Patient safety advocates, tech and gadget lovers, rejoice! The scope of innovation in healthcare technology is breathtaking, with researchers, developers, and entrepreneurs making amazing strides to transform healthcare quality, safety, delivery, and experiences.
This article profiles 10 game-changing enterprise systems, medical and assistive devices, and commercial and consumer technologies with crossover applications in healthcare. Some are already on the market, while others are in the pipeline. Taken together, these up-and-coming technologies share common themes:

• They address top priorities in healthcare, including cybersecurity, smart use of data, cost savings, infectious disease prevention, clinical effectiveness, and improved patient care, outcomes, and satisfaction.

• They represent interdisciplinary, translational solutions to complex problems, such as applying behavioral analysis, machine learning, and artificial intelligence to strengthen cybersecurity; combining living tissue with polymers to design three-dimensional (3D)-printed body parts; and blending engineering, medical, and pharmaceutical know-how at the nanoscale to create miniscule robots and microneedle patches for drug delivery.

• They push the boundaries of healthcare—by turning science fiction into reality or reimagining altogether what technology can do for healthcare systems, clinicians, and patients.

“The overall state of technology continues to be strong, improving lives and helping to provide solutions to chronic illnesses and diseases,” said Charles “Phil” Cogdill, senior director of quality, sterilization, and microbiology at Medtronic and chair of the AAMI Board of Directors. What follows are 10 categories of innovations and notable examples of specific technologies that the healthcare community will want to keep an eye on now and in the future.

1. Behavioral Analysis, Machine Learning, and Artificial intelligence for Cybersecurity

Most healthcare organizations are aware by now that they are vulnerable to network breaches or attacks—more vulnerable, in fact, than organizations in other industry sectors. “Healthcare organizations have a much larger bull’s eye on them in terms of stolen data,” said Steve Schick, senior director of corporate communications at LightCyber, a cybersecurity company. Healthcare data are worth considerably more than personal identification or financial details alone, he said.

The Internet of Things is a second special challenge, Schick said. In healthcare, this refers to the wired and wireless systems, such as diagnostic and monitoring equipment and medical devices connected to networks. On their own, such healthcare technologies do not have robust security. “The best way to protect those things is through the network itself,” he said.

By and large, cybersecurity technology is based on a 20-year-old model aimed at preventing inadvertent or malicious breaches and attacks on networks, Schick said. Prevention security is necessary—and effective at preventing up to 95% of network incursions. But, as the threat landscape changes rapidly and would-be infiltrators adapt, prevention alone is no longer sufficient. Motivated intruders can crack any network, even those perceived as ironclad, such as the U.S. National Security Agency in 2016 and the Federal Bureau of Investigation in 2015.

Enter LightCyber Magna, an award-winning platform that comes at the cybersecurity challenge from a different angle: detecting intruders. Right now, most organizations have no idea their networks are under attack until long after damage is done, when protected data are leaked or offered for sale or operations are held for ransom. In fact, discovery of a breach typically is made by a third party, not by the victimized organization itself, Schick said.

Moreover, it takes an average of about 5 months for discovery to occur, Schick said. “This gives somebody plenty of time to go low and slow and avoid detection and basically do whatever they want,” he said. LightCyber Magna, developed by top cyberwarfare experts from Israel’s intelligence corps, accurately and efficiently detects attacks. The platform uses machine learning and artificial intelligence to understand what’s normal on a network, for all users of the network, and for all wired and wireless technology, including medical devices, connected to the network. The solution is innovative in that it has a deep level of

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visibility across the entire network and across all endpoint users and devices, Schick said.

LightCyber Magna looks for anomalies indicative of an attack, using behavioral analysis that tracks stealth reconnaissance and lateral moves on the network. Because every network is different, rogue behaviors are very much human-controlled, trial-and-error processes, Schick said. For example, it would be highly unusual for someone who works in the finance department to start conducting information technology (IT) administrative procedures on a network. That’s a red flag that would prompt an alert to network security professionals, who can immediately lock down the suspect users and devices and stop any attack early on. Already, network security professionals, like clinicians, receive hundreds or thousands of alarm signals and alerts every day. They will appreciate the fact that LightCyber Magna filters out the noise and sends only meaningful, actionable alerts.

“Knowing there is an attack and stopping it is obviously the most valuable thing you can do,” Schick said. But attacks don’t happen every day. “A number of our healthcare customers have appreciated the ability to know that there’s not an attack,” he said. “There’s value in knowing your network is safe.” That information can be reported to C-suite executives and board members, who are paying closer attention to cybersecurity. Plus, as healthcare organizations go through mergers and acquisitions, the technology is useful for advance detection and risk management of vulnerabilities for newly connected networks.

2. Intelligent and Predictive Analytics
What if healthcare systems and hospitals could turn the voluminous sets of data they generate into actionable intelligence that delivers meaningful results? That’s the aim of intelligent and predictive analytics.

One exemplar in this category is Qventus, formerly known as analyticsMD, a software platform billed as “air traffic control for health systems.” The platform won a 2016 Fierce Innovation best of show award and the 2017 Healthcare Informatics Innovator award. Cofounder and CEO Mudit Garg’s “ah-ha
“We have a whole library of recipes, a playbook of things that can happen and countermeasures that can be put in place in the moment to prevent situations from getting really bad.”

—Mudit Garg, cofounder and CEO of Qventus

moment” for this innovation came when he worked on McKinsey & Company’s Healthcare Systems & Services team. “I constantly saw that frontline clinicians were working really hard to provide the best care,” he said. “We know they train for decades to make clinical decisions. But the systemic management system around them just didn’t exist.”

That’s the sweet spot for Qventus. The technology “augments and enables” healthcare professionals by helping them manage the complex environment of care and reducing the cognitive burden of trying to juggle both patient care and clinical workflow at once, Garg said.

The software aggregates, analyzes, and learns from multiple internal and external sources of data, predicts potential problems, and recommends actions to avert them. Internally, these data include electronic medical records (EMRs) and documented processes for every aspect of patients’ journeys through clinical settings: arrivals, orders, tests, diagnoses, admissions, procedures, medications, risk factors, call systems, transfers, discharges, and more. The system also tracks and learns from individual physician’s practices and preferences. For example, a physician’s penchant for ordering blood tests can be met with appropriate staffing of phlebotomists. In effect, Qventus tracks “the boring area of how healthcare manages the process,” and identifies inefficiencies and expediencies that stem from that, Garg said.

The software also can factor in external data points, such as weather forecasts, infectious disease reports, and other phenomena that healthcare providers believe contribute to surges in healthcare demand. For example, some clinicians believe (evidence notwithstanding) that the full moon unleashes havoc in emergency departments and maternity wards, so Qventus can put the moon phase calendar in the mix of variables that might affect clinical settings and staffing—and determine whether the full moon actually does have an impact.

When Qventus spots a potential problem, it provides clinicians and other decision makers with “nudges” via text, voice, or email messages to take actions in the moment that improve quality, safety, consistency, and experiences. For example, backups in the emergency department can ripple exponentially throughout a hospital, from blood draws, diagnostic imaging, and lab results to diagnoses and treatment to staffing and availability of beds. Lack of capacity in the emergency department, and departments that service it, can result in long wait times, reduced quality of care, patient dissatisfaction, and even patients who are so frustrated that they leave without care.

For its customers, Qventus is producing real gains enterprise-wide or on priority issues or units. For example, the software amplifies common data used to identify patients at risk for falls, such as risk assessments and medications, by tracking alarm signal responses and patient movement to predict just when a patient will try to get out of bed unaided. “We look at whether this is worth the interruption” to nurses, Garg said, considering all of the other alarm signals that can desensitize them. “If it is, we communicate and the frontline team can make a decision to act based on the data and their own observations. We have a whole library of recipes, a playbook of things that can happen and countermeasures that can be put in place in the moment to prevent situations from getting really bad.” Some hospitals using Qventus have reduced patient falls by 35% to 40%, he said.

Emergency departments, meanwhile, are reducing patient wait times, length of stay, unnecessary testing, and, by 35%, the numbers of patients who leave without being seen, Garg said. Surgical departments are
scheduling just the right amount of time for operations, based on data about specific procedures and surgeons. This maximizes use of expensive surgical suites and reduces staff downtime and overtime.

Qventus also exemplifies the trend toward productive use of Big Data. The software learns from its diverse deployments in academic and community hospitals and other clinical settings in urban, suburban, and rural locations, which means the playbook and recipes for effective healthcare management keep improving, Garg said.

IBM Watson Health is another notable player in this space. Watson Health is applying cognitive systems that can understand, reason, and learn to the 80% of health data that are unstructured. Watson Health is partnering with an array of organizations—including hospitals, cancer institutes, EMR providers, professional associations, and healthcare, healthcare technology, and pharmaceutical companies—to translate health information into knowledge that can drive more informed decision making.3

Radio frequency identification (RFID) technology is another example of how intelligent analytics is a game-changer. Healthcare organizations are putting tags embedded with electronic chips on products and assets, including medical devices, drugs, medical records, staff, and patients. The chips transmit information via radio waves to databases. This tracking technology can improve asset and supply chain management, enhance productivity, and improve patient safety.6

3. No-Touch, Continuous Infection Control

Infectious disease control and prevention are high priorities in clinical settings, as antibiotic-resistant, potentially lethal superbugs are an increasing challenge. Whole-room disinfection systems are proving to be an effective complement to traditional cleaning methods.

Indigo-Clean offers a new way to combat infection, which goes beyond the buckets of bleach, ultraviolet (UV) light, and other disinfection practices deployed today. Indigo-Clean is a continuous environmental disinfection system that uses germicidal, visible violet blue light at a 405-nm wavelength to deactivate bacteria in the air and on hard and soft surfaces. Image courtesy of Indigo-Clean.

Whole-room disinfection systems are proving to be an effective complement to traditional cleaning methods.
removed, which means that bacteria growth starts right back up again.

Prime healthcare applications for the technology include operating rooms, triage and trauma centers, and oncology, wound care, transplant, and sterile processing areas, Yahnke said. These are places where disinfection is medically relevant; where high occupancy, constant use, and rapid turnover result in limited alternatives for disinfection; and where the product is most effective. For example, “the average surgical site infection can run from an average of $30,000 to well over $100,000,” he said. “If you can prevent a single infection, just one, you are going to save $30,000 right off the bat. You pay for the lights. That’s return on investment.”

Early adopters of Indigo-Clean, such as Froedtert and the Medical College of Wisconsin Froedtert Hospital, have reduced bacteria by 50% to 80%—over and above reductions achieved with normal disinfection methods already in use, Yahnke said. The company has completed numerous studies, now in publication, and is actively seeking additional academic partners for more formal outcome studies.

Kenall Manufacturing is working on fixtures for other applications, such as patient bathrooms where Clostridium difficile, a spore-forming bacteria, is a primary concern. The company also is working on a fixture for use in locker rooms where methicillin-resistant Staphylococcus aureus (MRSA) infections are a concern.

4. Nanotechnology

Just as computers and phones are getting smaller and smarter, so too are medical devices. A compound annual growth rate of 17.5% is expected in the global nanotechnology market, and the biomedical industry is one of the largest sectors in which nanodevices are making major contributions.

Two types of smart skin patches illustrate the potential. An interdisciplinary team at the joint biomedical engineering program at North Carolina State University and the University of North Carolina at Chapel Hill have developed a disposable microneedle patch with monitoring and therapeutic capabilities. The patch looks like a small Velcro fastener, but the hooks are actually 600- to 800-μm needles made of modified polymer, which are painless to users.

In one application, biochemical sensors embedded in the microneedles monitor the level of the enzyme thrombin in people at risk of blood clots, or thrombosis, and respond to the measurements by releasing the appropriate dose of the blood thinner heparin. In another application, the patch responds to blood glucose in people with type 1 and advanced type 2 diabetes and delivers microinjections of insulin at just the right time. The amount of drug in the patch, which is changed daily or a few times a day, can be tailored to meet patient needs.

“The microneedles are bioresponsive,” said Zhen Gu, associate professor in the joint program that developed the patch. “The patch responds to the physiological environment. It’s a quite simple and convenient approach to enhance patient care.”

In mouse models, the microneedle patch performed better than conventional injections at mitigating thrombosis. Now, Gu and his team are preparing pre-clinical trials in small and large animals. Depending on the results, and the Food and Drug Administration approval process, such smart microneedle patches could be on the market within 5 to 10 years, he said.

Researchers at Purdue University, the University of Illinois at Urbana-Champaign, and Oklahoma State University have developed a different kind of skin patch. Theirs is an electronic device made of nanowire mesh that’s the size of a postage stamp or smaller.
Applied to the skin, the flexible, stretchable patch provides electrical conductivity that can measure heart and muscle activity, detect body temperature, and generate therapeutic heat to alleviate sore joints, according to Chi Hwan Lee, assistant professor of biomedical engineering and mechanical engineering at Purdue University, a leader of the applied research team.

Originally developed several years ago and made of gold and platinum thin films, the patch was prone to cracking. Lee and his team solved that challenge with single strands of crystalline nanomaterials that their research shows can withstand scratches and cracks and a mesh structure that improves durability and stretchability. The electrophysiological monitoring patch, which is less than 10 μm thick, is encased in a water-soluble adherent that dissolves in a few drops of water when the patch is applied to the skin.

“You cannot feel the electrodes,” Lee said. “This patch is ultrathin, lightweight, and more portable compared to traditional sensors.” Designed to be used outside of clinical settings, and changed daily, the patch collects and sends data wirelessly to mobile devices for digital monitoring by patients and physicians.

Lee and a collaborator, Georgia Malandraki, assistant professor of speech, language, and hearing sciences at Purdue and a board-certified specialist in swallowing and swallowing disorders, are working on an application of the patch to remotely monitor people with dysphagia, or difficulty swallowing. Early tests indicate that the patch can be applied to the neck to measure the activity of muscles associated with swallowing. The two researchers are in the process of launching a company and, after further testing, plan to market the skin patch.

5. Robotics

A few years ago, robotic surgery took the healthcare community by storm. Soon, robots—and nanorobots—could be assisting clinicians with patient care and diagnostics as well.

Duke University’s Department of Electrical and Computer Engineering is planning clinical trials now for Trina, which stands for telerobotic intelligent nursing assistant. Trina is a remote-controlled robot developed with support from the National Science Foundation, which put out a call in 2014 to engineers and scientists for rapid response solutions to the Ebola crisis.

“My ears really perked up” with that challenge, said Kris Hauser, a robotics expert and associate professor in Duke’s departments of electrical and computer engineering, mechanical engineering and materials science, and computer science. He envisioned that robots could reduce the exposure of nurses and other clinical personnel to dangerous pathogens. His idea: a remote-controlled “body” under clinicians’ direction that could do some of the hard and dirty work of caring for patients—and keep clinicians safe outside the quarantine area.

Working with the Duke School of Nursing, Hauser and his team shadowed nurses to study and replicate the common tasks they perform, Hauser said. Now, Trina can do course manipulations: grabbing sheets from beds, pushing around hospital bed tables, delivering and taking away food trays, lifting objects from tables, throwing disposable items in the trash, cleaning up bodily fluids, and even shifting a patient in a bed (though
Trina, a mobile manipulator robot, has industrial-strength arms and an omnidirectional base that allows for deft movement. It's capable of many patient-related tasks, including grabbing sheets from beds, delivering and taking away food trays, and cleaning up bodily fluids. Trina also has a “Skype on wheels” face/screen that allows for interactions between patients and clinicians. Image courtesy of Duke University.

it's not strong enough yet to lift a patient). Trina also can perform fine manipulations, such as grabbing items from a tray and handing them to patients, human nurses, or physicians. The things that Trina can't do (for now at least) include inserting infusion needles into patients or manipulating infusion device connectors, because it lacks human dexterity and coordinated fine motor skills.

The Duke team used a number of innovative technologies developed only within the past few years. Trina is a mobile manipulator robot, which means it has an omnidirectional base that can move forward, backward, left, and right, and spin in place. The robot has two industrial-strength robot arms with series elastic actuators—essentially motors with springs attached to them to make it safer to operate around people. Trina also has many embedded sensors, including 3D depth sensors, laser sensors to give it a 360° view of the world, and a panoramic camera. It has two three-fingered, soft hands. And it has a “face”—a screen that makes Trina like “Skype on wheels,” Hauser said. Patients in isolation can see their clinician's face on the screen, and clinicians can see their patients, and they communicate with each other that way.

Trina is a hefty, nonhuman presence that can be intimidating to nurses and patients—at first. The Duke team has put Trina through its paces, with nurses and actors who simulate patients, through the school of nursing. “For the first 5 minutes or so, it’s a bit of wonder and awe and fright,” Hauser said. “Then, once you show somebody how they can control it, communicate with a person, interact with a patient, they start to recognize that there is some value in this. Especially when you start to talk about the issues nurses face in infectious disease outbreaks, you can see how a technology like this could help save their health and possibly their lives in these quarantine situations.”

For the clinical trials, the Duke team will test Trina's ability as a diagnostic machine that captures specimens and measures vital signs to facilitate diagnosis without a clinician entering a patient’s room. Already, Trina can gather information about a patient, such as measuring weight with its 3D-scanning capabilities, which would allow clinicians to calculate the correct dosage of medication. This could be particularly helpful for obese patients, children, and acutely ill people who cannot get out of bed to stand on a scale.

If Trina passes muster in the clinical trials, it could be ready for limited use in hospitals in approximately 5 years, Hauser estimates. Before that happens, Trina’s “Frankenstein-like” parts and assembly as a prototype would need to be polished. In 20 years, robots like Trina could be in widespread use around the world—perhaps deployed as rapid responders to infectious disease outbreaks.

6. 3D Printing and Bioprinting

3D experiences are no longer exclusive to movie theaters and entertainment, or to churning out prototype products. 3D printers, bioprinters, and other products are well on their way to personalizing and, perhaps, revolutionizing healthcare.

Take prosthetics. Customized artificial limbs that used to take weeks or months to create, and tens of thousands of dollars to purchase, can now be designed and printed using inexpensive 3D body scanners, body-modeling technologies, and printers in days or hours, for a few hundred dollars or
less—at home or in the community. Combined with high-tech, durable materials like titanium, motion sensors, and mechanical innovations that mimic natural movement, 3D prosthetics offer more affordable, comfortable, and effective options to people who have lost limbs.

But limbs are just the tip of the iceberg. A few years ago, researchers at Princeton University created a “bionic ear” that can “hear” radio frequencies far beyond human capacity. The proof-of-concept device merges electronics with cell tissue and could eventually be used to restore or enhance hearing. Fast forward a few years and researchers are now using 3D bioprinters to generate functional replacement tissue, including 3D organs, bones, joints, and blood vessels.

For example, Harvard University researchers announced in 2016 that they had made “the first entirely 3D-printed organ-on-a-chip with integrated sensing.” This type of microphysiological, digitally manufactured device mimics the functionality of the human heart. At this point, devices like these are intended to be used in the future for drug testing, instead of clinical trials with human subjects, and for disease modeling. One day, functional, biocompatible organs printed using layers of human tissue could be used for organ transplants.

In another application, physicians are using 3D-printed body parts to plan and rehearse surgery and to train medical students. At the University of Rochester Medical Center, for example, the 3D models of organs are so realistic that they “even bleed when they are cut, offering an incredibly realistic experience.”

7. Augmented and Virtual Reality

Like 3D technologies, augmented and virtual reality are crossing over from the entertainment industry to productive uses in healthcare, from medical training to planning procedures to optimizing patient care.

The Cleveland Clinic and Case Western Reserve University, for instance, are partnering with Microsoft to use 3D headsets and 3D content for augmented reality: the real-world layered with virtual objects and images—and virtual reality—to render a 360° virtual environment for medical education. With 3D holographic anatomy images, physicians and medical students will be able to visualize and explore virtual human bodies in ways that would be impossible with real people or cadavers.

Healthcare providers also are experimenting with augmented and virtual reality as a therapeutic tool to manage pain and treat depression and other psychiatric conditions. These technologies also have the potential to help stroke victims or people with neuromuscular disorders use their limbs again, augment compromised senses, and assist with daily living. Augmented and virtual reality are powerful because they can “trick” people to move or feel better with visual aids and by modeling behavior, offering motivation, or simply providing an inspirational escape.

8. Noninvasive Diagnostics

A slew of novel noninvasive diagnostic products are entering the market that are both accurate and comfortable for patients. Products in this category can extend the reach of healthcare to nontraditional settings and to populations that otherwise might not have access to it. Here are two examples.

ReCIVA (Respiration Collector for In Vitro Analysis) is a diagnostic and monitoring breathalyzer that reliably and reproducibly captures breath samples for chemical analysis. The device collects biomarkers for volatile organic compounds (VOCs) produced by the body. “The pattern of VOC biomarkers produced by the body reflect metabolic processes taking place within a person’s cells and tissues, within their microbiome, and from their response to environmental exposures,” according to Owlstone Medical, the British company that makes the ReCIVA breath sampler.

Specific diseases, including cancer and infectious and inflammatory diseases, exhibit particular VOC patterns. Detecting changes in the concentrations of VOCs, using a
“Breath Biopsy,” can enable clinicians to detect diseases in their early stages, which is the best time for successful treatment. ReCIVA is currently being used for Lung Cancer Indicator Detection (LuCID), the world’s largest breath-based clinical trial for early cancer detection in the United Kingdom and Europe.

iBreastExam is another breakthrough technology in this category. This portable handheld device uses sensor technology, not radiation, to detect breast lesions with greater than 85% accuracy, with results within 5 minutes at the point of care. This mobile device can be used by any healthcare worker or physician, providing an effective diagnostic tool that can be used in homes, offices, community centers, and remote locations. This device won the grand prize at the 2016 HITLAB World Cup, an international digital health competition.

Other exciting developments in this category include next-generation sequencing molecular diagnostics for screening, diagnosis, treatment, monitoring, and patient management; liquid biopsies to detect cancer; and products that measure blood glucose levels using saliva instead of blood.

9. Wearables and More

For many people, the human wrist has become home to smart watches and fitness trackers that can monitor heart rate, physical activity, and other health-related signals.

Some enterprising companies are looking to new territory on or near the human body. Here are a few examples introduced in January at CES 2017, a showcase for new technology:

- A stylish and discreet finger ring that tracks activity, heart rate, and sleep
- A smart shirt embedded with heart rate-monitoring and motion-tracking sensors
- Earbuds with an in-ear thermometer to measure core body temperature during activity
- A wearable electrocardiogram monitor
- A smart toothbrush embedded with sensors that collect data about brushing habits
- A smart spoon and fork designed to offset hand tremors

A different take on wearables is a smart watch for nurses under development as a prototype at Texas A&M University. The watch could help them monitor and manage their workload and stress levels. The device tracks nurses’ biometric data, such as heart rate and activity, and communicates it to colleagues and unit charge nurses or nurse managers, who get a quick view of their entire staff on a dashboard screen. Nurses would know who is available to help them in high-stress moments, and charge nurses or nurse managers would be able to adjust workloads or staffing to improve the patient care and work environment.

10. Drones

In the not-too-distant future, healthcare services and medical supplies could be brought to you by drones. In fact, this is already happening in remote areas outside the United States.

Zipline is a California company that is partnering with the government of Rwanda to deliver life-saving vaccines, medications, and
blood to 20 hospitals and health centers around that country. A fleet of 15 Zip drones, which the company calls small robot airplanes, can make up to 150 deliveries a day to rural and remote locations, where the lengthy rainy season ravages roads—if there are roads—and cuts off vehicle access.

Health workers communicate their needs via text message to a central Zipline home base. Within minutes, Zipline fills the order and launches a loaded Zip. The Zip flies at 100 kilometers, or about 62 miles, per hour, making the whole country accessible within an hour or so. Zips drop their payloads via parachute in designated spots near the health centers they serve. The UPS Foundation is supporting this effort with logistics expertise and resources.

Drones could help solve the “last-mile problem”: the inability to deliver urgently needed healthcare supplies to off-the-beaten path areas due to lack of transportation, communication, and supply chain infrastructure. In Rwanda, among other healthcare challenges, blood drops are expected to address the leading cause of maternal death: postpartum hemorrhaging and lack of access to blood products.

The Rwanda partnership, launched in 2016, is just the beginning. Expansion to other developing countries is planned, with the United States among the possibilities. “We’re working with the FAA [Federation Aviation Administration] on getting approval to serve Native American communities in the United States,” said Justin Hamilton, Zipline spokesman.

**Conclusion**

According to Purdue University’s Chi Hwan Lee, bioengineering know-how combined with knowledge of nanotechnology and nanomaterials enabled him to solve the design and performance problems of the initial electronic mesh patch. He sees “very good opportunities” for people interested in contributing to tomorrow’s innovative technology.

The new and emerging technologies described in this article all have the potential to be game-changers in healthcare. They also deliver the “wow” factor that draws healthcare technology management (HTM) professionals to the field. Just as important, many of these technologies validate the role that biomedical and clinical engineers can play in innovation.

Many of these experts stress the need to remain focused on costs and patient outcomes. However, impressive some technology may be, the “wow” factor alone should not drive purchasing decisions, they advise.

“Technology is changing faster and has shorter lifespans, which drives up long-term costs,” said Ted Cohen, manager of clinical engineering at the University of California Davis Health System. Healthcare technology in general, he emphasized, “needs more focus on improving patient outcomes and getting the caregivers more efficient and close to the patient.”

The expertise of HTM professionals will continue to be valued on interdisciplinary teams in their quests for next-generation innovations.
References


