Top Health IT Trends and Innovations for 2017:

What you Must Know to Stay Ahead in Today's Market

White Paper

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Abstract: While uncertainty abounds on the details of the healthcare plans under the current administration and Congress, the trends toward value-based reimbursement are apparent. Successful organizations that break through the value barrier must have a strong vision backed by a unified leadership team, well-trained and motivated employees, and efficient work processes that eliminate duplication of effort. This paper highlights key health information technology (IT) trends and innovations that Chief Information Officers (CIOs) and other health leaders must know as we quickly progress through 2017. By understanding some of the important health IT innovations and trends, CIOs and other executives can better position themselves to adopt one or more of these advances to help transition their organizations toward high-value care.

Key Words: Chief Information Officers (CIOs), Healthcare Information Technology, Electronic Health Records, Revenue Cycle Systems, Patient Safety Advocates, HIT, HIT Trends, HIT Innovations, Artificial Intelligence, Big Data and Advanced Analytics, Blockchain, Care Coordination Systems, Cloud Computing, Fast Healthcare Interoperability Resources (FHIR), Internet of Things (IoT), Personalized Medicine, Telehealth, Three-Dimensional Medical Visualization, Wearable Technology, National Institute of Health (NIH)

INTRODUCTION

This paper highlights several key health information technology (IT) trends and innovations that Chief Information Officers (CIOs) and other health leaders must know as we quickly progress through 2017. As of this writing, the federal government has launched initiatives to repeal and replace what many refer to as "Obamacare." While uncertainty abounds in this regard, gone are the days of unaccountable, fee-for-service healthcare. Our healthcare system must be reengineered to:

1) Provide consistent, high-quality care at lower cost;
2) Increase the value received from each healthcare dollar spent; and
3) Reward financially those providers who demonstrate this achievement.

Successful organizations that break through this value barrier must have a strong vision backed by a unified leadership team, well-trained and motivated employees, efficient work processes that eliminate duplication of effort. Further, they must have optimized IT systems including Electronic Health Records (EHRs) and Revenue Cycle Systems, and a willingness to deploy select emerging IT innovations to improve communication and help enable accountable high-value care. By understanding some of these important health IT innovations and trends, CIOs and other executives can better position themselves to adopt one or more of these advances to help transition their organizations toward high-value care.

Business Imperatives For Health IT Innovation

Following are key challenges, issues, and concerns that the healthcare industry is facing based on leading surveys of CEOs, CFOs, Physicians, and Patient Safety Advocates. These findings serve as key business imperatives that are driving innovation in health IT.

Top CEO Issues

According to an American College of Healthcare Executives (ACHE) survey, hospital CEOs ranked financial challenges as the No. 1 issue facing their organizations in 2016.[1] Governmental mandates and patient safety and quality ranked second and third, respectively. The top 10 issues identified by 383 CEOs for the 2016 ACHE survey are:

1. Financial Challenges
2. Government Mandates
3. Patient Safety and Quality
4. Personnel Shortages
5. Patient Satisfaction
6. Access to Care
7. Physician-Hospital Relations
8. Population Health Management
9. Technology
10. Reorganization (e.g., M & A)

Within each of these issues, the CEOs ranked the specific aspects they found most pressing. The aspects of the top three CEO issues are listed below:

Financial Challenges

- Medicaid reimbursement (including payment adequacy and timeliness)
- Increasing costs for staff, supplies, etc.
- Bad debt (including uncollectable Emergency Department (ED) and other charges)
- Transition from volume to value
- Government funding cuts (other than reduced Medicaid or Medicare reimbursement)
- Competition from other providers
- Medicare reimbursement (including payment adequacy and timeliness)
- Revenue cycle management (converting charges to cash)
- Inadequate funding for capital improvements
- Managed care and other commercial insurance payments
- Moving away from fee-for-service
- Emergency Department overuse
- Pricing and price transparency

Government Mandates

- CMS regulatory changes
- CMS audits (e.g., RAC, MAC, CERT)
- Cost of demonstrating compliance
- Regulatory/legislative uncertainty affecting strategic planning
- State and local regulations/mandates
- Increased government scrutiny of accounting practices (e.g., IRS, Sarbanes-Oxley Act)
- ICD-10 implementation

[1] http://www.ache.org/pubs/Releases/2017/top-issues-confronting-hospitals-2016.cfm. Accessed March 24, 2017

Patient Safety and Quality

- Engaging physicians in improving the culture of quality/safety
- Engaging physicians in reducing clinically unnecessary tests and procedures
- Redesigning care processes
- Pay for performance
- Public reporting of outcomes data (e.g., transparency, measure fairness, reporting)
- Redesigning work environment to reduce errors
- Compliance with accrediting organizations (e.g., Joint Commission, NCQA)
- Leapfrog demands (e.g., computerized physician order entry, ICU staffing)
- Medication errors

Top CFO Issues

Based on a Becker's Healthcare Survey, there are six top issues on the minds of CFOs for 2017: [2]

1. Volume Leakage
2. Smart Expansion
3. Clinical Documentation Improvement
4. Managing Risk
5. Paradigm Shift in Reimbursement
6. Improve Point-of-Service Collection Rates

Top Physician Issues

Medical Economics surveyed and published the top 10 challenges that physicians noted for 2017:[3]

1. MACRA/MIPS
2. Prior Authorizations
3. Payer Negotiations
4. Staying Motivated to Practice Medicine
5. Maintaining Certifications
6. Lack of EHR Interoperability
7. Patient Frustration with Rising Costs
8. The Non-Adherent Patient and "Quality" Care
9. Changing Patient Attitudes
10. Patient Satisfaction Scores

Top Patient Safety Issues

The ECRI Institute also surveyed and published the top 10 patient safety challenges for 2017 from the perspective of various healthcare organizations:[4]

[2] http://www.beckershospitalreview.com/finance/cfos-name-top-6-challenges-in-2017.html Accessed March 24, 2017

[3] http://medicaleconomics.modernmedicine.com/medical-economics/news/top-10-challenges-2017 Accessed March 24, 2017

[4] https://www.ecri.org/EmailResources/PSRQ/Top10/2017_PSTop10_ExecutiveBrief.pdf Accessed March 24, 2017

1. Information Management in EHRs
2. Unrecognized Patient Deterioration
3. Implementation and Use of Clinical Decision Support
4. Test Result Reporting and Follow-Up
5. Antimicrobial Stewardship
6. Patient Identification
7. Opioid Administration and monitoring in acute care
8. Behavioral health issues in non-behavioral health settings
9. Management of new oral anticoagulants
10. Inadequate organization systems or processes to improve safety and quality

Collectively, these lists of issues and concerns from CEOs, CFOs, physicians, and patient safety advocates are indicative of an industry that is in major transition. Each of these items represents key business imperatives and are difficult to address. However, emerging innovations in health IT can offer fresh and constructive ways to contend with these and new imperatives in the future.

Emerging Health IT Innovations and Trends

As today's business requirements increase and intensify, we see an enormous growth of new IT system and technology offerings introduced in the marketplace. Some of these technologies are brand new. Some are already in use in healthcare and are escalating in use. Others are employed in other industries and are in the process of being transferred to the healthcare industry. Which of these products and companies (many of them startups) will survive? Which of these technologies and promised innovations are long-term solutions, and which are just fads? These critical questions are not easy to answer.

Despite this uncertainty and the increasing activity in the health IT marketplace, certain innovations and trends are worth watching, learning about, and perhaps pursuing at this time or soon, given an organization's specific strategic business initiatives.

The following alphabetical list describes several key innovations and trends that are especially noteworthy.

Artificial Intelligence

Artificial intelligence (AI) is any form of intelligence displayed by a machine. In computer science, AI is defined as the study of *intelligent agents,* which is any device that perceives its environment and takes action(s) that maximize its chance of success at some goal. AI is commonly used to describe a machine that mimics cognitive human functions including perceiving, memorizing, judging, reasoning, and problem-solving (also referred to as "Machine Learning"). Capabilities currently classified as AI include speech recognition, competing in

strategic games such as chess, enabling intelligent (efficient) routing in content delivery networks, interpreting complex data, and powering self-driving cars.

Below are two examples of how AI and cognitive computing are evolving in today's marketplace.

IBM Watson Health is touted as a new partnership between humanity and technology. IBM Watson Health was formed to enable better care by uncovering insights from the massive amounts of personal and academic health data that is being generated every day. IBM Watson is an advanced form of cognitive computing that learns as the system ingests and crunches large amounts data. Computers like IBM Watson learn on their own without human intervention.

IBM is building businesses in healthcare and other areas around Watson and seeks partners within the medical, pharmaceutical, and hospital fields to make cognitive computing relevant to on-the-ground practitioners. Organizational partners working with IBM Watson include:

- Medtronic: To predict hypoglycemic episodes in diabetic patients nearly three hours before its onset, thereby preventing devastating seizures.
- Apple: To store and analyze Apple's ResearchKit data to gain new insights.
- Johnson & Johnson: To analyze scientific papers to find new connections for drug development.
- Under Armour®: To power a "Cognitive Coaching System" that provides athletes' with coaching around sleep, fitness, activity, and nutrition.

A Florida State University researcher has used advancements in AI to predict suicide attempts up to two years before they occur.[5] The study began by analyzing more than two million patient EHR files to identify 3,200 patients who had attempted suicide.

Jessica Ribeiro, the lead researcher on the study, used machine learning to predict which individuals would attempt suicide two years in advance with up to 80% accuracy. The machine learns the optimal combination of risk factors, according to Ribeiro. "What really matters is how this algorithm and these variables interact with one another as a whole. This kind of work lets us apply algorithms that can consider hundreds of data points in someone's medical record and potentially reduce them to clinically meaningful information," Ribeiro noted. Machine learning was able to identify certain information within EHRs to "learn" which factors lead to attempted suicide. That accuracy of 80% two years before increased to 92% a week before a suicide attempt. Ribeiro hopes that this machine learning will bring preventive medicine to those most in need.

"This study provides evidence that we can predict suicide attempts accurately," Ribeiro said. "We can predict them accurately over time, but we're best at predicting them closer to the

[5] https://news.fsu.edu/news/health-medicine/2017/02/28/how-artificial-intelligence-save-lives-21st-century/. Accessed March 24, 2017

event. We also know, based on this study, that risk factors—how they work and how important they are—also change over time."

Big Data and Advanced Analytics

Many healthcare organizations have invested hundreds of thousands or millions of dollars in IT systems and infrastructure. These organizations are trying to capture, process, store, and extract key insights from unprecedented amounts of data in response to the various business imperatives identified earlier. Those that are most successful in these initiatives have implemented strategies that are addressing the influx of data and growing need for intelligent reporting. These challenges have led to the concepts of Big Data and Advanced Analytics.

Big Data is a term that describes a large volume of data—both structured and unstructured—that inundates a business on a day-to-day basis. Big Data has the following characteristics:

- **Volume.** Organizations collect data from an increasing variety of sources, including various business transactions, social media and information from emerging sensor, or machine-to-machine data.
- **Velocity.** Data is streaming real time into an organization at an unprecedented speed and must be handled promptly. Examples include increased data rates from day-to-day internal and external customer transactions, radio-frequency ID tags (RFID), and third-party data sources (e.g., federal and state governments).
- **Variety.** Data comes in all types of formats—from structured, numeric data in traditional databases to unstructured text documents, email, video, audio, and images.
- **Variability.** Structured and unstructured data flows can be highly inconsistent with periodic peaks and valleys. Daily, seasonal, and event-triggered peak data loads can be challenging to manage and must be accommodated.
- **Complexity.**—Today's data comes from multiple sources, which makes it difficult to link, match, cleanse, and transform across various IT systems. Data integrity and quality can quickly spiral out of control without connecting and correlating relationships between data from multiple data sources.

As critical as the issues surrounding Big Data are, the amount of data is not what's important; rather, it's what the organization does with the data that matters. Emerging Advanced Analytics tools are designed to analyze Big Data for key trends and insights in a more efficient and effective manner. For example, advanced analytics systems are being designed to mine data and text from multiple sources, apply machine learning capabilities, and allow users to crunch, slice, dice, and present insights to health systems and providers regarding the impact and trends on individual patient and population health. Smart extensions to emerging advanced analytics systems include connecting to communication platforms with individual patients and broader care teams to ensure real-time monitoring of a patient's progress toward desired clinical outcomes and interventions across the continuum of care (e.g., care coordination systems).

BLOCKCHAIN

Blockchain is poised as the next frontier in healthcare to help solve some of the industry's interoperability and security challenges. Blockchain emerged in 2009 as the foundation for trading digital currency like bitcoin. This technology maintains a permanent record or log of each person's online transactions or exchanges on the network. Each transaction is cryptographically linked to the transactions before it, creating a permanent chain of events. The entire log is managed by the network, and it is duplicated and audited across a network of computers.

In healthcare, blockchain offers a new means to interoperate because it allows a distributed network of users to share a historical record (e.g., a patient's EHR) without the need for a central party. It enables all users of that network to account for verified health data across disparate systems and maintain a complete history of interactions with that data. In other words, in a blockchain network, every patient's healthcare interaction goes into a ledger that every provider can see. The EHRs may be very different and come from many different places, but the blockchain ledger itself is standardized.

Blockchain technology is still in its infancy when it comes to healthcare applications, but in a recent poll of healthcare executives, IBM found that 16% of them intend to implement some sort of blockchain solution(s) by the end of 2017.[6]

CARE COORDINATION SYSTEMS

The Agency for Healthcare Research and Quality (AHRQ) defines Care Coordination as *"*the deliberate organization of patient care activities between two or more participants (including the patient) involved in a patient's care to facilitate the appropriate delivery of healthcare services. Organizing care involves the marshaling of personnel and other resources needed to carry out all required patient care activities and is often managed by the exchange of information among participants responsible for different aspects of care.*"*[7]

With care coordination, physicians, pharmacists, physician assistants, nurses, and others across the healthcare continuum are connected to the most up-to-date patient information, regardless of geography or technology platform. When two or more healthcare organizations coordinate care on behalf of a patient, they will know:

1. which patients for whom they should be coordinating care;
2. which providers those patients see;
3. what procedures must be in place to determine when, how, and what patient information to communicate with each other; and

[6] https://www-01.ibm.com/common/ssi/cgi-bin/ssialias?htmlfid=GBE03790USEN&. Accessed March 24, 2017

[7] https://www.ahrq.gov/professionals/prevention-chronic-care/improve/coordination/atlas2014/chapter2.html. Accessed March 24, 2017

4. what tools, processes, and technology to employ to transfer and effectively use that information.

Today, existing EHR vendors are working to add care coordination capabilities to their systems. Also, many new vendors are offering IT systems that intend to enable care coordination within and across one or more health care organizations. As the care coordination marketplace matures, providers should look for automated tools to help them to:

- Assess patient needs and set goals
- Document and communicate patient care plans
- Monitor, follow-up, and quickly respond
- Link with community resources and facilitate patients through transitions of care
- Establish and ensure patient and caregiver accountability

Cloud Computing

The Cloud is a common metaphor for the Internet. Cloud computing refers to storing and accessing data and software programs over the Internet rather than on an organization's in-house computer system. Cloud computing gained impetus in 2009 with the availability of high-capacity networks, low-cost computers, and data storage devices. A key advantage to the Cloud is that an organization can scale up or down as computing needs increase or decrease and, therefore, only pay for the computing resources they need.

A growing number of existing health IT systems are migrating to the Cloud, while a majority of new IT systems run only on the Cloud. Cloud providers continue to invest heavily in strengthening their technical foundations, which makes Cloud computing one of the most secure infrastructures available. Clearly, the Cloud is here to stay and will play a significant part in enabling important innovations in the foreseeable future.

FHIR

Fast Healthcare Interoperability Resources (FHIR, pronounced "fire") is a draft next-generation standards framework that describes data formats and elements (known as "resources") and an Application Programming Interface (API) for exchanging EHRs. Healthcare records increasingly are becoming digitized in various care settings (e.g., physician's offices, hospitals, and nursing homes). As patients move around the healthcare continuum, their EHRs must be available to and discoverable and understandable by providers. Additionally, the data must be standardized and structured to enable efficient automated clinical decision support. FHIR is suitable for use in a wide variety of contexts including cloud communications, EHR-based data sharing, server communication in large institutional healthcare providers, and mobile phone apps. FHIR, though under trial today, is beginning to gain momentum in the industry as more vendors are committing to work together to build a more interoperable health IT infrastructure.

Internet of Things

Today, many physical objects and devices have embedded sensors, actuators, software, and network connectivity that are linked to capture and exchange information. These objects are often referred to as "connected" or "smart" devices and are designed to use the same IP for Internet connection. They can sense their environment, communicate together and with other IT systems, and offer promise to become tools to understand the complexity and respond swiftly. These devices are designed to churn out large volumes of data (Big Data) and send it to various computing systems. The overall term to define this capability is the Internet of Things (IoT).

Some interesting examples in healthcare include patient wearable devices that continuously monitor chronic diseases or track a patient through a facility and pill-shaped micro cameras that a patient can swallow. Current challenges facing the proliferation of IoT in healthcare include the expected high cost to acquire and integrate these systems with EHR systems, a lack of software development, patient acceptance to use the IoT devices, and physician acceptance of receiving more Big Data from these devices. Despite these challenges, something to watch is how the IoT expands into healthcare in the future.

Personalized Medicine

Launched in 1990 and completed in April of 2003, the Human Genome Project (HGP) was one of the greatest feats of *inward* exploration in history. This international research led by the U.S. Department of Energy and the National Institute of Health sequenced and mapped all of the genes—together known as the genome—of our species, Homo sapiens. For the first time, the HGP gave us the ability to read nature's complete genetic blueprint for *building* a human being.[8] The Human Genome contains approximately 23,000 genes that comprise roughly three billion DNA units. The HGP's primary goal was to provide researchers with powerful tools to understand the genetic factors in human disease, paving the way for new strategies to diagnose, treat, and prevent these diseases. Thus, the field of Personalized Medicine (PM) emerged.

PM uses technology to identify genetic, genomic, and clinical information to pinpoint specific genes that cause common diseases such as cancer, heart disease, and diabetes. Providers can predict more accurately a person's susceptibility to developing a disease, the course of the disease, and its response to treatment. These findings they can help develop more precise diagnostic tests and targeted therapies to make the treatment as individualized as the disease.

Today, the HGP has discovered over 1,800 genes that cause disease. Researchers can find a gene suspected of causing an inherited disease in a matter of days, rather than the years it had taken before the genome sequence was in hand. Researchers also have found that some diseases are caused by multiple genes interacting together. We now have over 2,000 genetic tests for various

[8] https://www.genome.gov/10001772/all-about-the--human-genome-project-hgp/ Accessed March 24, 2017

human conditions, which enable patients to learn their genetic risks for disease and help providers to diagnose disease and intervene sooner. Also, at least 350 biotechnology-based products resulting from the HGP are currently in clinical trials.

TELEHEALTH

The Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services defines Telehealth as "The use of electronic information and telecommunications technologies to support and promote long-distance clinical health care, patient and professional health-related education, public health and health administration." Telehealth technologies include videoconferencing, the internet, store-and-forward imaging, streaming media, and land-based and wireless communications.[9] With a secure internet connection, one can provide care to a greater number of people in a more sophisticated way than ever.

Health systems and physicians increasingly are turning to telehealth as a tool to enhance patient access to care, manage care on a timelier basis, and lower healthcare costs. Current Telehealth initiatives include electronic ICUs (e-ICUs), tele-stroke programs, electronic visits (e-visits) for primary and specialty care, tele-rounding, video-connected post-surgical transfers and follow-up, and urgent care. Some health systems are working toward virtual EDs and home monitoring to prevent illness. While there are many examples of how videoconferencing technology is being used in healthcare, the following two examples are excellent studies that show how telehealth can improve patient care.

> **Example 1**
> Elizabeth Morrison-Banks, MD, a health sciences clinical professor at the University of California, Riverside, received a $100,000 grant from Genentech to conduct a study in hopes of developing a telehealth program for individuals with multiple sclerosis (MS). The *Clinicians' Online Neurology Network Empowering Communities through Telemedicine – Multiple Sclerosis* (CONNECT-MS) study will cover a year in the lives of MS patients receiving care through telemedicine.[10]
>
> The goal is to provide improved neurological care to MS patients who would otherwise be burdened with travel or live in underserved populations. "People with advanced MS face additional barriers in traveling to an MS center, even if it is located nearby because if they have a lot of disability, over time, it tends to become increasingly difficult for them to leave their homes," said Morrison-Banks. "So if we can bring the 'medical home' into people's actual homes, we can meet multiple needs at the same time while allowing a safe and comfortable environment for the medical visit."

[9] http://www.hrsa.gov/ruralhealth/telehealth/ , Accessed March 24, 2017

[10] https://ucrtoday.ucr.edu/45279, Accessed March 24, 2017

Example 2

A study published in Alzheimer's & Dementia: Translational Research & Clinical Interventions found that videoconferencing can help patients with dementia and moderate aphasia symptoms regain communications skills.[11] Aphasia is a communication disorder that results from damage to the parts of the brain that contain language (typically in the left half of the brain). Aphasia may cause difficulties in speaking, listening, reading, and writing, but does not affect intelligence.

Researchers identified 34 participants with progressive aphasia, 31 of whom completed the study. Participants received an initial evaluation, eight speech-language therapy appointments via videoconferencing and two post-therapy evaluations.

Researchers analyzed patient compliance, functional gains, and duration of beneficial outcomes related to communication. Conclusions: videoconferencing intervention "provides a feasible model for delivering care to individuals with dementia and mild and/or moderate aphasia symptoms who have an engaged care-partner and have prior familiarity with a computer."

Three-Dimensional Medical Visualization

Three-Dimensional (3D) Medical Visualization, a relatively young field of science, uses computers to create 3D images from medical imaging data sets. This emerging technology relies heavily on advances in computing for its horsepower.

These techniques have revolutionized medicine, despite their youth. Much of modern medicine relies on the 3D imaging that is possible with magnetic resonance imaging (MRI) scanners and computed tomography (CT) scanners, which make 3D images out of 2D slices. Almost all surgery and cancer treatment in the developed world relies on this capability.

In the last five years, commercial CT scanners have become available that can take five 320-slice volumes in a single second, which is fast enough to make 3D videos of a beating heart. There are also various new diffusion imaging techniques that reveal the circulation of water through the body. This capability is critically important because water tends to follow otherwise hard-to-image structures such as nerve bundles and muscle fibers. Images of these structures are opening important new areas of study in neuroscience and biomechanics. Additionally, there are the imaging techniques that now work on the level of molecules and genes. The great potential of these techniques is that they can reveal pathological processes at work long before they become apparent on the larger scale, in the form of tumors, for example. Collecting the data is just one part of the challenge: representing it visually in a way that allows the most effective analysis is a second part of the challenge. However, advances are underway.

[11] tp://www.trci.alzdem.com/article/S2352-8737(16)30035-X/abstract, Accessed March 24, 2017

One of the most recent spectacular developments is the ability to represent medical data topologically; that is, showing the surfaces of objects. This capacity makes it easier to see the shapes of organs and other structures and to plan surgical and other interventions more precisely. The most recent image processing techniques add lifelike lighting effects creating photo-realistic images. Beyond this, hyper-realistic images can show what lies beneath certain layers as shown in the sample images above. These kinds of images are most valuable for reconstructive surgery. In fact, researchers are working on developing images to depict the potential outcome of interventions that show the result of a surgery. These advances promise to enable more precise care with improved outcomes but will require increased computer processing speeds, faster network bandwidth, and increased image data storage capacity, all at a lower cost.

Wearable Technology

Wearable technology (also referred to as "wearables" and "mobile health") are versatile and portable technology devices that can be worn by an individual. These devices capture, track, and transmit medically-useful Patient-Generated Health Data (PGHD) to enable providers to monitor patients remotely for faster intervention while reducing the need for making in-office visits. Examples of medically-useful data these devices can track include 7x24 physical activity, multiple organ functions, the amount and quality of sleep, and exposure to sunlight.

Today, the healthcare industry is not sufficiently equipped to receive, process, and store this data in their EHR systems. Currently, there is no standard interoperability format for connecting PGHD to EHRs. Perhaps the industry will develop such standards through the efforts of FHIR and advanced APIs so EHR vendors can design this capability in their next generation EHR systems.

The National Institute of Health

The National Institute of Health (NIH) plays a critical role in fostering innovation in the healthcare industry. The NIH, an agency of the U.S. Department of Health and Human Services, is one of the world's foremost medical research organizations and focuses on making important discoveries that improve people's health and saves lives.

The NIH provides leadership and direction to programs designed to improve the overall health of the Nation by conducting and supporting research in several areas including the "…*collection, dissemination, and exchange of information in medicine and health...*"[12]

The NIH invests nearly $32.3 billion annually[13] in medical research for the American people. More than 80% of the NIH's funding is awarded through almost 50,000 competitive grants to more than 300,000 researchers at more than 2,500 universities, medical schools, and other

[12] https://www.nih.gov/about-nih/what-we-do/mission-goals, Accessed March 24, 2017

[13] https://www.nih.gov/about-nih/what-we-do/budget, Accessed March 24, 2017

research institutions in every state and around the world. About 10% of the NIH's budget supports projects conducted by nearly 6,000 scientists in its laboratories, most of which are on the NIH campus in Bethesda, Maryland.

Many examples of NIH-funded innovation projects are available on the NIH website. For example, the NIH awarded $2.9 million to Scripps Whittier Diabetes Institute to conduct a clinical trial called Dulce Digital-Me, to investigate whether text message interventions can improve type 2 diabetes management for high-risk Hispanic patients. This study will include 414 low-income Hispanic adults with poorly-controlled type 2 diabetes, who will track their blood sugar levels and medication adherence with wireless devices. Half of the participants will receive standard text messages for reminders and encouragement, and half will receive personalized text messages related to nutrition habits, physical activity, and other factors based on their monitoring data. Researchers will measure hemoglobin A1c levels, LDL cholesterol levels, and systolic blood pressure to investigate whether personalized text messages lead to better physician communication, medication adherence, cost effectiveness, and overall outcomes.

A consortium of nine universities, led by Evanston, Ill.-based Northwestern University, has been awarded a $6.3 million grant from the National Institutes of Health's National Center for Advancing Translational Sciences. The consortium plans to build software that will integrate the computerized survey tool Patient Reported Outcomes Measurement Information System into EHRs, including Cerner and Epic, which have both signed onto this project as integration collaborators. The universities hope that access to self-reported information about patients' physical, mental, and social health characteristics through PROMIS will allow clinicians and researchers to improve patient care and medical research.

Along with Northwestern University, the grant was awarded to the University of Chicago, the University of Illinois at Chicago, the University of Alabama at Birmingham, Lexington-based University of Kentucky, Gainesville-based University of Florida, Salt Lake City-based University of Utah, Boston-based Harvard Catalyst CTS, and Los Angeles-based Southern California CTSI.

Many of these NIH-funded projects use existing technology such as text messaging and video conferencing to target specific, high-cost health issues in certain segments of the population. In other cases, newer technologies including artificial intelligence are applied. In any event, CIOs and other health leaders should stay current on the types of projects funded by the NIH and other healthcare grant organizations. Many of these projects can and will lead to new health IT innovations, which will help address the business imperatives identified earlier. For example:

- AI-powered wearables are projected to reach 60 million units in 2017, growing at an annual rate of 376%.
- The dominant driver in the segment is "hearable" devices, which are expected to represent 50% of the AI-powered wearable market share.
- In 2017, Apple is expected to lead the AI-powered hearable market, with 78% of the market share.

- Other prominent types of AI-powered wearables include smartwatches (42%) and activity trackers (4%).
- Although activity trackers represent a small share of the AI-powered wearable segment, they are poised to see 545% growth in 2017.

CONCLUSION

Providers, payers, and IT vendors need to work together to design solutions that engage and motivate people, rather than instructing or managing them.

Providers of the next generation are demanding simplicity and functionality of technology in their professional life that mirrors the personal life. Organizations that bring forward great design, function, and service for both providers and patients will have the edge.

For CIOs and other health leaders, it is time to "go back to school" to learn:

- The things that keep your organization's leadership team up at night.
- Current and anticipated industry and organizational pressures and imperatives.
- Emerging innovations and trends in IT.
- How others are applying new technologies and the results they are trying to achieve.
- What your vendor(s) are doing to innovate.

By doing the homework, CIOs and other health leaders can match organizational imperatives with one or more emerging innovations and present a business case for conducting a pilot or prototype innovation project for their organizations. By understanding some of these health IT innovations and trends, CIOs and other executives can better position themselves and their organizations to adopt one or more of these advances to help transition their organizations toward accountable, high-value care.