

Decentralized PCR testing and the Quadruple Aim

Insights for health systems





To optimize performance, many hospitals and health systems have turned to the Quadruple Aim framework, which focuses on both patient and clinician experience as well as organizational financial performance and population health. Organizations have come to realize, especially in the wake of the COVID-19 pandemic, that diagnostics – in particular, point-of-care testing (POCT) or decentralized testing – can play a central role in all these domains.

The term point-of-care testing is used to describe bedside testing or near-patient testing that is intended to provide more rapid test results than can be achieved in central or satellite laboratory settings. Other key characteristics of POCT are summarized below.

Becker's Hospital Review recently spoke with Dennis Deruelle, MD, practicing physician and CEO/founder of Hospitalist Information Partners, about how decentralized PCR testing supports the Quadruple Aim.



Laboratory tests can be performed outside of a central laboratory.



There is minimal sample preparation.



There are minimal pipetting steps.



Ready-to-use reagents (e.g., cassettes or single-use devices) are present.



It is easy to use/administer, and no pertinent medical technical qualifications are needed for operating the device.



Testing performance is high quality and results are available quickly.



Results lead to a rapid diagnosis or consequences for treatment.



Minimal hands-on time and low specimen volume are required.



Can operate under CLIA certificate of waiver.

What is the Quadruple Aim?

Several years ago, the [Institute for Healthcare Improvement \(IHI\)](#) created a framework called the Triple Aim, which addresses three priorities:

1. Improving the patient experience
2. Enhancing the health of populations
3. Reducing the per capita cost of care

Over time, other organizations have expanded this framework, adding a fourth element – the provider experience – resulting in the Quadruple Aim.

The healthcare industry had to respond with urgency and ingenuity to navigate the many challenges associated with the COVID-19 pandemic, which affected all four aspects of the Quadruple Aim. One important diagnostic tool that was widely used was PCR testing, which continues to be an important solution in today's post-pandemic world.

“During COVID-19, we saw innovation and inventiveness that changed healthcare forever,” Dr. Deruelle said. “Providers in the hospital were totally overwhelmed and point-of-care testing eased the burden. Faster results meant I could start treating patients sooner.”



Timely test results were critical during the pandemic, as certain treatments for COVID-19, like Remdesivir (Veklury®) and Nirmatrelvir/Ritonavir (Paxlovid™), must be administered within a certain time period. The same principle applies to other diseases, such as sepsis, that have a limited window of time during which patients can be treated effectively without further disease progression.

Figure 1: The Quadruple Aim





Why decentralized testing is so important

Near-patient or point-of-care testing empowers healthcare staff with diagnostic information to make expedient treatment decision and get patients on the appropriate clinical pathway. A decentralized testing infrastructure throughout a health system's ecosystem (emergency department, outpatient clinic, urgent care, physician office) delivers many benefits including but not limited to:

- Timely and appropriate patient treatment
- Reduced unnecessary testing
- Improved antimicrobial stewardship
- Reduced overuse/misuse of antibiotics
- Decreased length of stay
- Reduced readmissions

There are clear advantages to rapid and accurate POCT for COVID-19. Identifying those infected and rapidly instituting measures to prevent spread is important, though doing so near the patient is, arguably, of even greater importance.

Patients who come to a centralized location for rapid testing can potentially lead to increased concentrations of infected individuals, creating unnecessary risk to patients and care providers. These risks are not limited to the testing site; the use of public transit may indirectly spread infectious diseases, such as COVID-19, in route to centralized testing locations. Furthermore, some patients may have no means of travel, so without decentralized testing options, they may never be tested at all – increasing the disease burden. Decentralized testing is a strategy for addressing these disparities.

Decentralized testing for COVID-19 also addresses some unique specimen transport issues that evolved during the outbreak. Results are needed rapidly, and testing volumes have become higher than any other test performed. Centralized testing requires high volumes of couriers to assure specimens collected from all the sites they serve are quickly transported. By moving the testing closer to the patient, resources dedicated to specimen transport can be redirected elsewhere.



Population health: Decentralized PCR testing data supports disease tracking and antibiotic stewardship

The clinical laboratory is playing an increasingly important role in efforts to improve population health. A new movement called [Clinical Lab 2.0](#) suggests that the traditional, transactional laboratory model is evolving into a new business model that leverages longitudinal laboratory data to produce actionable clinical insights and better patient outcomes.

Connected, decentralized PCR testing improves population health by enabling seamless exchange of healthcare data between providers, payers and other key stakeholders. Decentralized testing requires data integration, which can minimize gaps in provider handoffs, as well as sophisticated analytics.

“Incorporating test results into the electronic medical record is essential,” Dr. Deruelle said. “If patients are transferred between facilities, for example, providers need access to those test results.”

Today’s PCR systems reduce the risk of misdiagnoses and give providers unprecedented access to fast, accurate test results. The data from PCR testing can interface with analytics platforms which provide statistical analyses that health systems and public health authorities can use to track and follow endemic and epidemic outbreaks.

Another major public health concern is antimicrobial resistance. As a result, providers try to avoid unnecessary use of antibiotics whenever possible. Rapid molecular test results have the ability to differentiate certain types of bacterial or viral infections and can help hospitals and health systems attain antimicrobial stewardship goals.

“Appropriate use of antibiotics has a large impact on quality, but there are often conflicting dynamics when prescribing antibiotics,” Dr. Deruelle said. “We want to treat sepsis as early as possible, but on the other hand, we don’t want to overtreat conditions that don’t require antibiotics. Test results can help guide treatment plans early on by ruling a diagnosis in or out.”



Case Study: Decentralized Molecular Influenza Testing at Sanford Health

Sioux Falls, S.D.-based Sanford Health is an integrated health system with 44 medical centers and 482 clinics in nine states. To provide a consistent, high-quality patient experience, regardless of the facility a patient accessed, Sanford Health wanted a standardized solution for influenza testing. Prior to seeking standardization, Sanford Health had five different flu test methods via multiple vendors.

Sanford Health was looking for a technology that was rapid, accurate, easy-to-use and had a broad test menu with the potential to bring molecular testing to all sites, whether large or small, urban or rural.

A comprehensive evaluation process comparing three different molecular systems led Sanford Health to select Cepheid's platform. Key criteria included test performance, workflow, test menu, scalability and financial considerations. Following this evaluation, Sanford Health has implemented Cepheid's rapid molecular testing platform at 70 sites. "Decentralized flu testing can be achieved by using the right technology and vendor partnership," said Jody Thompson, MD, Sanford Health's molecular technical director.

See the [full case study](#) about Sanford Health's experience implementing decentralized molecular influenza testing.

The patient experience: Consumerism is driving one-stop care and hospital-at-home initiatives

Innovative and decentralized PCR testing can improve the patient experience by meeting consumer expectations, streamlining care delivery and giving providers a more inclusive and robust picture of a patient's care needs.

"Consumerism is having a significant impact on the patient experience," Dr. Deruelle said. "People want one-stop care and they don't want to wait. They want to get tested, get the results and get treatment at one appointment. Point-of-care or decentralized PCR testing is how to do that."

Other advancements improving the patient experience include transitioning to telemedicine, telehealth and home-based healthcare. These care models, however, require innovations in care delivery. "Medicare's approval of telehealth for the original visit was a tectonic shift," Dr. Deruelle said. "Treating people at home and keeping them out of the hospital is going to become more common. Caring for people in the home requires more accurate point-of-care testing, as well as a mobile system of collecting test specimens."

The next frontier in decentralized diagnostic testing may be tests that patients can use themselves, at home. "Patients want more personalized testing, especially for STDs and UTIs," Dr. Deruelle said. "That's another major shift that introduces a new set of challenges. What will the next step be when a patient does a test on their own? Who will guide the treatment?"



Provider satisfaction: Fast access to test results improves patient flow + reduces workplace stress

Addressing clinician burnout is a top priority for hospitals and health systems. Decentralized PCR testing can address this concern by increasing the certainty of diagnoses, as well as improving patient flow.

"In medicine, physicians accept uncertainty, but we don't like it. We are always seeking to reduce it," Dr. Deruelle said. "We want to feel confident in our diagnoses and treatment plans. Getting test results faster can help. In some cases, we can complete the patient's journey during a 'micro visit' to the office, rather than through a hospitalization."

Anything that moves patients through the system faster increases throughput and patients' access to care, and improves flow. Access to test results can empower providers to discharge patients from an emergency room, observation visit or to a hospital admission faster with greater safety.

"Healthcare organizations are still struggling to manage spikes in patient volume, and testing has a direct impact on capacity," Dr. Deruelle said. "If you can't get a urine culture back for four days and someone's been in the hospital already for three days, you must decide whether to treat without the test results or keep that person in the hospital. Faster access to test results frees capacity and lowers stress for employees at all levels of the organization."



The cost of care: Better diagnostic information can improve capacity + decrease hospital admissions

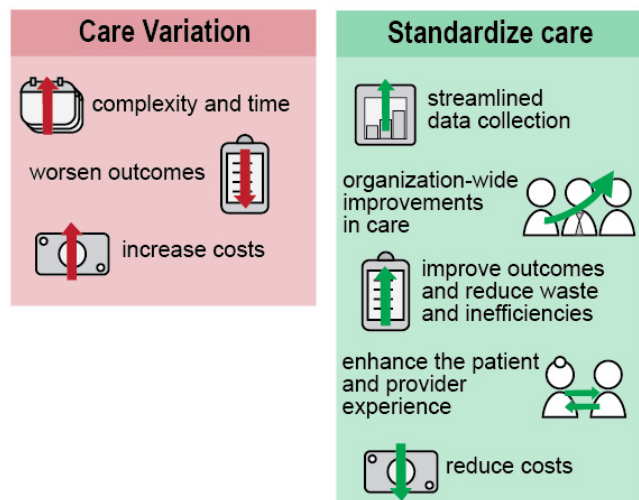
Amid healthcare’s ongoing labor shortage, maintaining capacity is critical. Patient flow is never constant, so hospitals and health systems are always trying to match patient volumes with staffing levels. When capacity is available in the system, patient flow can be handled in a more predictable way and more patients can be served in an efficient manner.

“Accurate, fast test results allow providers to triage faster and route patients to different care settings, potentially avoiding admissions,” Dr. Deruelle said. “Decentralized PCR testing creates capacity and can help patients avoid costly healthcare episodes.”

Novel care settings like urgent care clinics, freestanding emergency departments and micro hospitals are a growing trend that might benefit from access to decentralized PCR testing. “During COVID-19, conducting tests on location without shipping samples to a main hospital was a key innovation that maintained the patient flow,” Dr. Deruelle said. “Once facilities have decentralized PCR testing, they can avoid delay and keep the patient flow moving.”

The role of standardization in improving care, provider satisfaction and reducing waste

A significant challenge within healthcare is the issue of care variation. Care variation can add complexity and time, worsen outcomes and increase costs. As a result, some healthcare organizations have implemented initiatives to standardize care, which helps to ensure consistent clinical processes and treatment pathways. Standardization can enable streamlined data collection, drive organization-wide improvements in care, enhance the patient and provider experience, improve outcomes and reduce waste and inefficiencies – and thereby reduce costs.



When POCT such as decentralized PCR testing is standardized effectively, healthcare organizations can realize similar efficiencies and empower clinical staff. Having clear standards for decentralized PCR testing can contribute to broader initiatives that promote consistency and uniformity in care, which may advance the pillars of the Quadruple Aim.

Looking ahead: a pathway for pursuing the Quadruple Aim

As healthcare organizations embrace the Quadruple Aim, decentralized PCR diagnostic testing can be an important part of their toolkit. Effective PCR solutions drive better patient outcomes, improve population health, reduce the risk of misdiagnosis, promote operational efficiency and reduce provider burnout in the process. Further, decentralized PCR testing can increase productivity, help to prevent human errors and promote a better healthcare experience for patients and clinicians alike.

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