EDITORIAL

BRIDGING THE TECHNOLOGY GAP IN HEALTH CARE: DEVELOPING A MODEL TO BETTER HELP THOSE WHO HELP OTHERS

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Over recent years, there has been a significant increase of integrated computing devices and systems within the healthcare sector, including computerized machines which can see deep within the human body to detect illnesses previously missed, help engage the patient, provide enhanced education, and access medical data not readily accessible before. However, as new technologies, medications, treatments, and procedures are being developed rapidly, clinicians are expected to incorporate this new information into their daily practices, apply this knowledge to their patients, track each patient's individual health status and background, while communicating quickly with patients, hospitals, and other providers. Additionally, clinicians are expected to keep up with the latest published medical data in the hopes of increasing the accuracy of diagnoses and treatments to improve patient health outcomes. However, there is a "small" problem with this expectation, there is not enough hours in a day to accomplish all of these tasks. According to a report by the Memorial Sloan-Kettering Cancer Center, it would take at least 160 hours (or four 40-hour work weeks) of reading every single week just to keep up with new medical knowledge as it's published, let alone applying the effort to consider its relevance or to implement it practically[1]. This places false expectations on clinicians. While they may be an experienced doctor, they still require a process which delivers functional, meaningful, efficient, and user-friendly technology to their daily work environment.

There is currently a paradigm shift in health care delivery and payment models. The United States for example, is transitioning from a pay-for-performance procedures model to value-based model. Instead of being paid for per medical procedure, the value-based reward model seeks improved outcomes at a fair cost under the Health Information Technology for Economic and Clinical Health (HITECH) Medicare program. The outcomes are designed to enhance population health management using coordinated health services to better track patients and introduce preventative wellness measures in an effort to reduce or prevent health issues from occurring, resulting in overall better health of a targeted population and lower health care costs. Proactive population health monitoring's philosophy of implementing preventative wellness measures over reactionary health monitoring, depends highly on predictive analytics and the presentation of this information in a way in which clinicians and other medical staff can use this data to help diagnose and treat their patients.

Predictive Analytics can be defined as "technology that learns from experience to predict the future behavior of individuals in order to drive better

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decisions"[2]. Benefits of range from identifying trends, understanding patients, improving operational and clinical performance, driving strategic decision making, and predicting patient and staff behavior[3]. Sounds promising, but how effective is it? A report by the IDC in 2011 concluded that the typical Return On Investments (ROI) for projects which incorporated predictive analytics was approximately 250%[4]. As an example, the University of Mississippi Medical Center cited a 400% ROI from a documentation and data visualization initiative focused on physician engagement, and they are using predictive analytics into the treatment of pressure ulcers, which is projected to save the institution between $500,000 to $1 million United States Dollars (USD) and raise the health outcomes of this targeted population[5].

Predictive analytics can be used in a variety of ways within the health care field. Patient engagement, patient compliance, chronic disease management, regulatory compliance, avoidable deaths, hospital readmissions, public health, waste and abuse, and health outcomes[6]. So as technology becomes more and more ubiquitous in the health care delivery environment, capturing data has become more plentiful and easier to extract than in the past, and with the maturing of the predictive analytics field, why are so many clinical environments failing to embrace this technology, leaving a gap? The answer, is due to the implementation and facilitation of the technology and not its capabilities. A reality not only for developing countries but also for industrialized ones.

The health care sector can be overly complex, detailed, and contains challenges in presenting solutions effectively, accurately, and efficiently. Diagnoses and treatments, billing codes, test results, medication ordering and tracking, privacy and confidentiality information, and interoperability of data to name a few. Due to the wide-range of information required, the health care market has depended on hardware and software developers to provide technological solutions to meet the changing paradigm shift. However, between developers and clinicians, there has been a lack of communication and a discrepancy in wants and needs, creating a gap between healthcare delivery and technology. The result, clinical technology being developed with little or no clinical expertise. Physician and author of Rethinking the Electronic Health Record, Dr. J. Martin Wehlou reinforces this point by stating, "Since most current EHR systems are specified by civil servants, it's only natural that any requirement for providing better healthcare, quicker diagnosis and more consistent therapies have been left out entirely."[7]. The result is a forced adoption of ineffective technology leaving clinicians and other medical staff often feeling overwhelmed and frustrated, as the technology is not explained well or does not function properly. It is our view that a new approach to health care technology development, testing, and implementation is critically needed to assist in combating this unfortunate trend. The fusion of an integrated model, of clinical, scientific, and technical experts forming a collaborative environment which compliments individual's existing knowledge and experience, in an effort to produce more effective technology and improve health care delivery.

The Medical Informatics Center for Analysis Research and Education (MICARE) and others similar to it have created an ecosystem of scientists, clinicians, informaticists, and technologists working together to develop new health care technologies, algorithms, and models. Each proposed solution's use and effectiveness is validated within the clinical environment before releasing it to the health care sector. Participation in MICARE's health care technology is not limited to local, regional, or even national partners. Rather, as medical data continues to be used globally, so too should strategic partnerships between academic and clinically integrated organizations. An example of this can be seen in the collaborative work between Michigan Technological University's Medical Informatics Department in the United States and Escola Bahiana de Medicina e Saúde Pública, in Brazil. Scientists, informaticists, and technologists from Michigan Tech working with physicians from Escola Bahiana de Medicina e Saúde Pública who split their time between practicing medicine in a clinical environment and academic research, have begun several projects.

The collaborative projects are aimed at improving the technological experience of health care delivery and ultimately the patients' health outcomes. For example, two projects surround the development of a predictive analytics algorithms used within a mobile health application designed to forecast risk scores of patients. The first is a type two diabetes predictive application for adolescents implementing

gamification attributes in which their improvement in a healthy lifestyle (i.e. eating and drinking healthy, getting enough sleep and exercise, etc.) enhances their superhero powers and strength within the gaming application. The second is an application designed to help HIV infected women better monitor their health and their predictive risk score of obtaining cervical cancer based on a customized algorithm. In both applications, data is captured and sent securely to back-end databases where the information can be further analyzed and provided to the user's respective physician, permitting a more comprehensive view of the patient's overall health status. Another example is the development of an open-source gait analysis sensor system for surgeons and their patients before and after surgery. Computer vision, natural language processing, and machine language algorithms are developed to provide the surgeon with a functional and user-friendly solution, applicable to common variables, such as the various dimensions of physician practices, hospitals, and general health clinics, speech patterns and noise cancellation, and processing of medical terminology linking to recommended treatments. With the participation of clinical personnel within this ecosystem, solutions are designed and validated within the clinical environment.

Through the development of these and other health care delivery solutions, we have reached an important conclusion. A scientist, informaticist, or technologist who may not understand the health care domain, combined with an expert in the health care domain who doesn't understand the technology, results in each doing what they need to do, informed by the other, very efficiently. Instead of producing technology which is underutilized and often painful to adopt in a clinical setting, well-thought out solutions are being guided and tested by those who use them are being developed. The results are better data, producing better analytics and models, which in turn provide better information to clinicians using improved designed technology to achieve better health outcomes for their patients, ultimately helping those who help others.

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