

Scientific Updates Q2, 2020



Leadership Spotlight

Scientific Spotlight 1

Scientific Spotlight 2

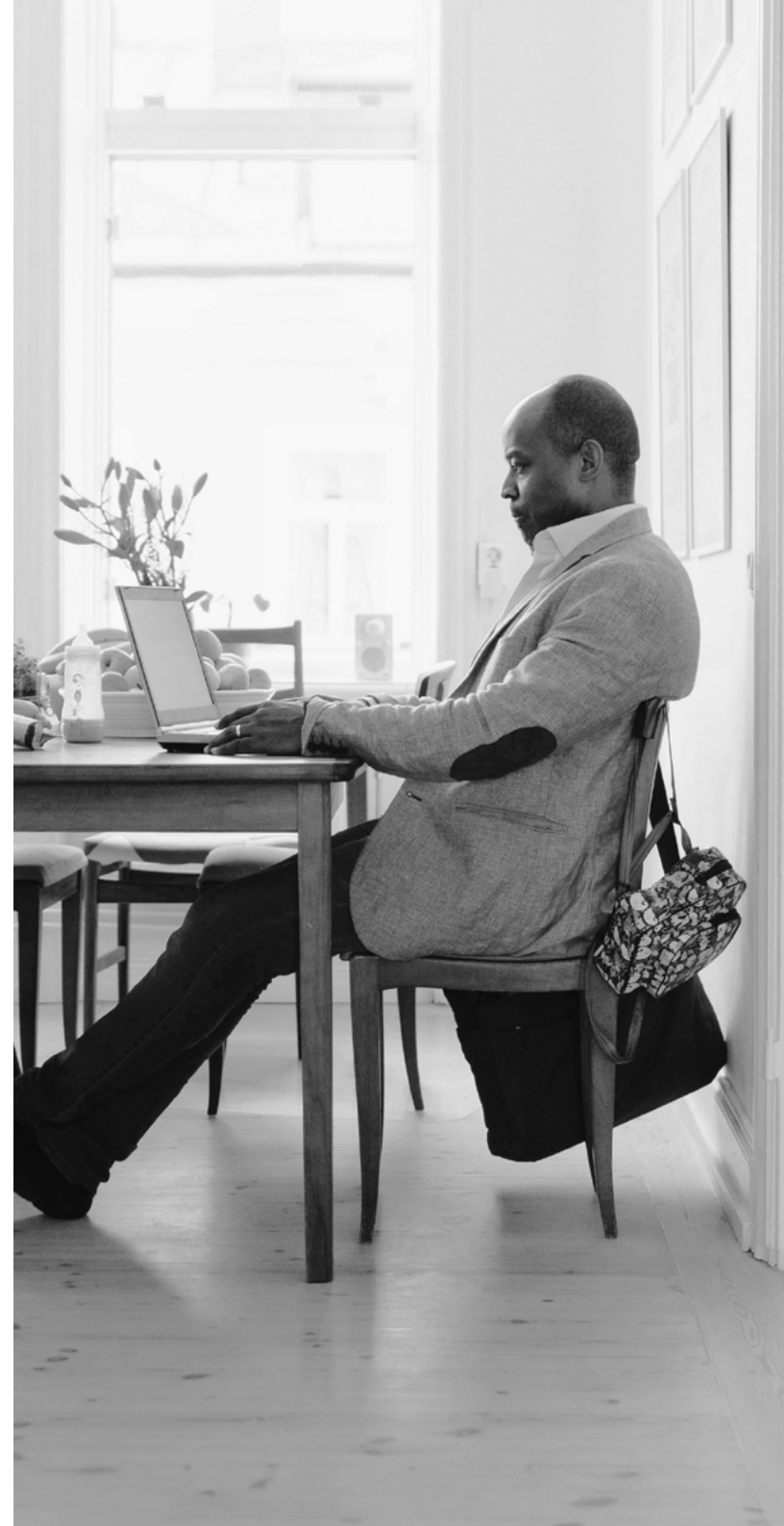
Publication Highlights

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Leadership Spotlight

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Tina Moen, PharmD, Senior Deputy Chief Health Officer & Chief Pharmacy Officer, IBM Watson Health. A clinical pharmacist by background, Dr. Tina Moen has 18 years of experience in healthcare technology, including that as former VP of Analytics and Chief Clinical Officer for the Provider Business at Truven Health Analytics. Prior to transitioning to healthcare technology, she provided clinical pharmacy services to pediatric, HIV, organ transplantation, and home healthcare patients.



Leadership Spotlight

What does Clinical Decision Support (CDS) mean to you? Does it mean the same to me?

The Office of the National Coordinator for Health Information Technology (ONC) states that, “clinical decision support (CDS) provides clinicians, staff, patients or other individuals with knowledge and person-specific information, intelligently filtered or presented at appropriate times, to enhance health and health care.” (Ref: [ONC website](#)) Others, such as the Agency for Healthcare Research and Quality (AHRQ), take a more general view of CDS as a tool that “provides timely information, usually at the point of care, to help inform decisions about a patient’s care.” (Ref: [AHRQ website](#))

Examples of CDS tools are as varied as the definitions and include documentation templates, clinical guidelines and condition-specific order sets, diagnostic tools, clinical reference information, and computer-generated alerts and reminders. (Ref: [ONC](#), [AHRQ](#)) Any one of these examples may or may not include patient-specific information and data.

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On the topic of information and data, consider the seemingly endless list of inputs that may go into clinical decision making: original research; clinical guidelines and consensus statements; organizational policy; data from medical claims and clinical systems; patient demographics, past medical history, and vitals, just to name a few. And what if members of the healthcare team don't all have access to the same information and data? With healthcare data rising at a compound annual growth rate of 36%¹, decision makers are faced with a quagmire of clinical uncertainty.

The current uncertainty we're facing as a world responding to a global pandemic at the same time there is new awareness around the need to tackle systemic racism has me thinking a lot about the importance of connectedness in our collective humanity. The impact of the lack of connectedness is significant in many aspects of life, including in healthcare. IBM has published some great resources highlighting the [impact of loneliness](#) on overall health and wellness and how the current [COVID-19 pandemic](#) has further impacted feelings of loneliness and isolation. Connectedness matters. With healthcare teams (it IS a team sport, after all) widening to include all the various specialties that contribute to a patient's overall care – connectedness in decision making is more important than ever.

How can technology help enable connected decision making in healthcare? Enter artificial intelligence (AI), which has great potential to make sense of vast amounts of data and deliver it in ways that meet the needs of multiple stakeholders on the healthcare team. AI must first be trained in the language of health and healthcare information and then be set on a path to continuously ingest and make sense of ever changing and expanding knowledge. There is no magic switch to flip.

Applying AI to solve challenges in healthcare requires vision, innovation, planning, diligence in execution, and endurance to achieve the desired outcomes. Perhaps most importantly, effective AI requires a strong partnership between humans and machines – a different kind of connectedness with the ultimate goal of supporting human to human connection in order to optimize the health of the patients we serve.

In this issue of the IBM Watson Health Quarterly Scientific Update, we share two publications outlining the very early stages of our journey to apply AI to the clinical knowledge from Micromedex in order to support connected decision making across the healthcare team. In the first paper, authors describe a new ontology-based conversation system that was refined by human experts and incorporated into a conversational searching agent (Watson Assistant) to access IBM® Micromedex domain-specific knowledge bases². In a second piece, the experience of integrating Micromedex with Watson into an electronic health record (EHR) system at Peninsula Regional Medical Center is presented. Although early in their journey, results indicate that cross-discipline integration and training supported an increased use of Micromedex and overall positive user perception³. In a third paper, published previously, authors describe the technical components of Micromedex with Watson and report early findings that indicate users engaged differently with the conversation agent and accessed a broader distribution of topics than they did via standard keyword search⁴.

[continues →](#)

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The current global pandemic is pushing innovation in healthcare, both the technology and the venues in which we provide care. Patients are accessing telemedicine services more commonly, and more services are being provided through retail pharmacies, drive-up clinics, and other unique settings. What will this mean for CDS in the future? While there is much work to be done, early experience applying AI to CDS is showing unique opportunities to support clinical workflow in new ways. Effective EHR integration will continue to be necessary along with imaginative methods to deliver critical information across the healthcare team to support connected decision making. We're always interested to hear about real world experience, both successes and challenges, and we hope you'll reach out and share yours with us. Until then, be well and stay connected!

– Dr. Tina Moen

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a member of our team, visit:

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1. Kent J. Big data to see explosive growth, challenging healthcare organizations. Health IT Analytics. December 3, 2018.
 2. Quamar A, Lei C, Miller D et al. An ontology-based conversation system for knowledge bases. Proceedings of the 2020 ACM SIGMOD International Conference on Management of Data. 2020 June:361-376.
 3. Weisman MD, Cordrey R. Pharmacy CDS with EHR-Integrated AI Natural Language Search. Presented at HIMSS20; 2020 April 9; Virtual.
 4. Preininger AM, South B, Heiland J, Buchold A, Baca M, Wang S, Nipper R, Kutub N, Bohanan B, Jackson GP. Artificial intelligence-based conversational agent to support medication prescribing. JAMIA Open. 2020. Ooaa009.



Scientific Spotlight 1

Pharmacy CDS with EHR-Integrated AI Natural Language Search***

Cordrey R, Weisman M.
Presented at: HIMSS20 Digital. April 9, 2020.

Providing direct connections to an artificial intelligence-supported clinical decision support (CDS) tool within the electronic health record (EHR) may alleviate challenges with accessing drug information to support clinical decision making.

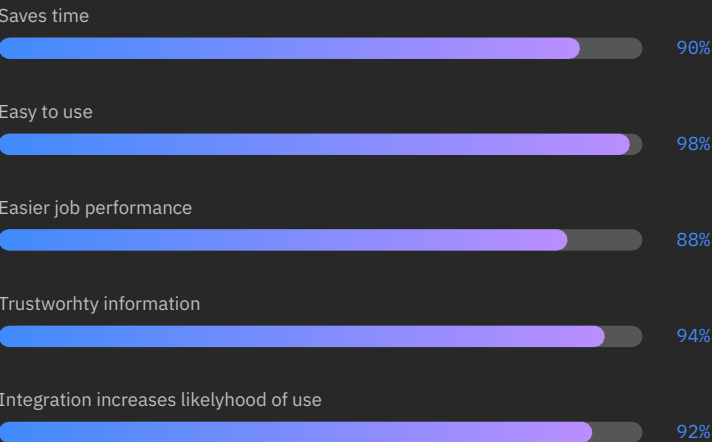
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Three asterisks (***) denotes publications that are produced solely by non-IBM authors using IBM data or technology

Peninsula Medical Center engaged in beta testing of the IBM® Micromedex® with Watson™ CDS tool. This evaluation compared tool usage prior to and after integration into the hospital EHR and evaluated user perceptions.

Tool usage increased from 275 visits in 6 months to 489 visits in 1 month following integration.

Survey Responses (n=49):



Users felt some situations would still require collaboration with a pharmacist; however, overall user impressions were positive, and tool use increased following EHR integration.

Scientific Spotlight 2

“TechQuity” in Diabetes – Does Digital Health Technology Improve Equity?

Craig KJT, Rhee KB. Diabetes
2020 June; 69(Supplement1):1193-P.

Preventive DHIs via EHRs, telehealth, decision support, mHealth and others, had a positive impact on health and healthcare delivery outcomes for those with DM-specific disparities in: Racial/ethnic groups, Low SES and Rural, and urban geographies

[Read more →](#)

Higher diabetes mellitus (DM) burden and health disparities have been correlated with several sociodemographic factors. This study identified global changes to digital health interventions (DHIs) which have improved outcomes in these populations.

A scoping literature review evaluating 4,298 records to characterize DHI interventions for cardiovascular disease, identified 13 specific to DHI impact on DM disparities. DM Health disparities targeted by DHIs:



Black: 29%
Hispanic: 24%



Socioeconomic
status (SES): 62%



Rural: 52%
US: 52%

In populations with DM-specific disparities associated with race/ethnicity, low SES or rural/US geographies, preventive DHIs studies found improved:

Health measures

↑70%

Healthcare delivery

↑40%

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Artificial Intelligence →

Publications featuring
our AI-enabled solutions
and technologies

Real World Evidence
and Artificial Intelligence
Combined →

Studies applying artificial
intelligence technologies,
such as machine learning,
to deliver more robust
insights from real world data

Real World Evidence →

Publications featuring
our unique data assets
and industry-leading
scientists

Research →

Publications highlighting
emerging technologies,
pre-commercial research,
and investments for the
innovations of tomorrow

Publication Highlights

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Artificial Intelligence

Real World Evidence
and Artificial Intelligence
Combined

Real World Evidence

Research

Cardiovascular

Automatic diagnosis of pulmonary embolism using an attention-guided framework: a large-scale study

arXiv

A deep learning model to detect pulmonary embolism trained with 1,670 sparsely annotated studies and 10,000 labeled studies of contrast-enhanced chest computed tomography scans achieved an area under the receiver operating characteristics curve (AUC ROC) of 0.812 in a test set of 2,160 patient studies.

[Read more →](#)

Cardiovascular

Deep learning based detection of acute aortic syndrome in contrast CT

IEEE 17th International Symposium on Biomedical Imaging

Two machine learning classifiers to detect acute aortic syndrome on contrast computed tomography (CT) scans were trained, validated and tested with 2291 contrast CT volumes achieved area under the receiver operating characteristic curves (AUC ROC) of 0.965 and 0.985.

[Read more →](#)

Clinical Decision Support

Pharmacy CDS with EHR-integrated AI natural language search***

HIMSS20

Following the integration of the IBM® Micromedex® with Watson™ clinical decision support tool into a hospital electronic health record, use of the tool increased and overall user perception was positive.

[Read more →](#)

Artificial Intelligence

Real World Evidence
and Artificial Intelligence
Combined

Real World Evidence

Research

Clinical Decision Support

An ontology-based conversation
system for knowledge bases

—
2020 ACM SIGMOD International
Conference on Management of Data

An new ontology-based conversation system, refined by domain experts, was developed and successfully incorporated into a conversational searching agent to acces IBM® Micromedex domain specific knowledge bases.

[Read more →](#)

Oncology

Genomic analysis of
myeloproliferative neoplasm (MPN)
patients from a single institution in
South Korea reveal novel pathogenic
mutations and perturbed pathways

—
Journal of Clinical Oncology

Compared to a cohort of 151 patients with myeloproliferative neoplasms (MPN) from a previous New England Journal of Medicine publication, 31 South Korean patients with myeloproliferative neoplasms (MPN) had a different genetic variant profile with the discovery of two novel CALR pathogenic mutations, exclusive NOTCH1 pathogenic mutations and enriched TP53 mutations.

[Read more →](#)

Oncology

Reading mammography
with multiple prior exams

—
IEEE 17ths International Symposium
on Biomedical Imaging

The Long short-term memory (LSTM) deep learning algorithm consistently outperformed the Random Forest deep learning algorithm in processing prior screening mammography images to identify abnormalities in new exam images.

[Read more →](#)

Risk Prediction

Cohort-derived machine learning
models for individual prediction
of chronic kidney disease in people
living with HIV: a prospective
multicentre cohort study

The Journal of Infectious Diseases

Several machine learning models
demonstrated accurate chronic kidney
disease prediction capabilities in people
living with HIV, with areas under the receiver
operating characteristic curve from 0.926
to 0.996 and precision recall curves ranging
from 0.631 to 0.956.

[Read more →](#)

Endocrine and Metabolic

Optimal ages for screening
for T1D risk in children

Diabetes

Researchers determined that the positive predictive value for predicting development of type I diabetes in children by the age of 15 from testing for multiple autoantibodies required two screenings, one at 2-3 years of age and another at 5-6 years of age.

[Read more →](#)

Endocrine and Metabolic

Prediction of heart failures
for diabetics only using major
longitudinal lab test results

Diabetes

Learning algorithms were developed from thirteen longitudinal lab test record measurements, such as fasting blood glucose and uric acid, to predict the risk of heart failure in patients with diabetes over 0.5, 1, 3 and 5 years with promising indications of predictive power as measured by area under the curve (AUC) of 0.77, 0.79, 0.79 and 0.80 respectively.

[Read more →](#)

Renal

Artificial intelligence in renal pathology:
IBM Watson for the identification
of glomerulosclerosis

Nephrology Dialysis Transplantation

The IBM Watson Visual Recognition Service was trained using 26 renal biopsies to distinguish the difference between sclerotic and non-sclerotic glomeruli with a high degree of accuracy (94.25% through 96.5%).

[Read more →](#)

Employee Population

Ten modifiable health risk factors and employees’ medical costs-an update

American Journal of Health Promotion

A study of 135,219 employees in the IBM® MarketScan® Commercial research database found that healthcare costs were significantly higher for employees at higher risk for high blood glucose, obesity, stress, depression and physical inactivity (P < 0.001) than those at lower risk.

[Read more →](#)

Infectious Diseases

Unintended consequences following the 2014 American Academy of Pediatrics policy change for palivizumab prophylaxis among infants born at less than 29 weeks’ gestation

American Journal of Perinatology

A study of the IBM MarketScan Commercial and Multi-state Medicaid databases found that use of outpatient respiratory syncytial virus (RSV) immunoprophylaxis (IP) for infants less than 29 weeks gestation age, aged less than 3 months, and in infants 3 to less than 6 months, in both the commercial and Medicaid population decreased after the 2014 American Academy of Pediatrics policy change on RSV IP. There was significant increased relative risk of RSV hospitalization for infants less than 29 weeks gestation age versus those at term in the Medicaid-insured population.

[Read more →](#)

Neurologic

Treatment patterns and relapses among treatment-naïve MS patients

Journal of Managed Care & Specialty Pharmacy

An evaluation of adherence to newly initiated disease-modifying therapies (DMTs) in 9,378 people with multiple sclerosis (MS) identified in the IBM® MarketScan® databases found that medication persistence at 12 months was more likely for those on oral agents compared to injectables (OR=1.45, P < 0.0001), although non-persistence was identified in 39.1% of all patients.

[Read more →](#)

Oncology

Regional disparities in time to treatment for breast conserving surgery and mastectomy in women with early-stage breast cancer

American Association for Cancer Research Annual Meeting

An IBM MarketScan claims analysis of women with early-stage breast cancer found that from 2012 to 2017 time from diagnosis to mastectomy (TtS) was significantly increased in the South (3.8 days; $p<0.01$) and West (8.0 days; $p<0.01$) geographies. For patients in Black communities, TtS was greater by 20.7 days ($p=0.02$) in the Midwest and 57.8 days in the West ($p=0.04$).

[Read more →](#)

Oncology

Complete human papillomavirus vaccination coverage over a 13 year period in a large population of privately insured US patients

Journal of Clinical Oncology

In a study analyzing IBM MarketScan data of more than 21 million commercially insured patients over a 13-year period, complete vaccination coverage for human papillomavirus was well below the Healthy People 2020 goal.

[Read more →](#)

Oncology

Trends in ALK inhibitors for non-small lung cancer

Journal of Clinical Oncology

IBM Access and Value Connect was used to construct a model of how anaplastic lymphocyte kinase (ALK) inhibitors have been used to treat lung cancer. Out of 2,309 patients, 145 patients were treated with an ALK inhibitor, 59.9% of those with alectinib and 33% with crizotinib. While the overall costs for alectinib and crizotinib were roughly the same, emergency department and in-patient costs were higher for crizotinib at \$1,635 and \$404, respectively, compared to \$503 and \$57 for alectinib.

[Read more →](#)

Ophthalmologic

Incidence of dry eye disease among patients with continuous positive airway pressure or other nasal mask therapy devices to treat sleep apnea in the United States

Investigative Ophthalmology
& Visual Science

A study of IBM MarketScan claims data of 330,926 patients who had a claim for the use of a continuous positive airway pressure or other nasal mask therapy found an increased incidence of dry eye disease over time, with increasing age, and was higher in women than men.

[Read more →](#)

Psychiatric

Rural-nonrural differences in telemedicine use for mental and substance use disorders among Medicaid beneficiaries

Psychiatric Services

In a study of IBM MarketScan Multi-state Medicaid claims data, rates of telemedicine utilization for mental health or substance use disorders increased slowly over 2012-2017; by 5.9 and 1.9 percentage points, respectively in adult rural Medicaid beneficiaries.

[Read more →](#)

Digital Technology

**Automating the classification
of complexity of medical
decision-making in patient-provider
messaging in a patient portal**

Journal of Surgical Research

Machine learning models outperformed a medical term count model in determining whether a patient portal message involved queries related to medical decision making and to classify the complexity of the decision making involved.

[Read more →](#)

Digital Technology

**Speech-based characterization
of dopamine replacement therapy
in people with Parkinson’s disease**

NPJ Parkinsons Disease

In a study investigating the feasibility of speech analysis to detect on and off medication states in patients with Parkinson’s disease, features generated from picture description, reverse counting and diadochokinetic rate achieved accuracies of 0.89, 0.84, and 0.60, respectively, to detect medication state (ON or OFF). This shows promise for remote monitoring rather than relying upon the gold standard testing by an in-person neurologist.

[Read more →](#)

Fraud

**Ontology-Guided Policy Information
Extraction for Healthcare Fraud
Detection**

Studies in Health Technology
and Informatics

Researchers proposed and validated a domain ontology-guided framework to interpret unstructured policy text and semi-automatically audit provider insurance claims. An automated system could significantly improve efficiency, thoroughness, and consistency in identifying policy violations compared to current manual review processes.

[Read more →](#)

Health Equity

Discovering New Social Determinants of Health Concepts From Unstructured Data: Framework and Evaluation

—
Studies in Health Technology
and Informatics

Natural language processing methodologies were created and evaluated by domain experts to surface a list 10,000 social-determinants of health (SDOH)-related terms from unstructured data. This list was compared to established thesaurus UMLS and SNOWMED-CT terminologies from which a notable percentage of SDOH-related terms were missing, 31% and 28% respectively.

[Read more →](#)

Health Equity

“TechQuity” in diabetes – does digital health technology improve equity?

—
Diabetes

A systematic review of global published scientific literature to identify papers digital health interventions (DHI) to address global disparities in cardiovascular related disease, identified a subset of thirteen papers addressing the impact of digital health interventions on populations with diabetes mellitus known to be impacted by sociodemographic factors such as race/ethnicity, low socioeconomic status and geography; 70% of these demonstrated improvements of health and 40% healthcare delivery.

[Read more →](#)

Infectious Diseases

In Silico Exploration of the Molecular Mechanism of Clinically Oriented Drugs for Possibly Inhibiting SARS-CoV-2’s Main Protease

—
J Phys Chem Lett

Through in silico methods, authors theoretically explored the potential mechanism of binding between the SARS-CoV-2 main protease, which performs key biological functions for the virus, and various marketed drug molecules currently under investigation as potential medications for COVID-19.

[Read more →](#)

Psychiatric

**A cross-cultural comparison of an
extended planned risk information
seeking model on mental health among
college students: cross-sectional study**

Journal of Medical Internet Research

This study applied the planned risk information seeking model (PRISM) to two populations of college students, one in the United States and one in China, to study their information seeking behaviors around mental health as they relate to media use and cultural identity. Media use was significantly associated with mental health information-seeking intentions in the Chinese sample ($P<0.001$), and cultural identity was significantly associated with intentions in both samples (China: $P=0.02$; United States: $P<0.001$).

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Produced in the United States of America
April, 2020

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