



Earlier Diagnostics: End-to-End Diagnostic Pathways

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Executive Summary

The UK's diagnostic services are under increasing strain due to rising demand, workforce shortages, and the growing complexity of healthcare delivery. To ensure timely, accurate diagnoses and meet future healthcare needs, it is essential to improve the entire diagnostic pathway — from sample collection through to result communication. This paper outlines key interventions at each stage of the diagnostic process to enhance efficiency, accuracy, and overall system performance.

Key Areas for Improvement:

1. **Pre-Analytical Phase:** Standardising sample collection, labelling, and transportation protocols is crucial for reducing delays and errors. Implementing real-time tracking systems ensures efficient handling and timely delivery of samples to laboratories, setting the foundation for smoother diagnostics and enabling real-time updates to patients on the status of their tests.
2. **Analytical Phase:** Leveraging automation and AI-driven technologies will enhance laboratory efficiency and diagnostic accuracy. Risk stratification tools allow for prioritisation of urgent cases, ensuring effective resource allocation while maintaining high diagnostic precision. Throughout this phase, communication with clinicians and patients remains critical, ensuring that progress is tracked and expectations are managed.
3. **Post-Analytical Phase:** Integrating diagnostic IT systems with clinical care platforms will streamline result communication, allowing for faster, more transparent reporting. Real-time data sharing ensures that clinicians receive actionable reports promptly, and patients are provided with clear, easy-to-understand results to support informed decision-making.
4. **Bringing Diagnostics Closer to Patients:** Expanding diagnostic services through community-based initiatives and home testing solutions for chronic conditions takes the end-to-end pathway closer to the patient. This approach ensures equitable access to diagnostics for underserved communities while maintaining consistency across the diagnostic phases. By integrating these services, healthcare systems can improve the reach and inclusivity of diagnostic care.

Early diagnostics is not just about detecting diseases earlier — it is a fundamental shift towards **prevention**, reducing the burden on both the patient and the healthcare system. By enhancing these critical stages of the diagnostic pathway and making diagnostics more accessible, healthcare systems can deliver faster, more reliable results that meet growing demand, improve patient outcomes, and ensure long-term sustainability.



Introduction

Accurate and timely diagnoses are crucial for effective healthcare and better patient outcomes. However, the UK's diagnostic services face significant challenges, including rising demand due to an aging population and the increasing prevalence of chronic conditions, workforce shortages, and fragmented processes that contribute to delays in care. If left unaddressed, these inefficiencies will negatively impact patient outcomes and threaten the long-term sustainability of the NHS.

This paper presents a comprehensive approach to improving diagnostic pathways, with a focus on interventions across each phase of the process — from sample collection through to result communication. By addressing inefficiencies at every stage, healthcare systems can facilitate earlier diagnoses, improve patient outcomes, and build greater resilience to meet the growing demands of modern healthcare.

Beyond improving diagnostic speed and accuracy, a well-optimised pathway also enables earlier intervention and prevention, reducing the burden of late-stage disease on both patients and healthcare systems.

This approach highlights the importance of **streamlining end-to-end pathways**, integrating real-time patient communication within each phase, and expanding access to diagnostics through community-based initiatives and home testing, ensuring equitable care for all patients.

1: End-to-End Diagnostic Pathways

Achieving earlier and more accurate diagnostics requires addressing inefficiencies across the entire diagnostic pathway — from the moment a sample is collected to when results are communicated and acted upon. This section outlines key areas for optimisation and intervention across the diagnostic pathway.

1.1 Pre-Analytical Phase: Optimising Sample Collection and Transportation

The pre-analytical phase of diagnostics encompasses critical steps such as sample collection, labelling, transportation, and initial data entry. Errors or delays in this phase can have a ripple effect, leading to compromised test results, delayed diagnoses, and potentially poor patient outcomes. Given the increasing complexity of healthcare services and the diversity of test types, it is essential to optimise this phase.

Key interventions include:

- **Standardised Sample Collection Protocols:** Ensuring that all healthcare providers follow consistent, well-defined protocols for sample collection, labelling, and storage can significantly reduce errors.
- **Integrated IT Systems for Sample Tracking:** Implementing real-time tracking systems for sample transport ensures that samples arrive at the laboratory within the necessary timeframe, minimising delays. Such systems also allow for proactive troubleshooting in case of issues.
- **Regionalised Sample Collection Hubs:** Establishing regional collection hubs can streamline transportation logistics, particularly in remote or underserved areas. These hubs could serve as centralised collection points, improving turnaround times.

1.2 Analytical Phase: Improving Laboratory Efficiency

Once samples are collected and logged at the laboratory, the analytical phase begins. This involves the testing itself, and it is often where bottlenecks occur due to high workloads or inefficient processes. Increasing efficiency in this phase involves both human and technological solutions.

Key areas for improvement include:

- **Automation and AI in Testing:** Leveraging automated platforms for routine tests can significantly reduce the time taken for results. AI-assisted tools for digital pathology (and radiology) can also accelerate result generation and enhance accuracy, reducing the burden on laboratory staff.

- **Risk Stratification and Targeted Testing:** Incorporating AI-driven risk stratification models allows laboratories to prioritise tests for high-risk patients, ensuring that the most urgent cases are processed first. This approach also supports targeted screening programmes that focus on high-risk populations, maximising resource use.
- **Demand Management and Test Prioritisation:** As pathology workloads increase, managing demand effectively becomes critical. Clinical decision support tools can assist clinicians in selecting the most appropriate tests, preventing unnecessary ones and ensuring resources are directed where they are most needed.

1.3 Post-Analytical Phase: Result Interpretation, Communication, and Integration

The post-analytical phase focuses on interpreting test results, communicating them to clinicians and patients, and ensuring that results are used to inform treatment decisions. Inefficiencies in communication and data sharing often lead to delays in patient care. Addressing these inefficiencies is key to improving diagnostic accuracy and timeliness.

Key solutions include:

- **Seamless Result Communication:** Integrating diagnostic IT systems with clinical care platforms allows for the automatic sharing of test results with healthcare providers. This reduces the time between diagnosis and treatment initiation, enabling more efficient patient management. Integration with apps, such as the NHS app, also allows patients to access their results directly, improving transparency and patient engagement. This integration facilitates real-time updates, helping to bridge gaps between the diagnostic laboratory and clinical care teams.
- **Clear and Actionable Reports for Clinicians:** Laboratories play a key role in ensuring that diagnostic results are presented clearly, supporting timely and accurate clinical decisions. Providing easy-to-understand, actionable result reports — potentially augmented by AI — helps clinicians interpret results efficiently and correctly. AI can also help flag critical findings, suggest follow-up actions, and reduce the risk of miscommunication or diagnostic errors.
- **Communication Between Laboratories and Clinicians:** Open communication between laboratories and clinicians is essential for ensuring the appropriateness of test orders and accurate interpretation of results. Laboratories should provide feedback on test utilisation and offer consultative support to help clinicians interpret complex results, particularly in areas like molecular diagnostics. This collaborative approach reduces the likelihood of unnecessary testing and enhances diagnostic accuracy.
- **Transparency in Waiting Times and Delays:** Providing realistic expectations for test turnaround times helps manage clinician and patient expectations, especially for complex diagnostics. Regular updates should be given if there are any delays in



processing, ensuring that both patients and clinicians are aware of potential disruptions and the expected timing for test results.

2: Patient Experience and Access

2.1: Improving Communication and Timely Access to Results

One of the most critical aspects of patient empowerment is ensuring that patients have timely access to their diagnostic results and understand the implications for their care. Improving the way results are communicated — both in terms of speed and clarity — can enhance patient satisfaction and trust in the healthcare system.

- **Direct Patient Access to Results:** Providing patients with direct access to their diagnostic results through digital platforms such as the NHS app allows for greater transparency and engagement. This can help reduce the anxiety patients often feel when waiting for test results. Patients should also receive guidance on how to interpret their results and be offered follow-up consultations to discuss any concerns.
- **Real-Time Notifications:** Introducing systems that provide patients with real-time updates throughout the diagnostic process — such as notifications when their sample has been received, processed, and when results are available — can help patients stay informed and engaged. This type of communication could be delivered via email, text, or mobile apps.
- **Clear and Actionable Results Communication:** Diagnostic results should be communicated in a clear, easy-to-understand format, avoiding medical jargon wherever possible. Test results should include not just the raw data but also explanations of what the findings mean for the patient's health and the next steps they should take.

For example, a patient receiving a blood test result could be provided with a summary that explains whether their levels are within normal ranges and what actions they should consider, such as making lifestyle changes or booking a follow-up appointment.

2.2: Ensuring Equitable Access to Diagnostics

Equitable access to diagnostic services is critical to addressing disparities that arise from socioeconomic status, language barriers, and geographic limitations. To ensure that diagnostics are accessible to all, healthcare systems must implement inclusive strategies across the diagnostic pathway, from pre-analytical processes to post-analytical communication.

- **Community-Based Diagnostic Outreach:** Expanding community-based diagnostic services can bridge the gap for underserved populations, providing easier access to

essential diagnostic tests. Mobile diagnostic units and local health centres can reduce the need for travel and improve early detection in remote or low-income areas, ensuring that all patients receive timely diagnoses.

- **Home Testing for Chronic Conditions:** Providing home-based testing kits for chronic conditions such as diabetes or hypertension can help address access issues by allowing patients to manage their health without needing to visit healthcare facilities. This initiative improves early detection and management of conditions, reducing the burden on hospitals while supporting patients in hard-to-reach areas.
- **Multilingual and Accessible Communication:** To ensure that all patients benefit from diagnostic advancements, healthcare systems must provide diagnostic information and test results in multiple languages and formats. This includes offering translations and adapting materials for patients with limited literacy or digital access, helping reduce communication barriers and ensuring inclusive care.

By incorporating these strategies, healthcare providers can ensure that diagnostic services are accessible to all, improving equity in healthcare and enhancing patient outcomes, regardless of socioeconomic or geographic challenges.

Case Study: The Community Diagnostic Centre Model

One example of a promising end-to-end pathway improvement is the "Community Diagnostic Centre" (CDC) model, which consolidates multiple diagnostic services into a single location for patients. These community-based hubs decentralise diagnostic services, allowing patients to undergo multiple tests during one visit, potentially reducing the time between testing and diagnosis, while also reducing strain on hospitals.

In the UK, the NHS has been implementing CDCs to provide a full range of diagnostic tests, including imaging (CT, MRI, Ultrasound, and Plain x-ray), physiological measurement, and pathology services. These hubs are designed to receive and process referrals from primary, community, and secondary care, offering quicker and more accessible diagnostic services in the community.

By integrating the CDCs with digital reporting systems, test outcomes can be efficiently communicated to referrers. This model has shown potential to reduce waiting times for diagnostic tests and increase patient satisfaction. The CDC approach aligns with healthcare improvement principles by potentially reducing unnecessary hospital visits and streamlining the patient journey.

As CDCs continue to be implemented and evaluated, they may prove to be a valuable resource in optimising diagnostic pathways and improving overall patient care.

3: Conclusion

Improving diagnostic pathways requires a comprehensive approach that addresses inefficiencies at every stage, from sample collection to result communication. By standardising protocols, integrating technology, and improving patient access, healthcare systems can enhance the reliability and effectiveness of diagnostics, ultimately improving patient outcomes.

Improving diagnostic pathways is not just about detecting diseases earlier; it represents a fundamental shift towards prevention. By enabling timely intervention, early diagnostics reduce the burden on both patients and the healthcare system, ultimately improving outcomes and making care more cost-effective.

Equitable access and patient engagement are integral to this process. Bringing diagnostics closer to patients through community-based services and home testing solutions ensures that underserved populations have equal access to critical diagnostics, while real-time communication keeps patients informed and engaged. Initiatives like Community Diagnostic Centres (CDCs) demonstrate how decentralised models can reduce delays and improve access, creating a more responsive diagnostic pathway.

Key Recommendations:

1. **Pre-Analytical Standardisation:** Establish consistent protocols for sample collection and transportation, supported by integrated IT tracking systems. This improves reliability, ensures timely delivery to laboratories, and provides patients with real-time updates.
2. **Automation and Analytical Improvements:** Use AI-driven automation to streamline test processing, prioritise urgent cases, and manage laboratory capacity effectively. Throughout this phase, maintaining clear communication with clinicians and patients is critical for managing expectations.
3. **Integrated Post-Analytical Communication:** Create seamless communication pathways between laboratories, clinicians, and patients. This ensures that diagnostic results are delivered promptly, with clear explanations to support informed decision-making.
4. **Bringing Diagnostics Closer to Patients:** Expand diagnostic services through community outreach and home testing to ensure equitable access. This approach makes diagnostics more accessible to underserved populations, improving the reach of diagnostic care without compromising consistency or quality.

By focusing on these areas, healthcare systems can build a more cohesive, patient-centred diagnostic process that meets growing healthcare demands while improving care across the entire end-to-end pathway.



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