

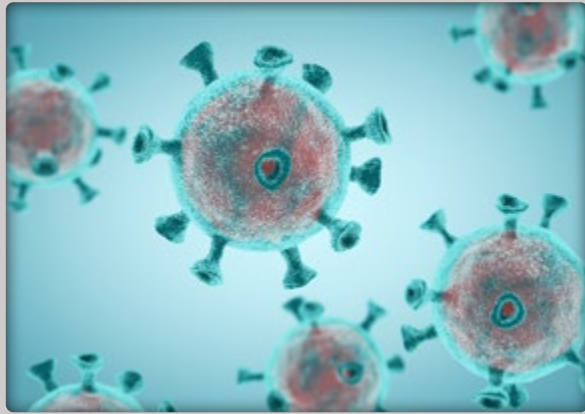
What's the new normal in health care?

Changes post-COVID-19 and beyond



 sas

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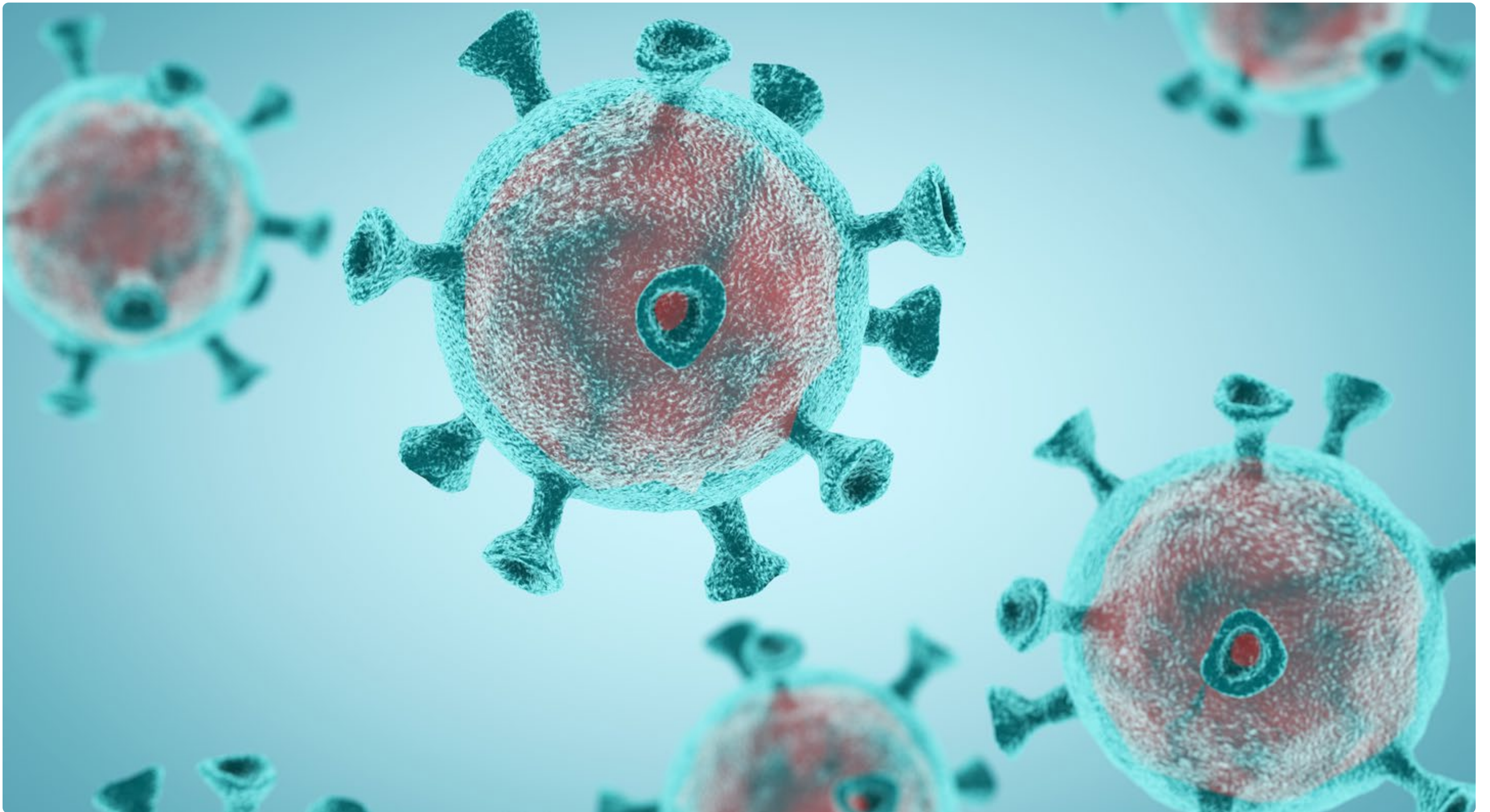
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Will health care be fundamentally changed post-COVID-19?

Greg Horne, Principal Health Analytics Strategist, SAS

Even prior to the disruption of coronavirus, the landscape of patient care was changing. Online health consultations, embedding health providers in retail locations and remote monitoring of post-surgical patients were becoming more accepted by patients and physicians alike.

In fact, “care model innovation” is one of the key trends driving technology investments in health care, [according to Deloitte](#). But will our collective experiences during the COVID-19 outbreak be enough to propel distributed and virtual care into a significant percentage of care delivery?

As health care access changed and matured throughout the 20th century, industrialized nations saw a rise in the prevalence and use of primary care doctors as the gateway to health care. People without a primary care doctor increasingly use walk-in clinics for minor ailments. And we’ve seen a massive rise in the demand for emergency rooms, including for mental health and substance abuse. In many countries, access to care has been improved through growth in public health care or the inclusion of health coverage by employers. These routes to health are now seen as the traditional method of care provision, but this is beginning to change too.

New approaches to health care delivery

We utilize care differently now than in generations past. With the rise in outpatient surgical procedures and the recognition that outcomes are improved in the home with monitoring and good physical therapy, the need for long hospital stays, and the beds associated with them, is disappearing.

Another driving force for change in health care access is the increased use of diagnostics, testing and screening. These can now be carried out in almost any location and through extended hours to meet patient needs and increase convenience.

As we move forward with new approaches to care, new needs for infrastructure and service, and the disruption by new players, new doors into health care are starting to open and become more prevalent. Analytics can inform locations (both virtual and physical) that are good candidates for care site expansion. Four of these include:



1



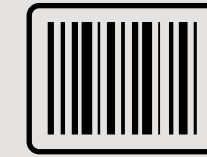
Retail pharmacies

Consumers want convenience, so in the trend toward one-stop shopping, the pharmacy is picking up a lot of the primary interactions with patients. And the pharmacy is growing to provide even greater health care services. The trend extends to grocery chains, which are employing dietitians to give advice in stores. Companies like Walmart are taking this further and adding primary care physicians in addition to the eye care and audiology services they have offered for many years, becoming a true health care provider for both customers and staff.

And the convergence trend isn't limited to physical stores. Amazon is exploring the potential of setting up a health care company just for its staff, which it feels will be a better value and higher quality service than its current health care package. Amazon has embraced this in its consumer business, too, with pharmacy services and a move into delivery by drones.



2



Retail shopping centers

As we see the move from physical retail to more online shopping, the mall or shopping center infrastructure that supported shops is emptying and becoming vacant. Health care organizations see an opportunity to transform these spaces into care facilities. These repurposed health care centers are especially useful for diagnostics and imaging, outpatient surgery, primary care and treatment of minor injuries. Malls and shopping centers make ideal locations for health care because they're designed for large crowds and are often in the center of communities, with transportation infrastructure and ample parking already in place.

In the Nordics, planners are looking at purposely building health malls in new subdivision areas to promote community mix and movement, and in an effort to prevent health issues associated with social isolation. The vision is that these facilities will encourage wellness using AI and analytic technology, coupled with access to primary care and other health services.



3



Virtual care

Access to health advice through online channels began with search engines, but has become more structured and accurate with the rise of wearable technology and virtual care.

The wearables market is primed to explode as regulation and payment models catch up with the potential of the technology.

Phone access to a triage nurse has been common practice for many years. Now, increases in communications bandwidth, common phone apps and the necessity of social distancing during the pandemic have made virtual face-to-face calls more acceptable to both clinicians and consumers. In many locations around the world, virtual care over video was initiated to alleviate the long distances that some clients needed to travel in order to seek help from mental health professionals. Those programs expanded over time to other disciplines, including post-surgical care, dermatology and others.



4



Caring for our seniors & disabled

Improvements to health care access and technology will enable patients who have mobility challenges to see their physicians more regularly without the challenge of travel. People of all abilities and ages may be able to stay in their homes longer, instead of transitioning to a care facility. Patients with complex conditions can be monitored and cared for as they would in a senior living facility. In turn, these facilities will need to improve the living experience they offer, invest in digital health technologies and maintain affordability in order to stay relevant.



A modern hospital waiting area with yellow armchairs and a reception desk. The room is bright and clean, with white walls and a light-colored floor. There are several potted plants and framed pictures on the wall. The reception desk is in the background, and there are some medical equipment visible in the distance.

Where do we go from here?

New doors for health care access play a role in managing costs, driving quality, and improving patient access and experience. As with all areas of care, change brings both opportunities and challenges. Many of the new doors to care will shine a light on inequality and the social determinants of health.

So will health care delivery change as we know it? Yes, change is inevitable. Many market forces are supporting the transformation to virtual digital health programs, and the COVID-19 pandemic is just the latest compelling event. The use of data and analytics in this space will be a game changer in achieving better health outcomes, improving health (not just health care) and seeing a universal approach to care for the benefit of all citizens.

Many market forces are supporting the transformation to virtual digital health programs, and the COVID-19 pandemic is just the latest compelling event.



Reducing hospital-acquired infections with AI

Hospitals in the Region of Southern Denmark aim to increase patient safety using analytics and AI solutions from SAS.

The Region of Southern Denmark, with help from SAS, has become the first place in the world to implement a complete system for monitoring hospital-acquired infections. Professor Jens Kjølseth Møller at Lillebaelt Hospital is the brain behind the new system, which is made possible by [SAS® Analytics](#). Kjølseth Møller expects the system to reduce the number of infections during hospitalization by one-third, significantly increasing patient safety.

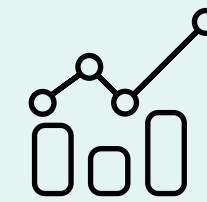
“It is unsatisfying that patients admitted to Danish hospitals are at risk of further illness,” says Peder Jest, Medical Director at Odense University Hospital. “The work of providing a high degree of patient safety and good infection hygiene is, therefore, a key focus area for the Region of Southern Denmark. With SAS, we now have the ability to monitor and predict the risk of hospital-acquired infections at a patient level.”

The challenge: An estimated one in 10 patients acquires an infection while hospitalized, and over 3,000 patients in Denmark die per year because of their infections. But until now, no one knew the actual infection rates, or exactly when and where to make a precise effort to prevent them. Now all hospitals in Southern Denmark have access to the new monitoring system that provides a complete picture of hospital-acquired infections at a patient level.

The system is the result of pioneering Danish work that connects many years of clinical experience with modern technology. Danish hospitals found it unacceptable that admitted patients were at risk of further illness. The work of providing a high level of patient safety and good infection hygiene became key focus areas.

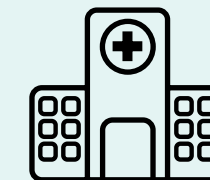
“Now we have a tool that can monitor hospital-acquired infections. With that we can make sure - and even make it transparent and well documented - that we do everything we can to prevent these unwanted infections,” Jest says. “This

Region of Southern Denmark - Facts & Figures



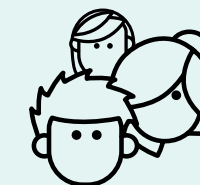
284,000

previous patient cases were used to develop risk models



Lillebaelt Hospital

is one of five hospitals in Southern Denmark



Public health care

is the region's main responsibility

means that our clinical managers are enabled to monitor their efforts and create better results because the system tells them where to look. This is a new era in the work of reducing hospital-acquired infections.”

The first complete system for monitoring infections

Kjølseth Møller had earlier developed a system that could present an overview of the number of infections. This system used local data from one hospital only in the region. But it was not complete, because it couldn't include unstructured clinical information on infections recorded in clinician notes by doctors and nurses.

The Region of Southern Denmark decided to work with SAS primarily for two reasons: great experience with high-quality [artificial intelligence](#) (AI) technologies and deep insights into the health care sector.

The technology dictates rules and clinical terms. These are the so-called “triggers” that can identify signs of infection in patients. It is the first time worldwide that a system based on AI has provided a complete overview of hospital-acquired infections.

In the future, all patients admitted to hospitals in Southern Denmark will be scored for their risk of developing a urinary tract infection while admitted to the hospital. This will enable doctors and nurses to respond in real time and prevent hospital infections. The risk models are developed with AI based on 284,000 previous patient cases in the region.

“We know how many infections there have been for a specific period in a particular department,” Kjølseth Møller says. “We changed our work procedures from handling much of the data ourselves to using a data management solution from SAS, which is accessible by both clinicians and administrators. We deliver raw data to the SAS system, and SAS presents the information in a way that they can understand and act on.”

From data management to model development and deployment, everyone works in the same integrated environment. [Within SAS Visual Data Mining and Machine Learning](#), AI helps predict which patients have an increased risk

of developing hospital-acquired infections during hospitalization. The infection-monitoring overview is displayed through the region's management information portal, where doctors and departmental managers are accustomed to retrieving other information.

More hospitals want to monitor their hospital-acquired infection rates

In 2018, clinicians in Southern Denmark hospitals could, for the first time, draw reports of all infections. SAS allows hospital and departmental management to monitor the development of hospital-acquired infections with overview and development reports over time at the hospital, departmental and sectional levels.

“The knowledge we receive about patients today is the knowledge that will help prevent infections for patients tomorrow,” Kjølseth Møller says. “It will help us also work much more actively with what we call intervention, where we try to change routines to see if we can do better than what we do now.”

Reducing hospital-acquired infections with artificial intelligence





How will COVID-19 impact health care costs?

We can't know the full effects of the pandemic yet—it will continue to alter the landscape for years to come. But we polled some of our industry experts to get an idea of how it will impact state health programs in the US, private insurers worldwide, and how we all pay for health care. Here's what they had to say.

QUESTION

How are health insurers responding to COVID-19?



Amanda Barefoot,
Health and Life Sciences Manager, SAS

ANSWER

At the beginning of the pandemic, health insurers were trying to understand the current situation. Similar to governments and health systems, plans needed to create complete views of their populations to estimate COVID-19 spread.

As the pandemic and its aftermath continues, we're seeing health insurers start to look ahead. A national health plan noticed medication challenges early on and has allocated staff to focus on analyzing the data. It hopes to identify if there are impending shortages of drugs to support critically ill patients with COVID-19, patients hoarding medications and supply chain impacts from drug manufacturers.

Other plans are proactively putting measures in place to prevent fraudsters from taking advantage of loosened claim policies and government regulations. Impacts of job loss are being analyzed by insurers as well, as they look to model various scenarios of membership changes. A state-based health insurance company is looking to partner with both government and a national laboratory company to ensure supply and demand can be met for COVID-19 testing.

QUESTION

How are private health insurers responding?



Norman Black,
Principal Public Sector Consultant, SAS UK

ANSWER

In Europe and most of Asia, COVID-19 testing and treatment are being handled through public health systems or public health care insurers and are not covered by most private health insurance policies.

In many countries, however, private health insurers are working in close partnership with the government system. For example, in the UK, a large proportion of private hospital capacity has been totally reallocated to the National Health Service, resulting in noncritical private treatment being postponed until the situation is stabilized. In order to support policyholders and ensure retention, private health insurers are stressing added value services that are continuing to be provided. These include remote video consultations and mental health programs. Indeed, COVID-19 is likely to lead to a significant rise in telehealth capabilities by private health insurers, including the expansion of IoT-based remote health monitoring. This would be a positive coming out of an otherwise tragic situation.

QUESTION

How will COVID-19 affect state health programs in the US?



Sarah Newton and David Hancock,
State and Local Government Industry Consultants, SAS

ANSWER

For the first time in US history, every state and territory declared a public health emergency. At the same time, states had to deal with rising unemployment, declining revenue and surging enrollment within the Medicaid and Children's Health Insurance Program. State Medicaid programs have rapidly scaled their enrollment while also seeking federal relief to expand their abilities to confront the pandemic.

To help, the federal government increased its contribution to these programs by 6.2%. However, this increase does not offset the expanded cost of testing and treating those impacted by COVID-19. While many payers have seen decreased utilization, Medicaid's persistent enrollment of elderly, disabled and pregnant women means a consistent expenditure with COVID-19 expenses in addition to program costs. While the costs borne by state health care services will increase, they are an important program in combating the coronavirus pandemic, and integral to restoring the health of our citizens.

QUESTION

How has the experience of paying for health care changed in response to COVID-19?



Alex Maiersperger,
Senior Consultant, Health and Life Sciences, SAS

ANSWER

I believe the experience of paying for health care should and will change in several important ways, including rising consumer expectations for both public and private payers and enhanced technology. Consumers will continue to demand more value in exchange for increasing health care costs - including more frequent and useful communication, modern tools to manage their health, such as telehealth and at-home care options, and expert guidance when health is on the line. COVID-19 social distancing habits will likely increase the speed of technology adoption for health care providers, especially in digital forms, signatures, and payment.

One of the largest burdens identified by health plan members, physicians and patients alike is the billing experience when hospitalized or when seeking medical care. Sometimes understanding, keeping up with, and paying bills is more difficult than receiving the care. This difficult time should spur organizations to improve the experience of receiving bills from health care providers, explanation of benefits from health insurers and the coordination between the two.



Can AI propel us towards universal health coverage?

Greg Horne, Principal Health Analytics Strategist, SAS

The World Health Organization defines universal health coverage as ensuring that everyone can obtain the care they need, when they need it, right in the heart of their own communities. While countries in all regions of the world continue to make progress toward these goals, millions of people still have no access to health care. Considering this stark reality, it's imperative we ask ourselves, how might advanced analytics and artificial intelligence (AI) improve health care access and outcomes globally?

Augmenting clinical decisions with AI

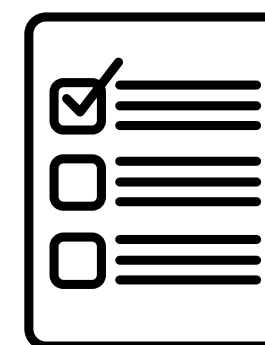
Importantly, AI is a tool that supports physicians, not a technology that will replace them. Just as the stethoscope didn't replace doctors' ears but enhanced their skills, AI will enhance their ability to deliver care.

For example, supercharging technologies like computer vision, text analytics and predictive modeling with AI can help doctors diagnose diseases earlier and with greater accuracy. Likewise, empowering physicians with insights derived from mushrooming volumes of clinical and other data (e.g., environmental, social determinants) enables them to make more informed treatment decisions once the diagnosis is made. Doctors can use real-time data to create personalized and predictive feedback for each patient. And they are freed to spend more time having meaningful conversations with their patients.

More broadly, advanced analytics and embedded AI will help health care organizations tangibly improve patient safety and care quality; personalize diagnostics and treatments; empower whole person care; reduce preventable, avoidable complications; improve access to care; and help plan care infrastructure for future generations.

Forecasting the impact of potential disease outbreaks

Vaccination has been a key tenet of global universal health care access in both the developed and developing world, especially in safeguarding children against disease. Consider measles, for example. Complementing global [vaccine safety](#) campaigns and education on herd immunity principles, data and analytics play a vital role in tracking vaccination rates in communities. Such efforts have led to better health care cost containment and improved quality of life.



Supercharging technologies like computer vision, text analytics and predictive modeling with AI can help doctors diagnose diseases earlier and with greater accuracy.

Today, AI also can play a role in helping curb the outbreak and spread of other, more deadly diseases. With the Ebola and the Zika virus global pandemics, for example, containment and treatment efforts have focused on the diseases' likely spread. Using predictive forecasting and analytics to understand human movements around such outbreaks have allowed for more effective intervention and disease containment, reducing the loss of life.

Establishing patient safety protocols

Antimicrobial resistance is one of the world's most pressing public health threats, by 2050 projected to kill more people each year than cancer. In a move to reverse this startling trend, advanced analytics are revealing antibiotic prescription patterns and mapping where use is not required.

Beyond mere monitoring, these insights are being used to educate doctors on how to best prescribe - and also to help inform patients why completing the full

course of prescribed tablets, even when they may feel better, is so important. Like all challenges with universal health care, the education of providers and patients alike is required to drive cost-effective and efficient care to all.

These examples of global progress in improving care access and delivery to at-risk populations demonstrate the role of good data, translated into actionable knowledge. Advanced analytics are already helping change lives and build a healthier, safer planet. The predictive power of advanced analytics will continue to change medicine in many ways, generating operational improvements that drive better care in our homes, hospitals and communities.

But that transformation needs to start somewhere - and it needs to start now. If we strive only for the moon and don't appreciate the value in what's immediately around us, the true promise and potential of AI will only be further delayed.

Article originally appeared in *Health IT Outcomes*, July 2, 2019. Reprinted with permission.



Cancer treatment enters a new era with AI

Amsterdam UMC uses the SAS® Platform and AI solutions to increase speed and accuracy of tumor evaluations.

The application of [artificial intelligence](#) (AI) is gaining traction in oncologic care, and Amsterdam UMC is leading the way by using [computer vision](#) and [predictive analytics](#) to better identify cancer patients who are candidates for lifesaving surgery.

With one of Europe's largest academic oncology centers, Amsterdam UMC strives for every patient to contribute to the care of the next patient. This is done by collecting enormous amounts of data on each patient, including biomarkers, DNA and genomic data.

"Our opportunity is to use AI to help us with our ever-growing data volumes," says Dr. Geert Kazemier, Professor of Surgery and Director of Surgical Oncology at Amsterdam UMC.

His search for a robust [analytics](#) platform led Kazemier to SAS, kicking off a partnership that has furthered the science of using AI to evaluate liver tumors pre- and post-systemic therapy. Additionally, the [SAS Platform](#) gives thousands of cancer researchers at Amsterdam UMC access to cutting-edge analytics to improve research and collaboration.

Human limitations in tumor assessments

Colorectal cancer is the third-most common cancer worldwide, and it spreads to the liver in about half the patients. Kazemier, who specializes in liver surgery, says the best way to treat this type of cancer is to remove it. But some tumors are too large to be removed, and these patients must undergo systemic therapy, such as chemotherapy, to shrink the tumors.

After a period of treatment, tumors are manually evaluated using computerized tomography (CT) scans. At that time, medical professionals can see if a tumor shrunk or changed in appearance. How a tumor reacts to systemic therapy determines whether lifesaving surgery is possible or if a different chemotherapy regimen is necessary.

This manual approach presents many challenges

Evaluating tumors is a time-consuming process for radiologists. And for each CT scan, typically only the two largest tumors are measured - possibly leaving vital clues hidden in the remaining tumors, if a patient has more than two. Furthermore, the manual assessment is prone to subjectivity, which results in variation of response evaluation among radiologists.

3D evaluation is also lacking, according to Kazemier. "A tumor might shrink but not symmetrically. This is difficult to quantify with the human eye," he explains. In other instances, tumors might change appearance, indicating there is less blood running through the metastasis - a positive sign of systemic therapy effectiveness, which is also hard for humans to detect.

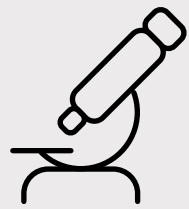
Then there is human error. Unfortunately, due to human limitations, radiologic errors happen, and a misdiagnosis can subject a patient to life-threatening risks, such as unnecessary surgery or chemotherapy.



AI will help us save lives...
I'm absolutely sure about that.

Dr. Geert Kazemier,
*Professor of Surgery and Director of Surgical
Oncology, Amsterdam UMC*

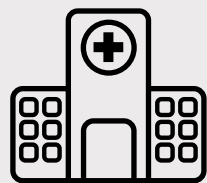
Facts & Figures



1,100
cancer researchers



1,000+
scientific articles published annually



One
of Europe's largest academic oncology centers

AI detects tumors faster and more accurately than humans

Together with SAS, Amsterdam UMC is transforming tumor evaluations with AI. It uses computer vision technology and deep learning models in [SAS Visual Data Mining and Machine Learning](#) to increase the speed and accuracy of chemotherapy response assessments. Data scientists also take advantage of the [SAS Deep Learning With Python \(DLPy\)](#) API to create deep learning models. Capabilities like automatic segmentation help doctors quickly identify changes in the shape and size of tumors and note their color.

"We're now capable of fully automating the response evaluation, and that's really big news," Kazemier says. "The process is not only faster but more accurate than when it's conducted by humans."

The project started by training a deep learning model with data from 52 cancer patients. Every pixel of 1,380 metastases was analyzed and segmented. This taught the system how to instantly identify tumor characteristics and share vital information with doctors.

Prior evaluation methods limited what doctors could see, but the AI models provide total tumor volume and a 3D representation of each tumor, allowing doctors to more accurately determine whether lifesaving surgery is viable or a different treatment strategy should be chosen.

"AI will help us save lives ... I'm absolutely sure about that," Kazemier says.

Advanced analytics for cancer researchers

Outside the clinic, the SAS Platform is also available to more than 1,100 Amsterdam UMC cancer researchers to enhance their research efforts. SAS Visual Analytics allows them to quickly spot hidden trends, while SAS Visual Statistics provides a powerful tool to perform advanced analytics and predictive modeling.

Additionally, SAS® Viya® supports the automatic translation of raw images to objective metrics in a clinical setting. Such automation will save radiologists a lot of time, while reducing the number of dangerous false negatives and false positives.

By running these solutions on SAS Viya, Amsterdam UMC gives researchers an open analytics platform to collaborate and obtain innovative results faster. Now, biologists, doctors, medical students and even business analysts working to improve the patient journey can benefit from analytics regardless of their data skills or coding language preference.

“There are a lot of people working with the SAS Platform who do not have analytic or data science training,” Kazemier says. “This is the next phase of analytics for us, and I see tremendous opportunities ahead.”

Explainable AI

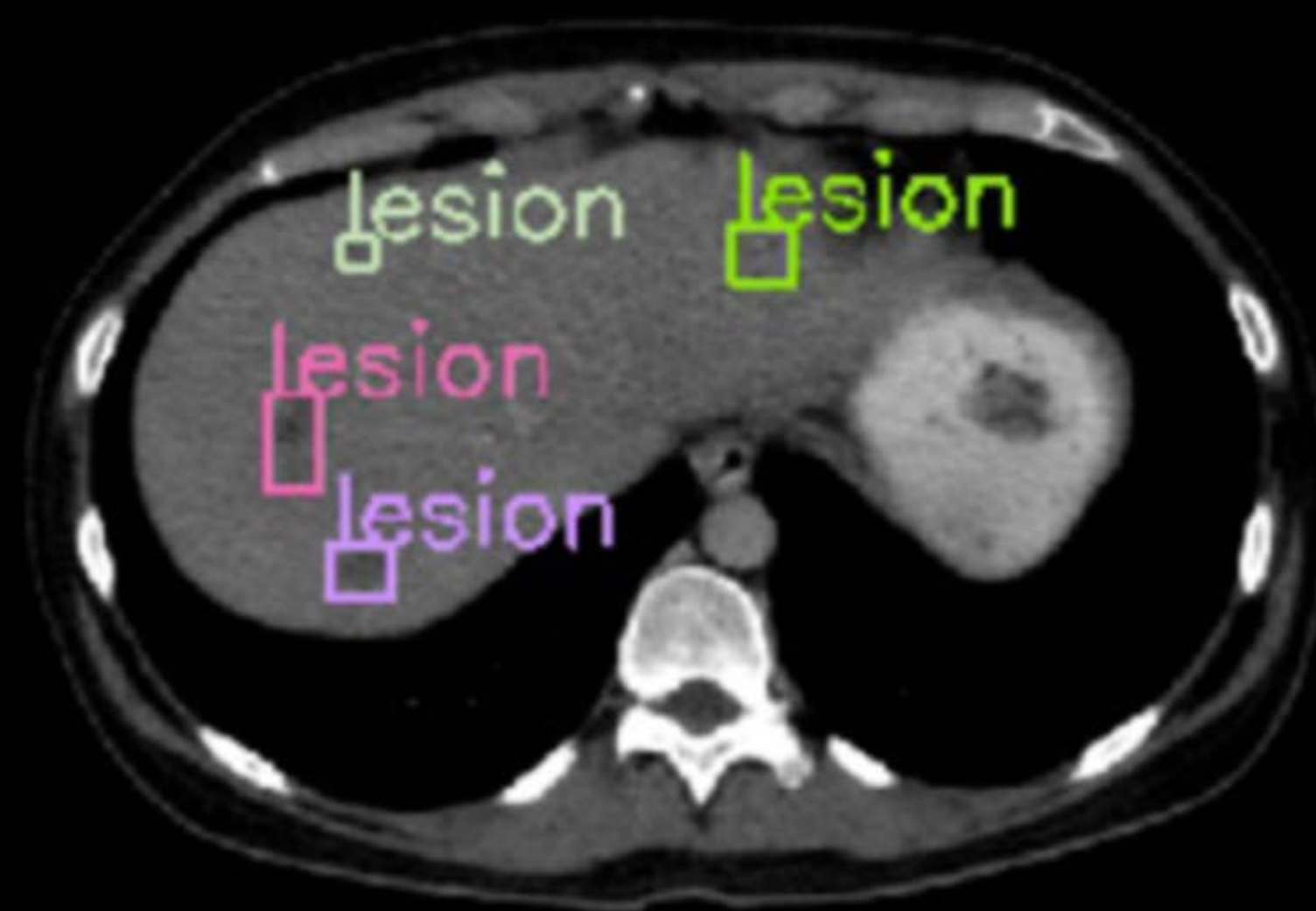
For Kazemier, AI technology must be transparent and open if it’s going to revolutionize health care. “If you create algorithms to help doctors make decisions, it should be explainable what that algorithm is actually doing,” he says. “Imagine if an algorithm came up with something bad for the patient and the doctor follows it. What’s the effect of that? To err is not only human.”

A critical factor in the ongoing deployment of analytics within clinical settings is to establish an end-to-end auditable and transparent process for decision management in health care. The SAS Platform provides a summary of how each analysis is performed, making it easier for doctors to track their models and algorithms. This improved collaboration between human and machine builds more trust in AI. This level of transparency attracted Kazemier to SAS.

“We needed an explainable model while still maintaining a high level of learning performance,” he says. “SAS was the most trustworthy solution we found.”

Looking forward, Kazemier sees a bigger role for AI at Amsterdam UMC.

“In the future, we may be able to predict the outcome of surgery and overall patient survival,” he says. “While we are currently using AI technology with colorectal liver cancer patients, AI has the potential to be used in assessing many solid tumor types, including breast and lung cancer. We have only touched the tip of the iceberg.”





Prime Therapeutics using AI to analyze prescription data, detect fraud

John Desmond, Editor, *AI Trends*

Prime Therapeutics, a drug cost management firm with 66,000 client pharmacies and 28 million members, is working with software supplier SAS to analyze prescription ordering data in an effort to identify fraud.

Owned by the Blue Cross Blue Shield health insurance organization, Prime Therapeutics is having some success in its efforts. The company referred \$30 million in potential fraud cases last year and is on a track to refer \$40 million in cases this year, said Jo-Ellen Abou Nader, a VP with Prime Therapeutics, in a meeting with AI Trends at the recent AI World Conference & Expo in Boston.

Health care fraud, waste and abuse (FWA) is estimated to cost \$68 billion annually, 3% of \$2.26 trillion spent on health care in the US, said Steve Kearney, Medical Director, SAS. The company's FWA products add a layer of analytics that can understand context, learn patterns and recognize objects. The tools can perform complex calculations on large data sets.

Today's fraud schemes can come from pharmacies, prescribers and members. Pharmacy schemes include duplicate billing and false claims. Prescriber schemes include medication duplicate billing and "pill mills" in which the volume of prescriptions filled dramatically exceeds the local population, suggesting the pills are being resold. Member schemes include doctor and pharmacy shopping and drug stockpiling.

"We have pharmacies trying to act as physicians," said Abou Nader of Prime Therapeutics. "That's a new scheme."

Another new one is a telemedicine scheme in which a company baits a patient into providing medical and card information, which is sent to a physician who writes a prescription for a high-cost topical ointment, for example. "There is no patient-physician relationship in these schemes," said Abou Nader.

AI running on powerful hardware is making the SAS FWA products more capable. "Now we can look at the entire data set," Kearney of SAS said.

One member, misrepresenting herself as a health care provider, obtained opioids from 18 pharmacies and 53 prescribers in one year. This person also had 58 emergency room visits during the year. The SAS and Prime Therapeutics fraud detection effort identified \$206,000 in fraudulent pharmacy and medical costs, and referred the case to the affected client.

SAS has built some social network analysis visualization tools resulted in one referral of \$700,000 in identified fraud. An investigation of a

pharmacy which was physician-owned and prescribed a high volume of opioids resulted in a referral of \$352,000 in identified fraud. The pharmacist was terminated from the network and referred to the Board of Pharmacy for further action.

The link analysis tool can show the web of interactions between physicians and pharmacies, a view not previously possible to see.

SAS working with Prime is staying abreast of more sophisticated and evolving health care fraud schemes, and the team is getting results. "People are going to jail," Abou Nader said. Staying ahead is hard work. "We have to constantly change and update our models," Kearney said.

Whereas Prime Therapeutics could only see prescription information across its networks in the US, now it has access to data on emergency room visits. However, while some states are collecting data on prescriptions, primarily to track opioids, the data is protected so that the insurance companies cannot access it. "There is an opportunity to share data, but we're not allowed to," Abou Nader said, noting that is subject to change as laws and regulations evolve. She noted that there is no common identification for individuals across the health system.

Article originally appeared in *AI Trends*, November 14, 2019. Reprinted with permission



Jo-Ellen Abou Nader
*Vice President, FWA & Supply Chain Optimization,
Prime Therapeutics*



Steve Kearney
Medical Director, SAS





The power of data-driven thinking in hospitals

By Dr. Joost Huiskens, Health Care Consultant, SAS

The amount of data collected and analyzed by hospitals and health care organizations across the world was already on the rise, but the global pandemic has sharpened the focus on data even more.

With trends changing not daily, but hourly, during the pandemic, health care professionals struggle to monitor larger intensive care capacities, track staff safety/fatigue and optimize every available resource. At the same time, decision makers must assimilate new research findings, adjust policies and do it all in real-time because acting quickly is a matter of life and death. During this crisis, it's no wonder that health care leaders turn to analytics to help them make data-informed decisions quickly.

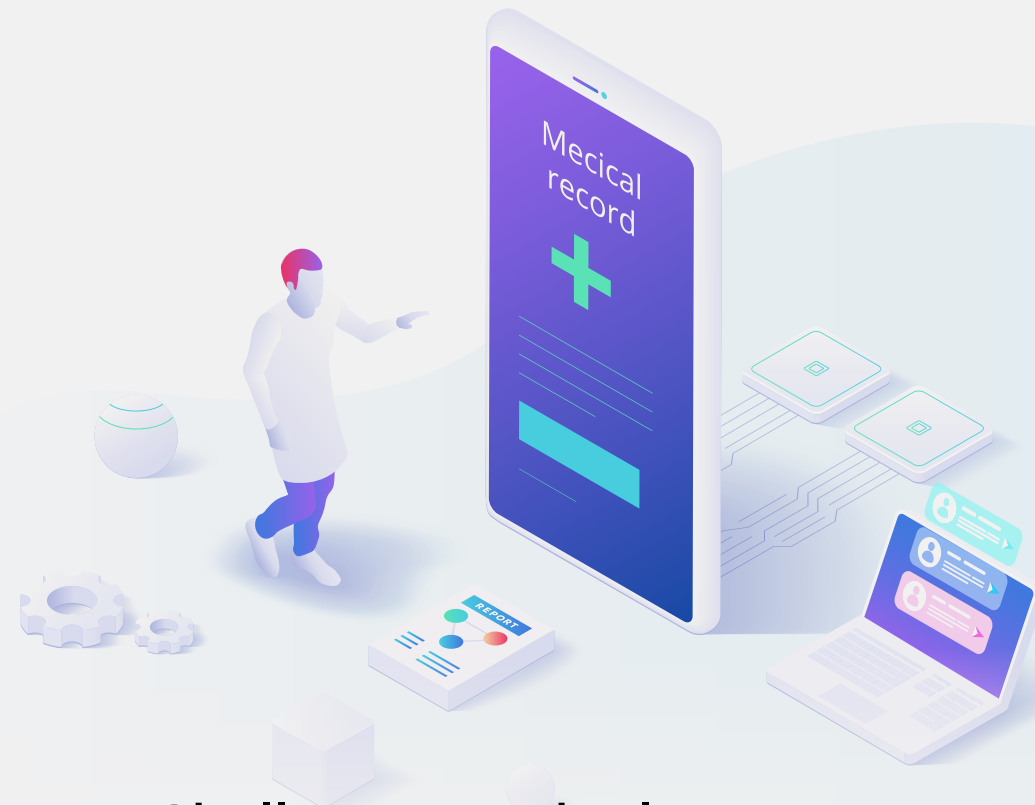
While the urgency of the pandemic may be pushing the health care industry to more rapidly adopt data and analytics for decision making, no one knows what the new normal will look like. To get a better idea of where we'll go from here, it may help to look at where the industry is with data and analytics overall today.

New sources of data

As data-generating technologies have proliferated throughout society and industry, leading hospitals are trying to ensure this data is harnessed to achieve the best outcomes for patients. These IoT technologies include everything from sensors that monitor patient health and the condition of machines to wearables and patients' own mobile phones. The network of these machines means that clinicians have an overview of everything happening in the hospital, and can be alerted in real time should an anomaly in the data reveal changes that need urgent attention.

This radical shift further toward data has the ability to support decisions made by doctors and ultimately improve patient outcomes. With the help of artificial intelligence (AI) and advanced algorithms, medical professionals will soon see their capabilities advanced by data, in everything from the logistics of prioritizing which patients to treat to how best to support them through diagnosis and treatment. These technologies are changing the way society manages health care - leading to healthier citizens with a longer life expectancy.





Challenges with electronic health records (EHR)

43%

said reporting and querying of EHR analytics are slow.

30%

felt challenged with interoperability with other systems.

28%

said EHR analytics lacks the visualization they need.

Source: How satisfied are health care organizations with EHR analytics?

Adopting new technologies

Health care providers and clinicians have never been slow to use technology to improve patient outcomes. They have, naturally, sometimes held back because of cost implications - MRI scanners are not cheap, for example. But they have always been quick to see the potential of new technology to help improve patient care.

AI, however, has been slower to take off. Somehow, many hospitals and health care providers do not seem to be ready for decision making supported by algorithms. Perhaps it's a change of culture and a concern about the explainability of decisions supported by a "black box." Perhaps personnel simply do not yet have the necessary skills and experience to take advantage of the insights locked in the data. Whatever the reason, it's been a fairly slow start.

But even before the push of the pandemic, a groundswell toward data-driven decision making was beginning. A number of leading health care organizations have started to embrace AI and analytics. They've often begun with small-scale projects, but there's growing recognition that the future lies in personalized health care - and that personalized medicine depends on data and advanced analytics.

AI offers a unique combination of quality and safety for patients, better outcomes and reduced costs. After all, getting the right medication or treatment quicker, with fewer side effects, is significantly cheaper than trying a number of expensive options first. It's also far better for patients.

A shift in culture will take us into the future

Now that the COVID-19 crisis is ushering in higher levels of analytics use, it seems likely that over the next three to five years more and more health care providers will become data-driven organizations. This will, in most cases, require a change in culture. Providers must move toward using data to generate insights that then drive decisions. It's likely that this acceptance will grow as organizations see what the early impact can be.

Providers will need to support the change in culture with changes in three other areas. The first is staff competence in using analytics and understanding the insights that emerge. It's vital that your staff understands the recommendations from the decision engine and can explain these to patients and colleagues. The second area is infrastructure. Hospitals will need suitable facilities and equipment to gather data and then analyze it. The third is a successful data strategy.

A successful data strategy starts now

A successful data-driven hospital needs to centralize its data strategy for business operations and care.

This means that health care providers must develop strong data and model governance. Staff and managers alike need to be sure that data quality is high and the outputs from models remain appropriate. Models are only as good as the data that's fed into them. And insights are only as good as the models.

It's not reasonable to expect the IT staff to be responsible for data that's input by clinicians. Clinicians, therefore, need to understand the benefits of high-quality data and take responsibility for ensuring that patient data is correct. This is a bit of a vicious/virtuous cycle. Until people see the benefits of decisions driven by reliable data, it's hard to persuade them that reliable data is important. However, without reliable data, it's impossible to generate the necessary impact. A strong data strategy - covering collection, assurance, preparation and use - will go a long way to help.

History in the making

Throughout history, advancements in health care have been met with varying degrees of skepticism by their contemporaries. The modern adoption of AI and data-driven practices could join Semmelweis' revolutionary handwashing discovery and breakthroughs with test tube babies in the 1970s. They're all procedures which require a cultural shift in thinking if they are to make a positive difference in people's lives.

While the pandemic crisis may be pushing the health care industry to make that cultural shift more quickly, it will be interesting to see what happens during pandemic recovery and potential future outbreaks. My hope is that the new normal will include widespread AI adoption because that will help improve patient care, reduce costs and achieve better outcomes.

Find out more about use of [AI in health care](#).





AI enlisted to track complex chemical interactions in people

Alex Woodie, Managing Editor, *Datanami*

If you like multivariate statistics, then you're going to love what Melissa Strong, PhD, is doing at IndiOmics, the biotechnology company she founded to gain a greater understanding on how chemicals interact with – and possibly harm – people that come into contact with them every day.

For starters, there are about 84,000 chemicals registered with the Environmental Protection Agency (EPA), according to Strong. From sunscreens and pesticides to plasticizers and hardeners, the average American contains within their body a unique chemical cocktail brewed from their specific path through this world.

Factor in different genetics, medical histories, and environmental factors, and you have the sort of combinatorial explosion that is unworkable in the traditional scientific sense. "It's never only X and Y," Strong says. "It's A through X and Y. It's honestly A-Z and another set of A-Z."

Strong concedes that the large number of variables makes it impossible to do the sort of controlled study that is the gold standard among scientists. Ethics also precludes researchers from injecting possibly carcinogenic material into humans to see what happens. (Finding a control group that is free from chemical contamination poses another problem.)

But the inability to do double-blind studies doesn't mean there's no path forward for studying how chemicals interact with human physiology. It just means that researchers need to adapt their methods to the reality of the situation. The good news – if it can be called that – is that the world presents a huge pool of chemistry-laden candidates for studying human-chemical interactions. All it needs is somebody to start sorting it out.

That's essentially what [IndiOmics](#) is setting out to do.

Familial chemistry

Growing up in eastern North Carolina, Strong became aware at a young age the negative impact that chemicals can have on people's lives. When her brother was born with a brain abnormality, doctors looked for signs of the

problem in the Strong family's genetic profile. When nothing could be found, concerns turned to environmental variables.

A possible culprit to the brain abnormality was found when a local dry cleaning company was discovered to be disposing of chemicals by pouring them down the drain. The chemicals seeped into the groundwater supply, and eventually into the well serving Strong's home.



Strong's brother wasn't the only person in the area who suffered from possible effects of illegal chemical dumping. Clusters of diseases popped up in the area around Wilmington, Jacksonville, and Marine Corps Base Camp Lejeune, including an unusually large number of male military veterans who developed breast cancer.

"Plenty of people had children born with congenital effects," Strong tells Datanami in a recent interview. "It was all linked to the same case – dry cleaning solvents and other things that were getting dumped on base in the '70s, '80s, and '90s. When you have clusters like that, the epidemiology gets really compelling to say, okay, we have a known group of people, known exposure, known health effects. It would almost be impossible to say this could have happened any other way."

AI to the rescue

Based in Wilmington, NC, IndiOmics is tackling the problem in several ways. That includes a detailed questionnaire on individuals' histories; wet lab work to explore impacts of specific chemicals on living tissue; and data science and computer modeling work that harnesses the results of the questionnaire and lab work, as well as data from other sources, such as the [CDC's annual report on exposure to environmental chemicals](#).

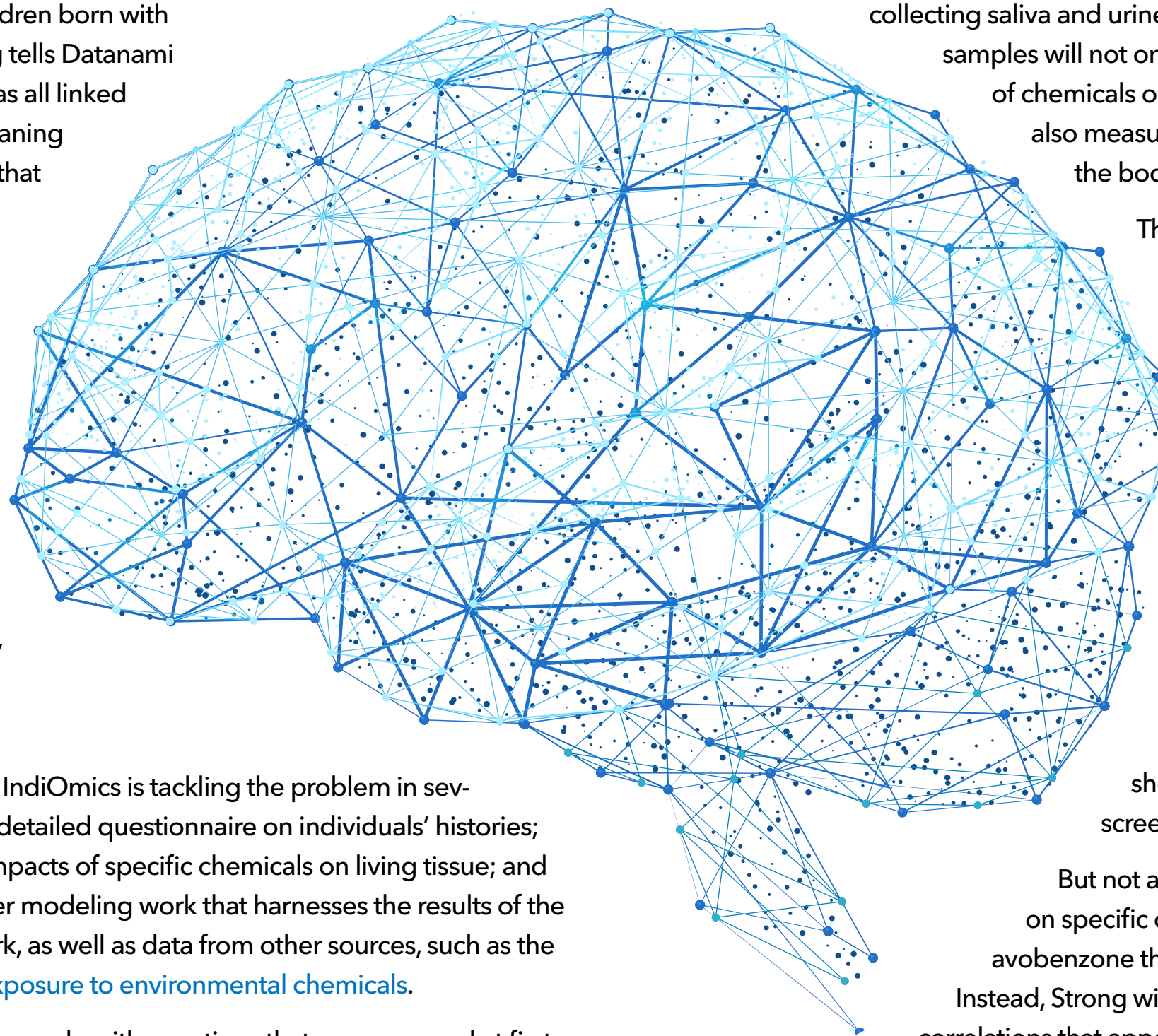
The questionnaire probes people with questions that seem unusual at first. Do you use plastic containers to heat food or liquids in the microwave? Do

you park in a closed garage connected to the house? Do you use sunscreen? Do you drink well water? Were you breastfed as an infant? Did you eat school lunch when you were a child? The answers to these questions provide important variables into discerning the pathways that chemicals take into our bodies.

IndiOmics is currently recruiting individuals for the next phase of its research: collecting saliva and urine samples for laboratory testing. These samples will not only indicate whether traces of hundreds of chemicals or their metabolites are present, but also measure the inflammatory response of the body.

Through its various efforts, the company is taking both a broad and a narrow approach to identifying links between chemical exposure and incidence of disease. For instance, during the recent SAS Global Forum in Dallas, Texas, Strong was invited on stage to demonstrate the use of SAS software to identify correlations between sunscreen use and cancer. In the demo, which used CDC data, Strong used SAS software's automated machine learning function to show that chemicals contained in sunscreens were highly correlated with cancer.

But not all of IndiOmics efforts will be focused on specific chemicals, like the oxybenzone and avobenzone that are often found in sunscreens today. Instead, Strong will be on the lookout for unanticipated correlations that appear out of the blue.



“It’s easier to focus on specific exposures in some cases,” Strong says. “But a lot of the unanswered science is how this very large mixture, a cocktail of chemicals, is interacting in thousands of people across the board. We don’t only want to include people who have been highly exposed. We actually want a diverse population of individuals to answer these questions as directly as possible. So in that case, we’re doing a larger sweep of known exposure and different markers.”

Minimizing uncertainty

Strong has several goals in mind for the company. First and foremost, she hopes to discover ways that chemicals are hurting people’s health. To that end, she has connections with several state and federal agencies that are willing to take a look at her research, ostensibly for possible civil or criminal actions.

But IndiOmics has other goals. The company started life as a nonprofit, but now Strong is using the social enterprise business model. To that end, Strong envisions something along the lines of the 23 and Me business model: selling chemical-testing kits to individuals and presenting the physiological results in an easy-to-consume dashboard, complete with personalized recommendations. Eventually, even insurance companies may pay for the kits, if it improves people’s health, she says.

Not only have data science tools grown more robust, but the amount of data that’s available to be analyzed has grown tremendously in recent years, Strong says. “People are very eager at this point for reliable conclusions, produced by professionals using ML and AI.”

However, considering the previously discussed inability to conduct rigorous scientific studies, Strong recognizes that extreme care must be taken in how the data is collected and analyzed. Without the ability to determine causation with 100% certainty, the best that Strong can do will be amassing correlations between causes and effects that are so compelling that they can’t be dismissed.

That will require minimizing the level of uncertainty to an acceptable point. It also impacts how one talks about it.

“To get to causation, conventionally, you’re going to have to design a controlled study to really minimize the influence of outside variables, which is obviously going to be very hard if you’re talking about a cocktail of chemicals,” Strong says.

“I might not be able to say ‘X causes cancer.’ But I’m going to say, A-Z, this unique combination in this person, is highly correlated with increased risk for disease now and in the future,” she continues. “We’re going to get to where we say ‘more likely than not.’ That’s usually how it’s going to be worded, legally.”

If Strong’s data science work has the sort of impact that she envisions - where human bodies are no longer the unintended petri dishes for millions of chemical experiments - then the words we use to talk about it will not be important at all.

Article originally appeared in *Datanami*, July 1, 2019. Reprinted with permission.



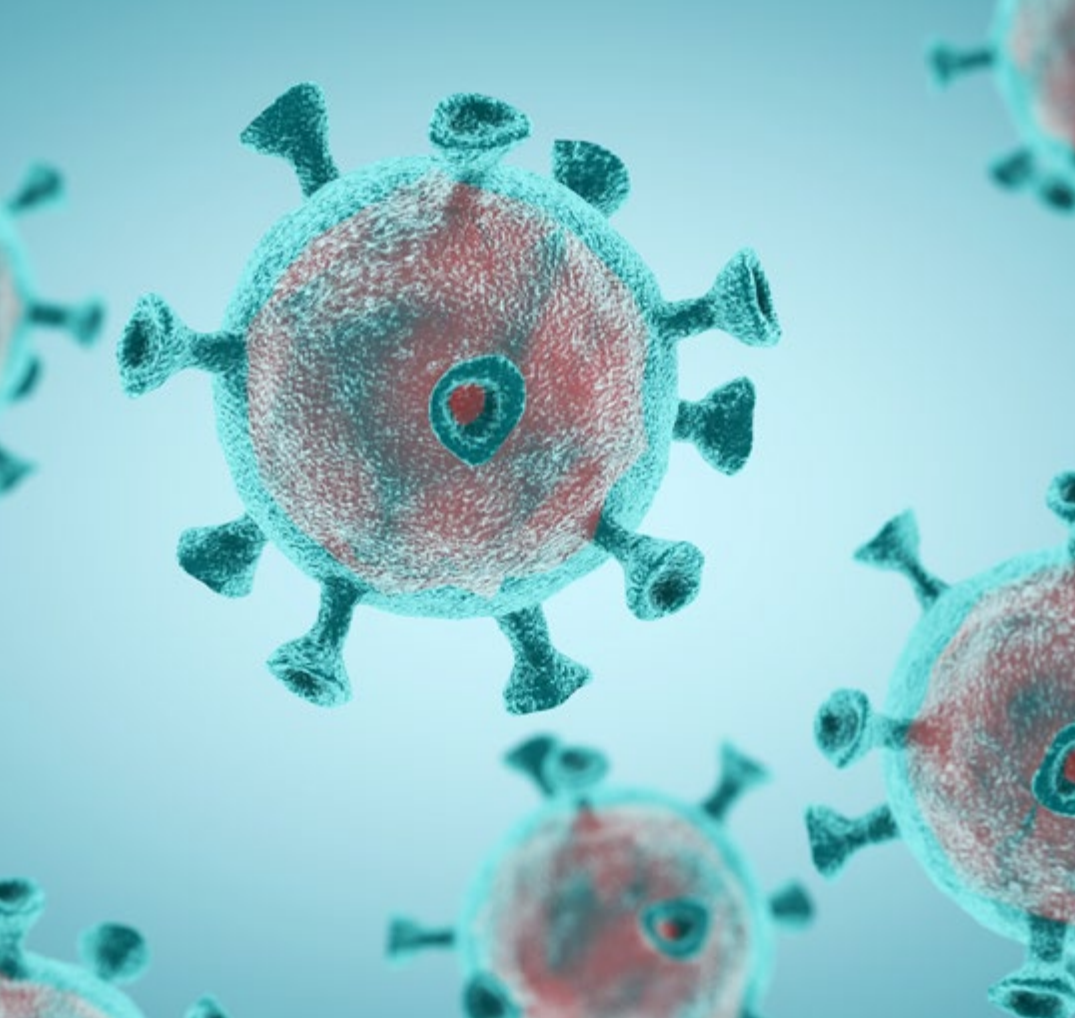


Figure 1: Dashboard view

Tracking the coronavirus outbreak

Since its initial reporting in Wuhan City on Dec. 31, 2019, the new coronavirus (SARS-CoV-2) has spread in a global outbreak, causing the COVID-19 acute respiratory disease that has infected millions and killed hundreds of thousands in more than 190 countries.

At SAS, we're using our most advanced technology to help our customers across every industry combat the coronavirus outbreak. For example, SAS experts created a dashboard for an overview and trend analysis of the outbreak (see Figures 1 and 2 to the right). Explore the dashboard and more on the SAS COVID-19 Resource Hub.

[EXPLORE THE SAS COVID-19 RESOURCE HUB](#)



Figure 2: Location analysis

Check out the full dashboard for country-specific data, a time-series animation that demonstrates the spread of the virus across the globe, trend analysis and more. As the data and this outbreak evolve, our analytics and reports will evolve to be even more meaningful to the global health community.

STRENGTH IN NUMBERS

At this moment, the world is focused on solving one problem. That's why we're partnering with organizations worldwide to put analytics to work where it's needed most.

- We are helping hospitals use predictive analytics to allocate critical, high-demand resources.
- We are collaborating with public health officials to build epidemiology models based on local data to forecast impacts on populations and infrastructure.
- We are working with governments to optimize resources so citizens get the best health outcomes possible.
- We are helping agencies with contact tracing using social network analytics to determine and visually track potential exposure.
- We are engaging with health systems to build capacity before it's needed using scenario analysis.
- We are enabling producers of vital goods like food and medical supplies to forecast changes so they can adapt production and supply chain.

The variables are many. But the world is proving there is clarity and strength in numbers. Because good data and good decisions will save lives and help us get better together.

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