



ANDRÉ DA LOBA / MARLENA AGENCY

Engineering Safer Spine Surgery



Approximately one in every 3,100 surgical procedures on the spine is performed at the wrong place. To reduce these errors, Johns Hopkins researchers have devised software that, in clinical evaluations, accurately labeled different levels of the spine on X-rays taken during surgery.

Biomedical engineer Jeff Siewerdsen, the leader of the team, says the software, LevelCheck, does not replace the surgeon's expertise, but "it offers helpful guidance and decision support, like your GPS."

Using a high-speed processing unit, the technology combines a patient's CT scan from before surgery with X-rays taken during surgery. After matching the X-ray to the CT scan, LevelCheck labels the vertebrae on the X-ray, which surgeons can use in real time during the operation. A recent study showed the software was 100 percent accurate in labeling the spine correctly.

Traditionally, several X-rays are taken in the operating room to determine where to perform surgery. One X-ray overlaps another until the entire spine can be seen. After identifying the target area, surgeons then count the number of vertebrae from the top or bottom of the spine to the target area where the procedure needs to take place.

Neurosurgeon Jean-Paul Wolinsky says it can be challenging to count. Some people have more bones in one area of the spine. For others, some bones are smaller and can be missed. Plus, the bone quality might not show up well on the X-ray.

When there is a mistake and surgery takes place at the wrong level, it can result in pain, follow-up surgeries or degeneration of the spine. Financially, each wrong-level surgery is estimated to cost more than \$100,000.

Siewerdsen and his team continue to evaluate LevelCheck's performance and benefits, and they hope it will be ready for licensing by 2016. LevelCheck is the first offshoot of a program called Operating Room Quality Assurance, which is funded by the National Institutes of Health to develop safer ways of imaging in the operating room.

Startup Looks to Ultrasound to Detect Postsurgical Blood Clots



The system, developed by two former Johns Hopkins biomedical engineering graduate students, is expected to improve success rates for transplant surgeries in humans.

Postsurgical blood clots form in up to 15 percent of soft tissue transplant surgeries in the U.S. They begin at blood vessel connection sites and are difficult to detect. Half of them result in surgical failures, which require invasive follow-up procedures.

But Johns Hopkins startup company Sonavex Surgical has a solution: EchoSure, a patent-pending system using ultrasound to detect blood clots while they form. Co-founders David Narrow, Sonavex's chief operating officer, and Devin O'Brien Coon, president and chief medical officer for the company and a plastic

and reconstructive surgery assistant resident at The Johns Hopkins Hospital, say preliminary large-animal studies have shown efficacy, and they anticipate clearance from the FDA to begin working with humans in mid-2016.

The technology is applicable to most transplant and many vascular surgeries. A surgeon performing a soft tissue transplant surgery, for example, must connect at least one artery and vein of the transplanted tissue to an artery and vein in the surrounding skin. Those connection points are prime locations for clot formation.

But a surgeon using EchoSure will place a thin, biodegradable marker beneath vessel connection points during surgery, and the marker's artificial contrast with its surroundings in an ultrasound image will make it easy for clinicians to locate the vessel connections and detect blood flow abnormalities associated with nascent blood clots.

EchoSure's ultrasound software, developed in close collaboration with Johns Hopkins University engineering professors Jerry Prince and Emad Bactor, produces cross-sectional images of blood vessels. If a cross section is no longer round and the blood vessel's internal surface area has

decreased, a blood clot likely is forming, "but it won't be too late to remove the clot and save the transplanted tissue," Narrow says.

"Nothing else on the market is able to unlock the tremendous value of ultrasound for this application," he adds.

WEB EXTRA:
See an animation of the technology at hopkinsmedicine.org/insight.



BRIAN FITZGERALD / THREE IN A BOX



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

Health Care Apps, Uber-Style

People are using apps for far more than a taxi ride these days—they are beginning to use them for health care. Here's a list of five patient-powered apps and what they offer.

Dubbed “Uber for doctors,” **Heal**, a new California startup, is bringing back the **physician house call**, all from the tap of a smartphone app. Heal's service delivers licensed and background-checked pediatricians and family doctors in less than 60 minutes for \$99. Doctors are available in Los Angeles and San Francisco from 8 a.m. to 8 p.m. daily.

Like the on-demand car service, Heal uses smart technology to find its nearest and best-matching available doctor to the requested need of the patient, turning living rooms into waiting rooms. 📱

In New York City, **Pager** provides a similar **physician house call** service at a cost of \$50 for the initial visit, \$100 for a physical and \$200 for regular visits. 📱

In Chicago and Milwaukee, **Go2Nurse** provides **pre- and post-pregnancy care, eldercare, specialized care for patients with Alzheimer's and Parkinson's diseases**, and other services. Prepaid visitation plans range from \$200 to \$1,000 per month. 📱

On the optometry front, New York City-based **Blink** provides **at-home, on-demand eye exams** at a cost of \$75 per appointment. Technicians visit homes with portable testing equipment to take measurements that are reviewed by optometrists, who provide a prescription within 24 hours. 📱

Popping up in major metropolitan areas, including New York City, northern New Jersey and San Francisco, **The I.V. Doc** provides **in-home, on-demand I.V. hydration therapy** for everything from flu, jet lag and exercise fatigue, to food poisoning, general exhaustion and hangovers. Costs range from \$150 for a super B vitamin complex boost to \$399 for flu and migraine relief. 📱

IPad Apps Teach Pathology Around the World



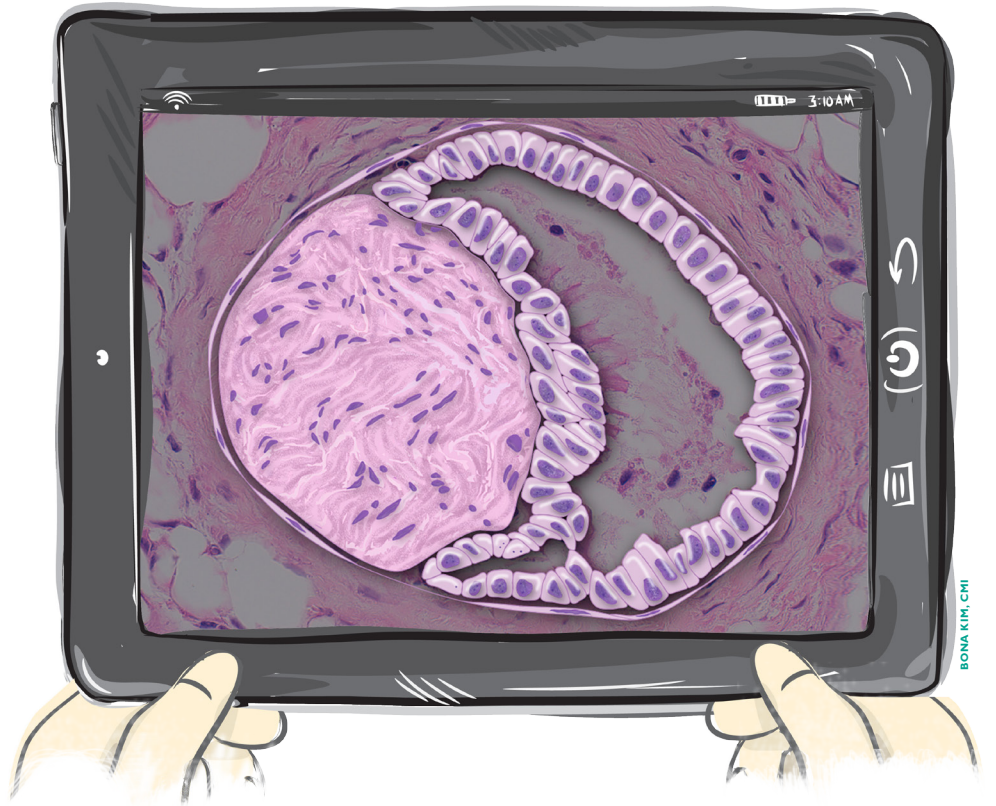
In 2012, the Department of Pathology released two iPad apps that have attracted more than 33,000 users in over 100 countries. Now the department is updating the apps and creating new ones, thanks to a recent collaboration with Zhejiang DIAN Diagnostics Co., the largest private diagnostics laboratory in China.

The first two apps—the Atlas of Pancreas Pathology and the Atlas of Pancreatic Cytopathology—were co-developed by the departments of Pathology and Art as Applied to Medicine. Both were designed to improve the skills of medical residents, fellows and practicing pathologists to diagnose pancreatic conditions and are available for free.

Unlike a textbook, which may have one example of a certain lesion on the pancreas, the app provides numerous examples through photos, microscopic views and illustrated videos. Alone, the Atlas of Pancreatic Pathology consists of more than 1,500 photos and 40 illustrations.

“The apps harness the power of tablets to host a large number of images and make them interactive and with multimedia,” says Ralph Hruban, director of pathology. “Each person learns differently, and we can present materials in a number of formats that empower the user to learn in a way that feels best.”

Each app has an interactive teaching algorithm, or decision tree, that prompts users to answer questions to arrive at a diagnosis; a searchable image database where users can view examples based on a diagnosis or features of the tissue; flashcards;



and an image-based quiz.

The updates were completed in April 2015. “It's a win-win for both organizations,” says Hruban. “DIAN wanted access to the latest diagnostic educational information, and we wanted to update the apps and work on others.”

Through the collaboration, the team will develop iPad apps on the pathology of eye diseases, brain tumors, thyroid tumors and skin; thyroid cytopathology; gastrointestinal pathology; and prostate pathology. In addition, each app will be available in English and Chinese.

WEB EXTRA:
To see how the Atlas of Pancreas Pathology works, watch a video at hopkinsmedicine.org/insight.

New Software Connects Johns Hopkins with Health Care Consumers



For many people, the term “engagement” summons images of diamond rings. In marketing terms, however, engagement is about something else: creating a relationship between people and a brand through meaningful interactions.



New software being used by Johns Hopkins Medicine's Marketing and Communications Department aims to improve that engagement by better understanding the wants and needs of health care consumers.

The application, called customer relationship management (CRM) software, makes it easier to give people the health and medical information that is most relevant to them. When a visitor interacts with Johns Hopkins Medicine online—for instance, by signing up for a newsletter—a corresponding CRM profile is created. That profile connects all of the user's interactions and helps Johns Hopkins Medicine best determine his or her needs.

“We can share health condition-focused content, news on specific medical breakthroughs, relevant patient stories, videos and more targeted information—all based off of someone's profile,” says Therese Lockemy, director of Internet marketing and social engagement.

Johns Hopkins Medicine International (JHI) recently launched CRM software to better manage its international patients from the initial point of their inquiries to the time of their discharge.

“We want to build long-term relationships between our brand and our patients in a way that is meaningful to their health and wellness,” says Lindsay Roylance Rothstein, director of marketing and communications for JHI. “To accomplish that, we need to know what we're doing right and what we can do to improve the experience.”

As the number of CRM profiles increases, Johns Hopkins Medicine can analyze the information to more efficiently and effectively engage health care consumers. In the future, JHI's CRM will join the Marketing and Communications Department's CRM to create a powerful tool to measure success and identify areas to expand consumer engagement with the institution.