HARNESSING THE POWER OF HEALTHCARE DATA

Promising Medical Technologies for Improving Chronic Disease Management
Nothing can replace clinician judgment in patient care, but new data-driven technology in healthcare is helping advance delivery of the right care, to the right patient, at the right time. Sensor technology, artificial intelligence (AI), and machine learning can unlock the potential of data, providing actionable insights to guide clinical decisions.

The application of data science, whether built into a device, or leveraged in a managed care offering, may be today’s biggest opportunity for technology to advance chronic disease management (CDM) — both at an individual patient level and in terms of population health management.

Healthcare data can aid in delivering more consistent, coordinated care to patients, as well as advancing healthcare research.1 "At Medtronic, we’re taking two big approaches to how we use data to help healthcare systems be more efficient and effective in their delivery of care," explains chief medical and scientific officer at Medtronic, Dr. Richard Kuntz. "One is by developing devices that use sensing and AI technology to provide closed loop therapies. The other is leveraging data from various sources to help clinicians create more coordinated care pathways for patients."

The benefits of applying data science to these approaches are three-fold:

- **Improved accuracy and precision of care:** From earlier detection, to more precise surgery, machine pattern recognition can be used to promote the rapid and accurate reading of medical scans, slides, skin lesions, and much more.

- **Reduced administrative work:** Using natural language processing, for example, can help synthesize notes, improve productivity, efficiency, work flow, accuracy and speed for clinicians.

- **Empowered patients:** Giving individuals more day-to-day control of their disease can be achieved through algorithmic support and insights based on data gathered by sensors and machine learning.
Data Sources Powering Sensor Technology, AI, and Machine Learning

The first step in realizing the potential of data science to advance healthcare, is widening our lens to understand what kinds of data matter most.

“We’ve been collecting and reporting data from clinical trials for more than 60 years,” says Dr. Laura Mauri, vice president of Global Clinical Research and Analytics for Medtronic. “What is different today, though, is the feasibility of using real-world data to evaluate the safety and efficacy of medical devices,” she explains. “Healthcare practice data allows us to examine a broader range of clinical settings compared to traditional clinical trials. In turn, it can help patients and clinicians make more informed care decisions, create better care pathways, and improve patient outcomes.”

Additionally, Mauri says, a wider array and volume of data types are available. “Risk prediction can be improved by using multiple data sources. This includes relatively static data from electronic health records (EHR) — like demographics and chronic medical conditions — as well as continuously changing data from sensors — such as blood pressure, heart rate, and glucose levels. Combined, both can drive greater precision and efficiency to improve the health of individuals.”

APPLYING DATA-DRIVEN TECHNOLOGY TO CDM

Chronic conditions such as diabetes, cancer, cardiovascular disease, and chronic pain are the leading causes of death and disability in the U.S. They also contribute the most to the nation’s $3.3 trillion in annual healthcare costs. Chronic disease management (CDM) is complex, requiring an integrated care approach that includes regular screenings, check-ups, ongoing monitoring, and patient education.
By applying the power of sensor technology and AI into the latest implantable and wearable devices, and managed care solutions, new Medtronic data-driven technologies are uniquely positioned to help clinicians and patients with CDM.

**Sensor Technology and AI in Diabetes Care**

It's estimated that every year, nearly 300,000 people with diabetes in the U.S. visit an emergency room for hypoglycemia, and about 175,000 go to an ER for hyperglycemic crises. For Type 1 diabetes patients, successful disease management is becoming increasingly associated with better blood sugar time in range, which can be significantly impacted by diet and exercise. Through sensor technology and the advanced application of algorithms, our latest technologies help take the guess work out of daily disease management. The Guardian™ Connect Continuous Glucose Monitor (CGM) uses a feature, IQcast, to predict hypoglycemic events up to four hours in advance. Combining CGM technology with insulin pump therapy, the MiniMed 670G™ system automatically adjusts insulin delivery, helping patients to spend more time in range than patients on daily injections.4,5

Nutrino Health, now part of the Medtronic Diabetes Group, applies AI to diabetes management through a nutrition-science approach to CDM, including building a comprehensive food database and food analysis system. In addition, Nutrino has been developing algorithms to predict glycemic responses to food. By leveraging this technology and infrastructure with Medtronic continuous glucose monitoring (CGM) and insulin pump therapies, the program is helping reduce the substantial physical and mental burden of food and nutrition management for people with diabetes.

“We are passionate about personalized nutrition data services and technologies,” said Yael Glassman, Vice President, Nutrino, Medtronic Diabetes. “Our work in the diabetes space is helping to address the needs of a growing population that needs better tools and guidance. We are excited to now focus completely on the intersection of nutrition and diabetes to help more people be able to better manage their condition.”

**Shift Toward Personalized Care for Chronic Pain**

“The trend in medicine we’re seeing today is the need to personalize care,” explains Mauri. “The task for us is to incorporate sensor information into the tools we provide clinicians, and then help tailor treatment, in as close to real time as possible, based on the patterns we see.”

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**Click here for important safety information for the MiniMed 670G™ system.**

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For example, our unique Adaptive Stimulation technology — found in Intellis™ with AdaptiveStim, for the treatment of chronic, intractable pain — uses an accelerometer that adapts stimulation to pre-set levels based on a patient’s positions. The device also provides objective insights to a clinician on a patient’s functional activity and changes in function over time. This helps with ongoing, effective patient management and care, according to Dr. Chris Karas of OhioHealth in Columbus, Ohio.

Click here for important safety information regarding Intellis™.

“Until now, we didn’t have access to that kind of quantitative data, even in the hospital,” Karas said. “Spinal cord stimulation is a very individualized form of treatment,” he added. “It can be specified to the location of their pain and the type of their pain.”

Read more about the role of data in chronic pain management.

Data Science and Managed Care Offerings

It’s estimated patients with two or more chronic conditions represent 93% of Medicare Fee-for-Service spend. For these large patient cohorts well-suited for remote monitoring — like patients with heart failure and high blood pressure — Medtronic Care Management Services (MCMS) continues to innovate in the data science space, developing population health solutions for payers and clinicians. With a focus on “Triple-C” patients — those with complex, chronic, co-morbid (CCC) conditions — MCMS solutions apply data analytics, risk stratification algorithms, clinical monitoring software, and mobile design, resulting in:

- Monitoring functionality designed to make it easier for patients to stay engaged with their health and adopt positive health behaviors. Learn more about how we design mobile technology for patient engagement.
- Tools designed to help clinicians by flagging patients who may need follow up, and
- Metrics used to track improved outcomes for payers and post-acute care providers.
PARTNERING TO TRANSFORM THE FUTURE OF HEALTHCARE

In early 2019, Medtronic announced a partnership with Shanghai Jiao Tong University (SJTU) to create an AI laboratory in China, with the intent to further explore and advance the use of AI in medical devices. Through similar collaborations — and with clinicians, payers, and healthcare innovators around the world — Medtronic continues to create new data-driven solutions to address unmet patient and health system needs.

Learn more about how we are helping to usher in a new standard of care for patients.

References
1 https://healthinformatics.uic.edu/blog/4-uses-for-patient-care-data/
2 https://www.cdc.gov/chronicdisease/about/index.htm
3 http://clinical.diabetesjournals.org/content/diabcare/early/2017/12/20/cd17-0094.full.pdf
6 Chronic Conditions Among Medicare Beneficiaries, Chart Book 2012. Baltimore, MD: Centers for Medicare & Medicaid Services; 2012. Accessed November 18, 2014. Data is based on third-party solutions and data, which is not necessarily identical to the MCMS solution or Medtronic data. (ACCESED HERE)

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IMPORTANT SAFETY INFORMATION

MiniMed™ 670G System

The Medtronic MiniMed™ 670G system is intended for continuous delivery of basal insulin (at user selectable rates) and administration of insulin boluses (in user selectable amounts) for the management of type 1 diabetes mellitus in persons, seven years of age and older, requiring insulin as well as for the continuous monitoring and trending of glucose levels in the fluid under the skin. The MiniMed™ 670G system includes SmartGuard™ technology, which can be programmed to automatically adjust delivery of basal insulin based on continuous glucose monitor sensor glucose values, and can suspend delivery of insulin when the sensor glucose value falls below or is predicted to fall below predefined threshold values. The system requires a prescription. The Guardian Sensor (3) glucose values are not intended to be used directly for making therapy adjustments, but rather to provide an indication of when a fingerstick may be required. A confirmatory finger stick test via the CONTOUR®NEXT LINK 2.4 blood glucose meter is required prior to making adjustments to diabetes therapy. All therapy adjustments should be based on measurements obtained using the CONTOUR®NEXT LINK 2.4 blood glucose meter and not on values provided by the Guardian Sensor (3). Always check the pump display to ensure the glucose result shown agrees with the glucose results shown on the CONTOUR®NEXT LINK 2.4 blood glucose meter. Do not calibrate your CGM device or calculate a bolus using a blood glucose meter result taken from an alternative site (palm) or from a control solution test. It is not recommended to calibrate your CGM device when sensor or blood glucose values are changing rapidly, e.g., following a meal or physical exercise. If a control solution test is out of range, please note that the result may be transmitted to your pump when in the “Always” send mode.

Pump therapy is not recommended for people whose vision or hearing does not allow recognition of pump signals and alarms. Pump therapy is not recommended for people who are unwilling or unable to maintain contact with their healthcare professional. The safety of the MiniMed™ 670G system has not been studied in pregnant women. For complete details of the system, including product and important safety information such as indications, contraindications, warnings and precautions associated with system and its components, please consult http://www.medtronicdiabetes.com/important-safety-information#minimed-670g and the appropriate user guide at http://www.medtronicdiabetes.com/download-library.

WARNING: Medtronic performed an evaluation of the MiniMed™ 670G system and determined that it may not be safe for use in children under the age of 7 because of the way that the system is designed and the daily insulin requirements. Therefore this device should not be used in anyone under the age of 7 years old. This device should also not be used in patients who require less than a total daily insulin dose of 8 units per day because the device requires a minimum of 8 units per day to operate safely.

Intellis™

INDICATIONS Spinal cord stimulation (SCS) is indicated as an aid in the management of chronic, intractable pain of the trunk and/or limbs-including unilateral or bilateral pain.

CONTRAINDICATIONS Diathermy - Energy from diathermy can be transferred through the implanted system and cause tissue damage resulting in severe injury or death. WARNINGS Sources of electromagnetic interference (e.g., defibrillation, electrocautery, MRI, RF ablation, and therapeutic ultrasound) can interact with the system, resulting in unexpected changes in stimulation, serious patient injury or death. An implanted cardiac device (e.g., pacemaker, defibrillator) may damage a neurostimulator, and electrical pulses from the neurostimulator may cause inappropriate response of the cardiac device. PRECAUTIONS Safety and effectiveness has not been established for pediatric use, pregnancy, unborn fetus, or delivery. Avoid activities that put stress on the implanted neurostimulation system components. Recharging a rechargeable neurostimulator may result in skin irritation or redness near the implant site.

ADVERSE EVENTS May include: undesirable change in stimulation (uncomfortable, jolting or shocking); hematoma, epidural hemorrhage, paralysis, seroma, infection, erosion, device malfunction or migration, pain at implant site, loss of pain relief, and other surgical risks. Refer to www.medtronic.com for product manuals for complete indications, contraindications, warnings, precautions and potential adverse events. Rx only. Rev 0119

Read more about how we are helping to usher in a new standard of care for patients.