



Cover Story

# Smart Diagnostics



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# Improving Diagnosis Through Technology

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As we continue to explore how technology can be used in the diagnostic process, we need to ensure that technology drives diagnostic quality, improving the connection between clinicians and patients in order to provide safe, effective and efficient care.



## Key Points

- With the rapid advances in healthcare technology, careful consideration is needed as to how to integrate it into the clinical diagnostic processes.
- Technology interventions that improve diagnostic quality and safety must consider not only individual cognitive factors but also system factors.
- Five drivers are described, which are key to improving diagnostic quality.
- The COVID-19 pandemic has seen increased adoption of telehealth, but the challenges of this format, including for diagnostics, are yet to be identified.

Evolving technology in healthcare continues to shape the way we provide care to patients. Advances in artificial intelligence, data generated by patients using wearable and smartphone technology, and the involvement of technology companies, such as Google, Apple and Amazon, in healthcare hold great promise in improving clinicians' ability to diagnose and treat patients, as well as improving quality and safety of care. However, safe use of technology and using technology to improve safety requires careful consideration of how it will be integrated into clinical diagnostic processes and how it can enhance communication between patients and clinicians.

Safe, effective and efficient care starts with the diagnosis. Unfortunately, the World Health Organization (2016) reports that diagnostic errors are relatively common and most people will likely experience a diagnostic error in their lifetime, sometimes with devastating consequences. While this finding relies primarily on U.S. data, evidence suggests that same is true in Europe and Asia. Working in partnership with patients, their families, the healthcare community and interested stakeholders, the Society to Improve Diagnosis in Medicine ([SIDM](#)) seeks to catalyse and lead change to improve diagnosis and eliminate harm from diagnostic error. Diagnostic error is defined as "the failure to (a) establish an accurate and timely explanation of the patient's health problem(s) or (b) communicate that explanation to the patient" (National Academies of Sciences, Engineering, and Medicine 2015).

## Five Drivers for Diagnostic Quality

Because the diagnostic process can be complex, technology interventions that improve diagnostic quality and safety must consider not only individual cognitive factors but also system factors. Taking these factors into consideration, SIDM, in collaboration with the Health Research and Educational Trust (HRET) Hospital Improvement Innovation Network (HIIN), developed a [Change Package](#) that identified five drivers that improve diagnostic quality (Health Research & Educational Trust 2018).

- **Effective teamwork** – refers to skills and competencies of an interdependent, multidisciplinary team that includes patients and their families. The teams apply safety culture principles and practices focussed on active engagement of patients, families and caregivers. Making explicit each team member's role and responsibilities in the diagnostic process, then reinforcing these expectations regularly throughout a patient's clinical visit is vital. Organisations must also build in structures (i.e. processes, technology, or tools) to support and ensure effective communication amongst care team members and during handoffs.

- **Reliable diagnostic process** – describes the system of people, processes and environment involved in achieving accurate, timely and communicated diagnosis. Specifically, this refers to organisational structures that optimise diagnostic safety, clinical operations and workflow that supports

accurate and timely clinical information, and processes that ensure accessibility to specialty expertise. This can include forcing functions to help manage alerts and results or mechanisms for patients and families to provide ongoing feedback on the diagnostic process.

- **Engaged patients and family members** – refers to actions taken by the patient and family members working in active partnership with the care team. Engaged patients are empowered to participate in their care and participate in shared decision-making about goals related to diagnosis and care. Patients and families can also engage at an organisational level through participation in advisory councils and quality improvement teams.

- **Optimising cognitive performance** – refers to supporting the process of clinical reasoning including the integration of clinical knowledge and information derived from the patient, family or other members of the care team. This includes effective clinical decision support, education and forums that foster clinical expertise, as well as techniques that encourage reflection on clinical reasoning and decisions.

- **Robust learning systems** – the structures and processes for creating, retaining and transferring knowledge within a team to support organisational learning. This refers to formal integration of diagnostic quality and safety into organisational performance improvement. Activities can include root cause analysis of diagnostic error to methods for providing feedback on diagnostic performance for learning and improvement.

Technology interventions can target a single driver, but typically have greater impact and effectiveness when they address multiple drivers. For example, technology that increases patient, family and caregiver access to the clinical documentation (e.g. [OpenNotes](#)), enhances transparency, promotes ‘effective teamwork’ amongst care team members, and facilitates ‘engaged patients and family members.’ When patients and families review the clinical documentation and provide feedback to the clinician on diagnostic performance, it supports a more ‘robust learning system.’ Data mining approaches have been employed to support ‘reliable diagnostic processes’ by identifying delayed tests and missed follow-up appointments (Evenson and Kerby 2018). Patients and clinicians can then be contacted to reduce preventable delays in diagnosis supporting effective teamwork and robust learning systems. Machine learning and collective intelligence have been used to develop clinical decision support tools to optimise ‘cognitive performance’ and overcome biases (i.e. VisualDx, Isabel, [Dxplain](#), or [Human Dx](#)). These approaches

have also been used to support visual assessments in radiology and pathology supporting reliable diagnostic processes and cognitive performance.

### New Challenges

Because of the rapid spread of COVID-19, in-person visits to hospitals and care centres have been vastly limited, causing the widespread and unprecedented adoption of telemedicine. Telemedicine allows patients, families and their caregivers who are safer at home to access health care and can address all the drivers that improve diagnostic quality. However, little is known at present about the impact this rapid shift will have on diagnostic quality and safety.

To better understand how telemedicine is accommodating diagnosis, SIDM and multiple collaborators have begun work on a Patient-Centered Outcomes Research Institute ([PCORI](#)) funded project to identify issues in most critical need of study and research funding. Issues such as best methods for providing a diagnosis virtually (‘telediagnosis’ or ‘TeleDx’), understanding how to appropriately triage patients with new complaints, and determine when TeleDx is feasible or when an in-person visit is warranted will be explored. Previous research has documented that some uses of telemedicine aid in the diagnostic process and mitigate risk of some errors, but it remains to be seen whether expanded use of TeleDx will lead to new types of diagnostic errors, replicate similar errors to those seen in in-person care settings, or perhaps even improve diagnostic quality. The answer to these questions will require gathering on-the-ground perspectives of patients, clinicians, clinical practices, telemedicine providers, and hospitals and health systems.

The COVID-19 pandemic has taken a devastating toll on human lives and has strained healthcare resources while transforming, in real time, the way we deliver care and use technology without fully understanding the benefits and pitfalls of these changes. Aligning technology interventions with the drivers detailed in the HRET/SIDM Change Package will help to enhance and improve diagnostic quality and safety. When the technology is not in alignment, it can add to clinical, administrative, or cognitive burden, create barriers to communication between patients and clinicians, or at worst cause delays in treatment or incorrect diagnosis, leading to patient harm. As we continue this journey, focus should be maintained on ensuring that technology drives diagnostic quality, improving the connection between clinicians and patients in order to provide safe, effective and efficient care. ■

## REFERENCES

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