

# Scientific Updates Q1, 2020



Leadership Spotlight

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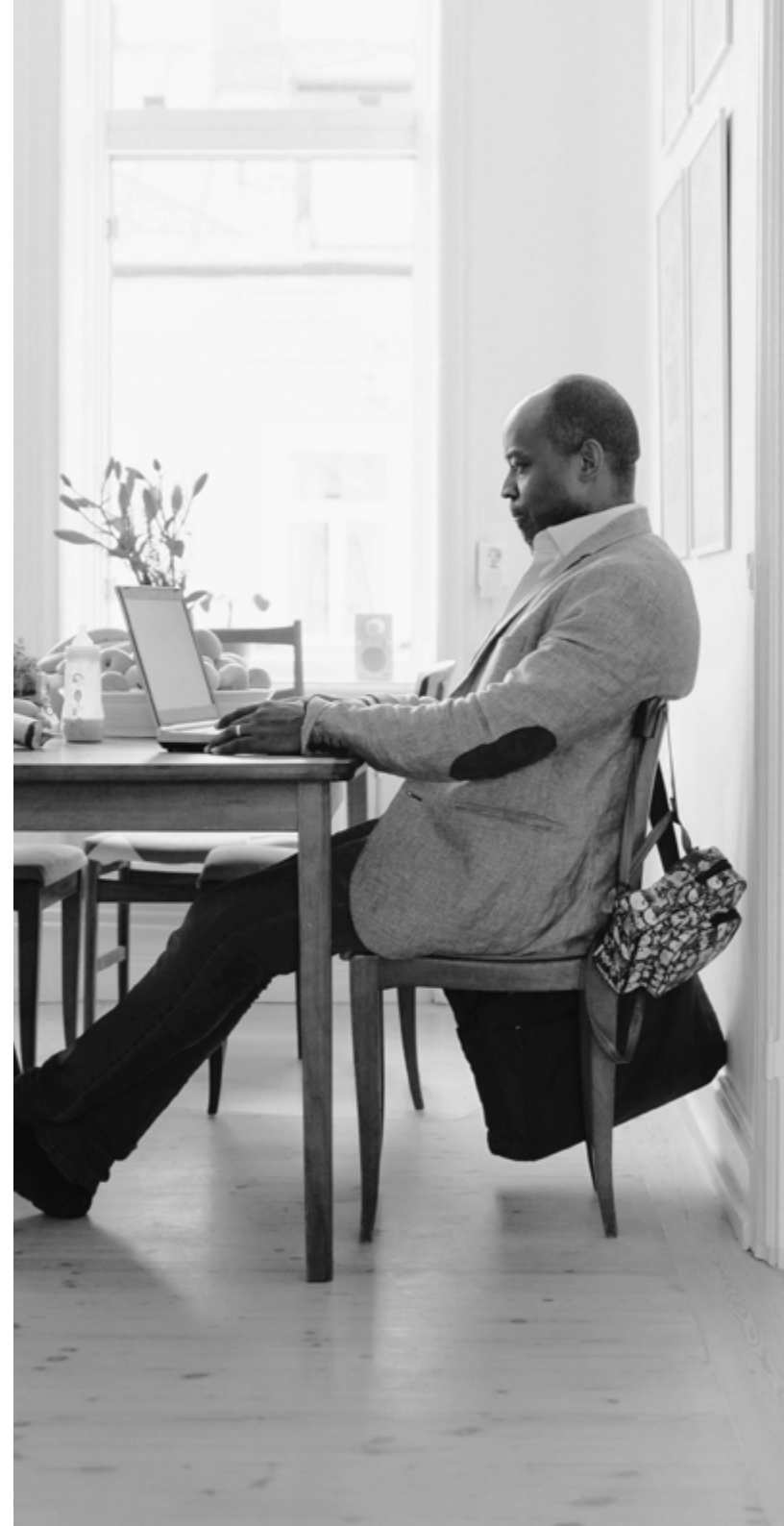
Publication Highlights

Contact us

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## Leadership Spotlight

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Bill Kassler, MD, MPH is the Chief Medical Officer for IBM Watson Health Government Health & Human Services. An internist, epidemiologist and healthcare leader, Dr. Kassler works at the intersection of clinical care and population health, including having served in the United States Public Health Service as an Epidemic Intelligence Officer at CDC, State Health Officer and CMO for the Centers of Medicare & Medicaid Services.



# Leadership Spotlight

The severity of the current global COVID-19 healthcare crisis highlights the challenges public health and healthcare ecosystems face across the world. These challenges range from understanding the etiology and epidemiology of diseases, to ensuring the adequacy of supply chains providing needed healthcare resources, and most importantly, understanding and reducing the impact to human life and wellbeing.

There are three phases in which stakeholders engage in a public health emergency like the COVID-19 pandemic: preparedness, response and recovery. This framework is also relevant to other situations such as the opioid use disorder crisis or even longstanding challenges such as food insecurity.

Each stage requires analysis of real-world data (RWD) to develop evidence-based plans and policies, monitor for situational awareness, effectively respond and evaluate to help improve readiness for the next crisis.

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The following are examples of IBM published co-authored work in which RWD and artificial intelligence systems are being used to help impact each phase:

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### Prepare

Preparing for a crisis requires an understanding of a potential challenge, having the foundation in place to assure continuity of operations, developing the plans and policies to enable a rapid response, and building the infrastructure to support those in need.

- Researchers in New York City conducted a user-centered study to determine how best to improve the application system for food insecure residents to apply for supplemental nutrition benefits (Snowdon JL et al. 2020. [AMIA Informatics Summit](#))
- IBM researchers created a risk prediction system based on high-resolution weather data for the regional transmission of the vector-borne viral disease dengue (Hettiarachchige C et al. 2018, [PLoS One](#))

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### Respond

Responding is the period in which stakeholders implement plans, translate science into practice, and course-correct based on new data to help improve practices.

- A new model is being created to estimate optimal levels of fluid treatment for sepsis patients in the ICU (Shahn Z et al. 2020. [Critical Care](#)).
- The role of genetic drift in the SARS-CoV-2 genome is explored to help scientists developing vaccines better understand this novel coronavirus (Koyoma T et al. 2020. [Pathogens](#))

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### Recover

Recovering requires an after-action review of the responses carried out during the crisis to understand lessons learned, and feedback into the preparation stage for future emergency responses.

- A retrospective study of claims data determined early intervention by infectious disease doctors for a broad range of infections was associated with lower mortality rates in a privately insured population under the age of 65 (Schmitt et al. 2019. [Clin Infect Dis](#)).
- An analysis of commercial claims data over 10 years determined that implementation of the 2008 Paul Wellstone and Pete Domenici Mental Health Parity and Addiction Equity Act (MHPAEA) was positively associated with utilization of mental health and substance use disorder outpatient services (Mulvaney-Day N et al. 2019. [Am J Public Health](#))

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Public health crises can cause immense hardship for those living through the experience, and as we have seen with COVID-19, especially for responders on the frontlines. Real-world data can play an important role in helping those on the frontlines and behind the scenes base their decisions and actions on the best available science and evidence.

– William J. Kassler

To learn more about IBM's response to COVID-19, please go to:

[ibm.com/impact/covid-19/](https://ibm.com/impact/covid-19/)  
[ibm.com/watson-health/covid-19](https://ibm.com/watson-health/covid-19)



# Scientific Spotlight 1

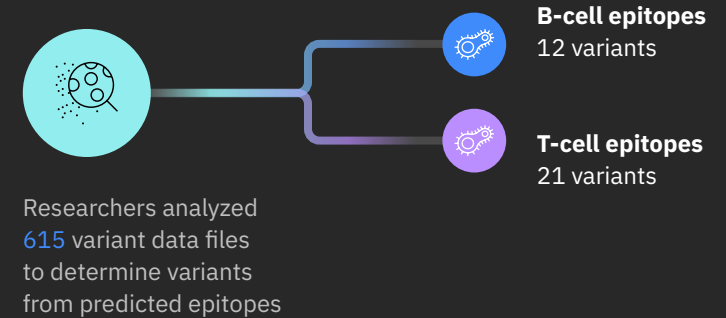
## Emergence of Drift Variants That May Affect COVID-19 Vaccine Development and Antibody Treatment

Koyama T, Weeraratne D, Snowdon J, Parida L. Pathogens. 2020;9(5):324. doi: 10.3390/pathogens9050324

Consideration of antigenic drift in the sub-strains of SARS-CoV-2, such as epitope variants discussed in this paper, is critical in the development of a vaccine approach that offers broad protection against the COVID-19 pandemic.

[Read more →](#)

With no established treatments for COVID-19, research to develop a vaccine for the novel SARS-CoV-2 coronavirus is progressing rapidly. Understanding viral genetic drift could provide insight critical to vaccine development.



The 23403A>G (p.D614G) variant in spike protein B-cell epitope was observed frequently in some European countries, which may lead to antigenic drift and result in vaccine mismatches that offer little protection to affected patients.

# Scientific Spotlight 2

## Social Program Management Software to Optimize Benefit Application and Management in New York City

Snowdon JL, Will VC, Lefebvre-Paille C, Farrell D, McLoughlin C, Curtin M, Kassler W, Kirchheimer R, Xhemalallari A, Aaronson L. 2020 March. Proceedings of the AMIA Informatics Summit.

The New York City Human Resources Administration/Department of Social Services (NYC HRA/DSS) elected to enhance its screening and application tool to be an online self-service web/mobile application for the Supplemental Nutrition Assistance Program (SNAP).

[Read more →](#)

57 naturalistic shadowing sessions at SNAP centers and 30 contextual inquiry interviews of SNAP center facilitators and outreach workers were conducted to inform the tool’s enhancements which uses the IBM Social Program Management Platform in conjunction with the IBM Universal Access application module.

**Comparisons on system utilization were made before and after deployment:**

Monthly system metric	April 2018 Pre-deployment	April 2019 Post deployment	% Increase
Logins (web + mobile)	912,532	1,684,248	84
Online applications/recertifications received	33,421	40,198	20.3
Document uploads	26,419	43,057	63
Profile update calls	9,696	17,547	81

Notable utilization increases for the New York City SNAP self-service web/mobile application were observed after user-center design methodologies were used to enhance the system. These improvements are likely to decrease the workload of SNAP staff.

# Scientific Spotlight 3

## Opioid Use Disorder and Employee Work Presenteeism, Absences, and Health Care Costs

Henke RM, Ellsworth D, Wier L, Snowdon J.  
JOEM. 2020 February 11.  
doi: 10.1097/JOM.0000000000001830.

Opioid use disorder (OUD) has an impact on employer costs, including those incurred due to productivity issues such as absenteeism. This research examined prevalence of employee OUD, related employee health care and productivity costs and whether pharmacotherapy for OUD reduces those costs.

[Read more →](#)

Cross-sectional analyses of IBM® MarketScan® Databases were carried out on commercially insured adults and examined:

- Health-related absences.
- Presenteeism
- Absenteeism
- Annual healthcare costs

16.8M

Retrospectively reviewed data for 16.8M study subjects who met the inclusion criteria

0.6%

0.6% of employees had an OUD diagnosis

Compared to employees who did not have OUD, healthcare and productivity costs for employees with OUD:

- Were ~\$6,294 higher for employees who received pharmacotherapy treatments
- Were ~\$21,570 higher for employees who did not receive pharmacotherapy treatments

These findings indicate that pharmacotherapy treatments for OUD help reduce overall healthcare and productivity costs, indicating a role for employer policies to support these types of treatments for their employees and their families.



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**Publication Highlights**

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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

Care Management

Efficient goal attainment and engagement in a care manager system using unstructured notes

JAMIA

Application of machine learning classifiers to predict patient self-management goal attainment from unstructured and structured care management phone interaction methods was successful in automatically distinguishing between patient engagement and lack of engagement.

[Read more →](#)

Clinical Decision Support

Pharmacological information needs expressed through a natural language conversational agent

Proceedings of the 2020 AMIA Informatics Summit

A comparison of the most common drug topics accessed in the IBM Micromedex® clinical decision support tool using the tool’s conventional search function or Watson Assistant (WA) AI mediated searching found that for both the top searches were for dosing (23.9% WA; 43% conventional). Other top search topics using the AI conversational interface were administration (11.5%), drugs that treat specific conditions or diseases (8.0%), and on- and off-label uses (6.8%).

[Read more →](#)

Clinical Trials

Knowledge extraction of cohort characteristics in research publications

Proceedings of the 2020 AMIA Informatics Summit

A general, scalable knowledge extraction pipeline is being developed to extract cohort information from clinical study results in research publications. This work builds upon previous work focused on identifying relevant patient characteristics from published studies.

[Read more →](#)

Artificial Intelligence

Real World Evidence  
and Artificial Intelligence  
Combined

Real World Evidence

Research

Oncology

Artificial intelligence tool for  
optimizing eligibility screening for  
clinical trials in a larger community  
cancer center

JCO Clinical Cancer Informatics

Manual clinical trial eligibility screening of 90 patients with breast cancer for 3 trials took 110 minutes compared to 24 minutes with Watson for Clinical Trial Matching (CTM). In the same study, agreement between CTM and manual eligibility determinations was 81%-96% for 239 patients with breast cancer across 4 trials.

[Read more →](#)

Oncology

A systematic review of studies  
of concordance with expert opinion  
for a globally implemented oncology  
clinical decision system

Proceedings of the 2020 AMIA  
Informatics Summit

The mean concordance between IBM Watson for Oncology (WfO) and multidisciplinary tumor boards was 77.5%; significantly higher than the mean concordance between WfO and individual clinicians 67.4% ( $P < 0.0001$ ) in a meta-analysis of 27 global concordance studies from China, India, South Korea, Brazil, Thailand and the United States.

[Read more →](#)

Privacy and Security

Anonymizing data for privacy-  
preserving federated learning

arXiv

A novel syntactic model for anonymizing data distributed across multiple sites used in federated machine learning outperformed existing state-of-the-art methods in a test using electronic health record data of 1 million patients. This approach maximized performance while achieving the level of privacy required to meet GDPR and HIPAA standards.

[Read more →](#)

Artificial Intelligence

Real World Evidence  
and Artificial Intelligence  
Combined

Real World Evidence

Research

Psychiatry

Artificial intelligence approaches to predicting and detecting cognitive decline in older adults: a conceptual review

Psychiatry Research

This paper provides an in-depth review of the use, benefits and current limitations of using artificial intelligence to study neurocognitive impairments by exploring six categories of use: sociodemographics, clinical and psychometric assessments, neuroimaging and neurophysiology, electronic health records and claims, novel assessments and genomics.

[Read more →](#)

Psychiatry

Detection of acute, 3,4-methylenedioxymethamphetamine (MDMA) effects across protocols using automated natural language processing

Neuropsychopharmacology

In a double-blinded, placebo-controlled study, natural language processing to detect speech alteration due to 3,4-methylenedioxymethamphetamine (MDMA) or intranasal oxytocin achieved cross-validated accuracies of up to 87% in training/validation and 92% in independent datasets. Results support a proof-of-concept for the potential use of speech analysis to measure states of drug intoxication.

[Read more →](#)

Risk Prediction

Identifying unreliable predictions in clinical risk models

NPJ Digital Medicine

A new methodology to create an “unreliability score” to indicate when a predictive clinical risk model is poor, for example with regards to large class imbalance, was tested and validated on data from over 40,000 patients in the Global Registry of Acute Coronary Events (GRACE).

[Read more →](#)

Neurology

**A probabilistic disease progression on modeling approach and its application to Huntington’s disease observational data**

JAMIA Open

A new probabilistic disease progression model applied to observational data from 16,653 Huntington’s Disease gene expression carriers offered a more comprehensive understanding of disease progression than a currently accepted staging system. Further validation of the model could lead to greater understanding of progression for a variety of chronic conditions.

[Read more →](#)

Neurology

**Framework for identifying drug repurposing candidates from observational healthcare data. Preprint.**

medRxiv

A causal inference framework was applied to two observational databases covering more than 150 million patients to evaluate the effect of 259 drugs on Parkinson’s disease prognosis measures. The new framework, which imitated hundreds of randomized trials, demonstrated a great degree of agreement in choosing similar promising candidates from the two databases and shows potential for identifying drug candidates for repurposing.

[Read more →](#)

Nephrology

**Identification and external validation of IgA nephropathy patients benefiting from immunosuppression therapy**

EBioMedicine

Three subgroups of patients with IgA nephropathy, the most common form of glomerulonephritis, were identified as benefiting from immunosuppression therapy using machine learning to analyze clinical and pathological data from 4047 IgA patients in China.

[Read more →](#)

Ophthalmic

**Automated and computer-assisted  
detection, classification, and  
diagnosis of diabetic retinopathy**

Telemed J E Health

This paper provides a descriptive  
standardized categorization framework for  
both computer-assisted and fully automated  
retinal image detection, triage and diagnosis  
of diabetic retinopathy.

[Read more →](#)

Psychiatric

**Dynamic ElecTronic hEalth reCord  
deTection (DETECT) of individuals  
at risk of a first episode of psychosis:  
a case-control development and  
validation study**

Lancet Digital Health

The Dynamic ElecTronic hEalth record  
detection (DETECT) AI-based methodology  
displayed a balanced prognostic accuracy  
of 0.724 for predicting the first episode of  
psychosis 1 year prior to the documented index  
event and an area under the receiver operator  
characteristic curve of 0.799 after training on  
matched case-control studies from the IBM  
Explorys database.

[Read more →](#)

Infectious Diseases

**Fluid-limiting treatment strategies  
among sepsis patients in the ICU:  
a retrospective causal analysis**

Critical Care

A retrospective analysis of data for 1,639 patients with sepsis estimated that 30-day mortality would have been reduced by -0.6 to -1.0% if fluid caps of 6 to 10L on 24 hour fluid volume had been implemented.

[Read more →](#)

Neurologic

**Care among migraine patients  
in a commercially insured population**

Neurology and Therapy

An evaluation of 284,719 patients with migraine in the IBM® MarketScan® database, found that 59.1% of these used preventive therapy, but 67.9% of those patients discontinued their preventive therapy with a median time to discontinuation of five months.

[Read more →](#)

Respiratory

**Lifetime health care costs associated  
with systemic corticosteroid use  
in adults with persistent asthma**

The Journal of Allergy and Clinical Immunology

In an evaluation of data from IBM® MarketScan®, use of systemic corticosteroids for the treatment of persistent asthma was associated with up to twice as much health care expenditure over a patient’s lifetime as compared to controls.

[Read more →](#)

Psychiatric

**Matched cohort study of healthcare resource utilization and costs in young children of mothers with postpartum depression in the United States**

Journal of Medical Economics

The healthcare expenditures for children born to mothers with postpartum depression (PPD) compared to matched children born to mothers without PPD were 12% higher (\$24,572 versus \$21,946, respectively;  $P < 0.001$ ) over 24 months of follow up.

[Read more →](#)

Psychiatric

**Opioid use disorder and employee work presenteeism, absences, and healthcare costs**

JOEM

In a study of 2016-2017 commercial claims data from IBM® MarketScan®, the healthcare and productivity costs for employees with opioid use disorder receiving and not receiving pharmacotherapy were \$6,294 and \$21,570 greater, respectively, compared to other employees.

[Read more →](#)

Wellness

**Analyses of employer medical claims data to assess receipt of high-priority preventive health services**

Am J Prev Med

Only 29% of men and 36% of women received all recommended age- and sex-appropriate preventive health services in an analysis of IBM® MarketScan commercial and Medicare claims data from 2010 to 2016 (86,895,424 person years). In the same timeframe, 33% of men and 13% of women failed to receive any recommended services.

[Read more →](#)



Women’s Health

**Real world evidence study of factors associated with breast conserving surgery for females diagnosed with early stage cancer**

JNCCN

Breast conserving surgeries were chosen more frequently than mastectomy for patients with early stage invasive cancer in women with older age, access to and use of genetic services, and pre-operative radiation in a six-year study of the IBM® MarketScan® claims data.

Best poster abstract winner

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Real World Evidence

Research

Care Management

**Social program management software to optimize benefit application and management in New York City**

—  
Proceedings of the 2020 AMIA  
Informatics Summit

An 84% increase in logins and an 81% increase in profile update calls was observed after the implementation of a user-centered online self-service web/mobile program management application in the New York City Supplemental Nutrition Assistance Program.

[Read more →](#)

Care Management

**Qualitative study of loneliness in a senior housing community: the importance of wisdom and other coping strategies**

—  
Aging Mental Health

In a qualitative study, interviews with older adults living independently within a senior housing community (n=30) revealed many experienced feelings of loneliness attributed to age-associated losses and lack of social skills, meaning and motivation. However, the study also identified positive coping strategy themes, including acceptance of aging, compassion, seeking companionship and an environment enabling socialization.

[Read more →](#)

Infectious Disease

**Emergence of drift variants that may affect COVID-19 vaccine development and antibody treatment**

—  
Pathogens

In an analysis of genetic variants for SARS-CoV-2, researchers identified 33 variants associated with B-cell and T-cell epitopes, with one common in a population of European cases, indicating potential for antigenic drift that should be considered during vaccine development for COVID-19..

[Read more →](#)

Infectious Disease

**Review of mathematical models of vaccination for preventing congenital cytomegalovirus infection**

The Journal of Infectious Diseases

A review of five studies applying infectious disease modeling determined that direct vaccination of infants for cytomegalovirus was the optimal strategy for preventing primary congenital CMV infection.

[Read more →](#)

Neurologic

**Atypical repetition in daily conversation on different days for detecting Alzheimer disease: evaluation of phone-call data from regular monitoring service**

JMIR Mental Health

In a study using natural language processing to analyze conversational data of 15 Japanese patients, atypical repetition across two conversations on different days outperformed other linguistic features as indicators for Alzheimer’s disease.

[Read more →](#)

Population Health

**Turning barriers into benefits to facilitate public health and partnership**

AJPH

Editorial discusses the ways companies have in impact on public health through:

- the health and safety of the products and services sold
- health, safety and well-being of their employees, dependents and retirees
- the impact they have on the environment
- through investments they make in the communities in which they do business

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