

Y2CONNECT started in 2013 as a study on how to better engage adolescent males in their sexual and reproductive health. Funded by a grant from the Centers for Disease Control and Prevention and the Secretary's Minority AIDS Initiative Fund, the project aims to develop a Baltimore-based online guide to health clinics. As Marcell realized many of the health resources for young men overlapped with those of young women, he ended up incorporating information for both.

Marcell worked with design firm Adapter to create the website and app, and he submitted the app through Johns Hopkins Technology Ventures to iTunes and Google Play.

The app is available for free in English or Spanish for Android and iOS operating systems.