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AI Powers Surveillance at Warp Speed

#3 in the 5 Forces for the Future Series

Throughout the coronavirus pandemic, the industry has witnessed the power of clinical surveillance. With a broad array of discrete tests that can identify a COVID-19 infection, health systems and public health authorities have needed a way to interpret and track the patients with infections.

By associating signs and symptoms, clinical surveillance has paved the way to better predict and prevent an escalation of the virus. But as valuable as those contributions are, they are only a glimpse of clinical surveillance's potential.

Connecting the Dots with Surveillance

When the pandemic hit, healthcare organizations quickly pivoted to incorporate COVID-19 updates into their clinical surveillance activities.

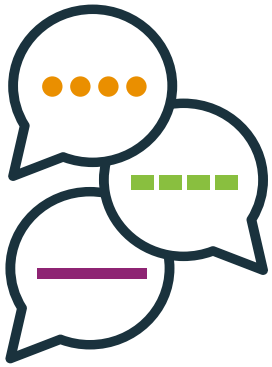
With a centralized, global view of COVID-19 cases, coupled with real-time alerting, hospitals and healthcare systems have been able to proactively monitor patient status for earlier interventions and expand data flow in meaningful ways.

Critical patient dimensions tracked have included age, where the disease was likely contracted, whether the patient was tested, and how long the patient was in the ICU, to name a few.

Surveillance was able to factor in whether patients had pre-existing conditions and problems with blood clotting, for example. This data trail helps providers create a constantly evolving coronavirus profile and provides key data points for them to report to state or local governments and public health agencies.

Without any other ways to piece together seemingly disconnected information, clinical surveillance now brings together information from different parts of the hospital and clinics into a consolidated view of COVID treatment, such as lab results, patient data, co-morbidities, mortality, and medications.

81% **Hospital executives say artificial intelligence is a good thing for healthcare.[1]**



The Language of Medicine

Clinical surveillance is powered by data. When data is coupled with evidence-based clinical decision support, a single source of truth can connect the associated symptoms that come with the disease, helping to surface how fast a disease is spreading and what the lab tests show.

Keeping pace with the latest changes to medical terminology and the associated diagnosis and procedure codes not only helps secure funding and reimbursement but also is essential to identifying clinical patterns.

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COVID-19 Fast Tracked AI

While normally slow to adopt technology, many health systems have transitioned to figuring out the patterns in COVID-19 and better predicting respiratory and organ failures associated with the virus. And since COVID-19 puts people at risk of developing sepsis, they have also needed to flag those most at risk. It was trial-by-fire with many fast-tracking tools powered by artificial intelligence (AI). This health crisis provides a sense of what may be possible to predict and prevent a range of chronic health concerns. This technology can then save lives and dollars for conditions that have proved resistant to prevention.

Achieving those savings depends on: 1) refining the use of AI for clinical surveillance; 2) expanding access to everything from electronic health records (EHR) to information that lives outside of direct clinical settings, from the *omics* through the social determinants of health; and 3) distinguishing AI hype from solutions that deliver proven, actionable insights for specific clinical concerns.

Looking Back with a Vision for the Future

While COVID-19 seemed to be a testing ground for machine learning and AI, the industry had been working for some time to harness technology's power for healthcare-associated infections (HAI). Publicly reported data shows HAIs cost the US healthcare system up to $45 billion annually.[2] On any given day, about one in 31 patients will have at least one HAI.[3] *C. difficile infections (C. diff)* is one such example. *C. diff* increases mortality risk and length of stay for inpatients and puts hospitals at risk for financial penalties. However, machine learning can predict patients who are at risk for *C. diff* infection and, therefore, empower clinicians to respond more quickly to treat patients and prevent spread in the hospitals.

Machine learning analyzes hundreds of thousands of factors that could contribute to *C. diff*, as well as how those factors might interact. It continuously learns and incorporates new data.

When used in a clinical surveillance system, machine learning can highlight at-risk patients before their infection progresses — introducing variables that far too often clinicians find difficult to spot while juggling their multiple patients — as well as conditions that fall outside of what they typically see.

Top 3 Uses of Surveillance Today[4]

Preventing adverse drug events

Antimicrobial stewardship

Creating patient safety alerts

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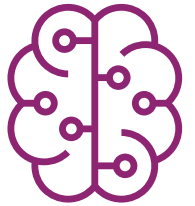
As researchers know well, rules-based systems are less efficient for these “edge” cases because each new data element necessitates a new rule. Complex cases such as COVID-19, *C. diff*, and even sepsis can benefit from AI at warp speed to help hospitals and communities act before clusters, outbreaks, or critical medical emergencies escalate.

AI-based clinical surveillance can uniquely track when relevant factors occur and understand how timing figures into interactions. Incorporating time is complicated, but knowing when there has been an increase or decrease in the white blood cell count, for example, is critical to making accurate *C. diff* predictions.



Machine learning can predict patients who are at risk for healthcare-associated infections.

AI Accelerating Results

3 “must haves” to advance trust in AI prediction and detection.

Expand data access.
Volume and variety of information are central to AI’s predictive power; optimizing emerging tools depends on comprehensive data access throughout the healthcare ecosystem. Data scientists must commit to rigorous testing across multiple parameters to avoid gaming of results and bias.

Foster focused collaboration.
Scientists and technologists must work collaboratively with expert clinicians to incorporate thousands of inputs: lab results, white blood cell count, bilirubin, neutrophils, vital signs, medicine administration, concentrations and durations of medications, duration in hospital, patient and hospital demographics — to name a few.

For each organ- or condition-specific version of an AI surveillance solution, clinicians should play a role in the validation process and in feature engineering so that the solution can deliver customizable, actionable risk scores that clinicians will use.

Support transparency.
By providing a visual picture of its output that illustrates how and why AI made the predictions, these surveillance solutions should enable clinicians to apply their own clinical judgment to the output. Any AI-enabled tool should do the same to help foster clinician buy-in and the change management necessary for widespread adoption.

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Half Million *C. diff* infections each year in the US, responsible for about 29,000 deaths[4]

$28 – $45 Billion the direct cost of HAIs to US hospitals each year[4]

1 in 31 hospital patients have at least one HAI on any given day[3]

Where Do We Go from Here?

In healthcare organizations around the world, these types of predictions will ultimately make an enormous difference in clinical emergencies such as brain injury, cardiac distress, and respiratory failure — situations for which minutes can be the difference between life and death.

AI-enabled clinical surveillance has the potential to deliver next-generation decision-support tools that combine the powerful technology, the prevention focus of public health, and the diagnosis and treatment expertise of clinicians. As such, surveillance can assume a major role in attaining the quality and cost outcomes our industry has long sought.

Read more insights and best practices on the 5 Forces here.

"Wolters Kluwer predicted 75% of C. diff infections from its machine learning model, validating the high performance of the model.

*In a separate effort, AI was able to identify patients at risk for the condition more than **six days before** C. diff occurrence. The early warning gives clinicians a head start to take actions that range from discontinuing proton-pump inhibitors to changing or discontinuing antibiotics."*

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4 Sage Growth Partners, Survey of 100 health executives.