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Future Direction in Informatics, Data, and Analytics

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Abstract
The healthcare field is undergoing an immense transformation driven by ongoing regulatory changes. Technological capabilities have shifted the traditional healthcare delivery system. New healthcare technology has become an important part of many organizations as they thrive to deliver innovative care. As society evolves, the healthcare system is evolving with it. There are multiple factors contributing to advancements. Healthcare must comply with policy change, regulations, cultural shifts and evolving patient needs all while staying up to date with cutting-edge technology. Healthcare shifts are focusing more on patient empowerment, consequently the healthcare system is drifting away from a fee-for-service system and adapting value-based care. It is refocusing to address cost of care, affordability and accessibility.

Key words: healthcare, technological advancements, policy.

Background

"The U.S. healthcare system has evolved over the past 100 years into an intricate web of relationships with varied players, each with their own goals and incentives that are not always in alignment" (Agarwal et al., 2020, p.10). Continuous pressures on healthcare resulting from poor performance have led national and local healthcare organizations to seek improvement on quality, safety and value in health service delivery (Sloan, 2014). "In a recent report from the Blue Cross Blue Shield Association (BCBSA), the rapid growth of new medical technology was cited as a leading cause for double-digit health care cost increases" (Kocakulah et al., 2004, p.49). Technology advancements have become a significant challenge for healthcare providers. Strategic planning associated with vendor selection, staff training and cost in relation to expected outcomes, play a significant role in the decision-making process for healthcare advancements.

Future of Telehealth

The expansion of internet and mobile technology has brought changes to healthcare in the last couple of years. Telehealth has helped with patient care tremendously by using technology to communicate with patients and make care accessible. "Usage has steadily increased since then with the expansion of the insured patient population, payers' focus on value-based care and patients' acceptance of Internet and mobile platforms for everything from banking to gaming in their everyday lives" (Olson et al., 2017, p.349). Providers have realized that the use of telehealth has attracted more patients. With Telehealth, patients can receive care at home, nursing homes, and other locations other than going in to receive care at the clinic. "Patient surveys consistently report

high satisfaction with telehealth, with many reporting satisfaction rates in excess of 90%. Some clinicians are concerned, however high satisfaction scores come with the potential for increased health care utilization, unnecessary antibiotic prescriptions, and increased diagnostic inaccuracy" (Olson et al., 2017, p.350). With patient satisfaction rates increasing, providers are also concerned about the negative effects telehealth might bring. One of those negative effects can be the abuse of trust. When a patient visits the clinic, providers can review the symptoms, and investigate why a patient might be feeling a certain way. With telehealth this may become a little more challenging. Another limitation that comes with implementing telehealth would be access to high speed internet. However, there are many communities that do not have access to these resources. Overall, the popularity has skyrocketed and continues to please both patients and providers. Researchers like Olson predict that telehealth will continue to be successful. The benefits of continuing to offer telehealth outweigh the risks.

Healthcare advancements have incorporated device developments, individual's health will be managed differently than we are accustomed to. Cars, watches, refrigerators, cell phones amongst other commonly used devices, are now introducing health monitoring capacity. Historically, these objects did not have internet connectivity and served one main purpose. Dash et al. (2019) suggest, furnishing such objects with computer chips and sensors that enable data collection and transmission over the internet has opened new avenues. The healthcare industry will need to adapt new technologies and infrastructures to support real-time data. Additionally, mobile health can accelerate interactive communication between patients and providers. Using real-time tracking can help providers be more proactive and efficient in delivering care to their patients. The focus will shift from acute care to preventative care. This can play a significant role in the lives of patients living chronically ill. Furthermore, early intervention can prevent avoidable emergency department visits reducing overall medical cost. "On a larger scale, the data from such devices can help in personal health monitoring, modelling the spread of a disease and finding ways to contain a particular disease outbreak" (Dash et al., 2019, p.8). Abhinav et al. (2018) add, "integration of digital technologies into clinical trials remains to be explored, but there is a critical need to evaluate these technologies in order to conduct more streamlined and pragmatic trials" (p. 2681). Medical professionals and administrators must adapt to the ever-changing healthcare environment. Patients are no longer recipients of products or services; they are becoming more involved and empowered to play active roles in the care they receive. Agarwal and colleagues (2020) suggest that providers, suppliers and especially payers have been the drivers of care delivery. Patients (consumers) who are the most impacted, rarely have been the center of the system. Historically, providers have been reimbursed for their services on a fee-for-service basis, they had secured payment regardless of patient outcomes. This idea is slowly shifting as a new value-based payment system is being implemented.

Digital health technology will produce significant amounts of data. This data is needed to advance ways in which care is delivered. Healthcare organizations are generating data at a tremendous rate which present many advantages and disadvantages at the same time. Through the use of data, it will be easier to make informed decisions. Although, data is nothing more than just data unless the appropriate infrastructure is available to transform that information into meaningful use. Systems must have the capacity to sustain such information as well as the ability to analyze it. With the appropriate analysis, data can provide further insight in care. It can pave the way for improvements on health outcomes. "It will facilitate healthcare by introducing prediction of epidemics (in relation to population health), providing early warnings of disease conditions, and helping in the discovery of novel biomarkers and intelligent therapeutic intervention strategies for an improved quality of life" (Dash et al., 2019, p. 24). Predictive analytics can help solve current issues in healthcare, it can detect fraud, optimize marketing campaigns, improve operations and reduce risk. "At all these levels, the health professionals are responsible for different kinds of information such as patient's medi-cal history (diagnosis and prescriptions related data), medical and clinical data, and other private or personal medical data. Previously, the common practice to store such medical records for a patient was in the form of either handwritten notes or typed reports" (Dash et al., 2019, p. 3). A comprehensive EHR system has completely changed this

practice.

Electronic Health Records

The future of EHR will not only focus on helping the provider, but health data will be "targeted at patients so that they can begin to manage their health care" (Rothman et al., 2012, p.765). For example, a patient with asthma can carry a wireless medical device. The provider's data can collect the time of asthma attack, location, patient activity (running in the park), amount of medication taken, heart rate of the patient, and how long the patient was in distress. The provider can create a review and track any trends. Will the patient be prescribed a different medication, does the patient need to do moderate activity, what times and season can the patient run to avoid asthma symptoms. As soon as the patient's heart rate goes up, the device can alert the patient to stop the activity and take medication. By alerting the patient, the patient can learn when specific symptoms arise to use the inhaler or to stop the activity. Future innovation of EHR will improve patient care, increase patient's participation in their care, improve diagnostics and create cost savings.

What happens when you are traveling or visiting family? People travel outside the states and outside the country due to work or for pleasure. There will be times when someone may get injured or sick and need to visit a medical facility or an emergency department. Rather than stating and trying to remember your medical history, allergies, and perhaps trying to find an interpreter (if you are visiting another country), implementing a universal EHR will be beneficial. The universal EHR will contain a patient's complete health information. "In an emergency, where a patient is unconscious, how are the medical staff supposed to know that the patient is hemophiliac?" (Green, 2017, p. 13). Having a patient's health record will prevent a medical error. "Without knowing of a patient's condition of this magnitude, even the smallest surgery may be lethal. Having a universal system would minimize the chance of these types of errors from occurring" (Green, 2017, p. 13). Besides traveling, a family could move their elderly parents out of state or when people need to relocate due to hurricanes or children with divorced parents living out on different coasts. It takes time to collect medical records, find a new physician, and have the new provider's medical records. Having access to their medical records is imperative for patient safety.

Having a universal EHR will help with cost savings. Physicians can review tests and lab work completed. This will prevent the same tests and lab work from being completed again. If a specialist is needed, the medical records can be reviewed by the specialist and the primary care physician to analyze and finalize a solution in a timely manner and in real-time (not having to wait for records to be sent and finding time to meet). Patient safety and patent quality will be accomplished with a universal EHR.

The Effects of Technology on Training

With all the innovative products developed for healthcare workers, what will the future be like for training healthcare workers? Virtual Reality is a three-dimensional teaching tool being used to educate and instruct healthcare workers. Learning by virtual Reality will allow healthcare workers to practice their skills without causing potential life-threatening errors. Learners can be prepared for unexpected issues. If the issue arises in the "real world," the learner can be prepared to cope with the issue. Not only does the three-dimensional tool help prepare surgeons for operations, but Dr. Gary Steinberg from Stanford Medicine was also preparing to remove a patient's aneurysm, "an artery was attached to the top of the aneurysm. 'You could not see it on conventional imaging, had I not known about it, it could have been a real disaster" (Stanford Medicine, 2017). Not only are surgeons being trained by Virtual Reality, but nurses are also being trained with Virtual Reality. Clinical environments, tools, and resources are available during the Virtual Reality sessions. Since empathy is needed when helping patients, learners can verbally practice how to speak to patients. The cost of Virtual Reality is lower than purchasing mannequins and without waiting for a class, anyone can learn during their own time. Virtual Reality training will have positive outcomes by improving clinical skills, surgical skills, communicating with patients, self-efficacy, anxiety, and

self-confidence in all learners. Practicing all skills will create a patient safety environment.

Health Information Systems

Health information systems (HIS) have dramatically developed over the years and have shown no signs of slowing down. It has provided healthcare organizations tools to better manage cost, increase work efficiency, improved quality of care, and many other benefits. However, one of the critical components of HIS is storing data that contains millions of important data on patients, leaving the system vulnerable to cyber-attacks. Although there are security systems in place to deter such attacks, it has not prevented hackers from attempting and at times succeeding with obtaining patient information. According to Aydos, Vural, and Tekerek (2019), "As a result of the attack on the hospital network of the University of California, Los Angeles in 2017, leakage was detected to computer systems containing sensitive data of 4.5 million people," (p. 338), allowing hackers to access sensitive patient medical and financial records. With policies such as the Patient Protection and Affordable Care Act (ACA) and the Health Information Technology for Economic and Clinical Health Act (HITECH) encouraging healthcare organizations to become more network-integrated to become more efficient and effective, it has unfortunately left these systems defenseless to cyber-attacks (Kruse et al., 2017, p. 1).

Phishing is one prime example of cyber-attacks. It is a way of obtaining information using manipulation and deceit. For example, in a healthcare setting, phishing can appear as messages from an authority or department such as IT, that warns or informs employees of an account deactivation unless they input their username and password, not realizing that they are providing information to the hackers (Wright et al., 2016, p. 115). When hackers obtain an employee's username and password, they can use the information and access a healthcare organization's electronic health records (EHR) and obtain patient information such as insurance or social security number or even employee information. As the healthcare industry continues to expand its utilization of informatics, data, and analytics, the technological advances has left the healthcare system exposed to cyber-attacks (Kruse et al., 2017). To prevent cyber-attacks and protect sensitive patient and employee information, improving security systems is inevitable. As informatics, data, and analytics continue to evolve, healthcare organizations must invest in the future to protect their systems from cyber-attacks, that future is biometric technology. Biometric technology is a collection of data such as DNA code, retinal vein and iris structure, fingerprints, or written signature or face, that is used to identify a person's biology using applications such as facial or fingerprint recognition (Dastbaz et al., 2013). By investing in biometric data and technology, accessing information will become more efficient and effective, but most importantly, it will prevent cyber-attacks and keep patient data safe. According to Cidon (2018), IT executives are discovering that biometric tools not only replaced username and password input but have shown its capabilities to integrate with existing security systems and strengthen access to physical hospital and building structures by using face and fingerprint recognition. It has also decreased record-matching errors by helping healthcare systems match medical records to patients using unique human characteristics. Not only will biometric technology improve security systems, but it will help healthcare organizations with identifying and registering patients seamlessly, decreasing medical inaccuracy and errors. As the demand for better security rises, healthcare organizations will have to invest in its future and integrate biometric technology to its existing systems. Implementing the right biometric system may take time but its ability to prevent cyber-attacks and improve patient care cannot be overlooked.

Health Informatics and Analytics

The exponential growth of data being generated in healthcare, is becoming increasingly unmanageable "Data and its close relative derived analytics have the potential to offer more knowledge and insight into improving patient care and economic efficacy than all of the other current noise in the industry" (Balgrosky 2020, p. 295). Data originates through many outlets including: cell phones, smart watches, glucose monitors, inhalers, clinical notes, insurance claims,

etc. Balgrosky (2020) further explains, “Big data has created data sets whose magnitude and construct have stressed traditional hardware and storage capabilities as well as databases that were not necessarily configured or architecture to capture, manage, and process such copious amounts of data”. Although tremendous amounts of data are available, raw data is not serving a purpose. Next steps are the most significant; this includes converting the data into information to generate better decisions and ultimately improve healthcare. “Predictable capabilities driven by Big Data and Thick Data will allow healthcare risk to be anticipated, shifting healthcare from reactive to proactive more of the time” (Balgrosky 2020, p. 309). It can enhance clinical outcomes and shift towards evidence-based outcomes. Data analytics can guide the path to achieving the triple aim: improved outcomes, reduction in waste and improved outcomes.

Data analytics improves patient care in the healthcare system, through the analysis of data. Analyzing data includes tracking providers' performance and identifying patients at risk for chronic diseases. An organization can review provider performance evaluations, observe providers, review complaints from patients and staff, and trend what the provider has prescribed and referrals to specialists. Using the data collected, an organization can review if the provider's practices are appropriate. With this information they can develop a training session with the provider to improve patient care and patient safety. A provider can analyze patient data entered into the Electronic Health Record (EHR) system. By reviewing demographics, diagnoses, procedures, laboratory tests, prescriptions, instructions to the patient, referrals, and notes written in the patient file, other providers can help a provider by (Data Across Sector for Health, 2018) "understanding and addressing health disparities in patient population" and the information in the EHR can help the provider review any potential health risks as well. Therefore, health informatics and analytics have an impact on how the data can be interpreted to make the necessary changes to healthcare.

Conclusion

Overall technology has had a huge impact on healthcare and will continue to do so. There are many challenges that will arise with the implementation of technology in healthcare as examined throughout our research. However, it is obvious that healthcare will continue to evolve in a positive way, ultimately making these changes beneficial for the consumer and the provider. Organizations continue to move in the right direction by focusing on value-based care. With new technologies preventive care will become common as well and patients will have the opportunity to play an important role in the care they receive. We can say that care will be different in many ways, primarily focusing on the well-being of the patient, while implementing technology.

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