The Importance of Independent Quality Assurance for Patient Safety and Quality Care

Independent quality assurance (iQA) testing is vital to the successful development and deployment of applications in any industry. Utilizing a dedicated QA team can be priceless in preventing defects and downtime due to application malfunctions. And it's especially essential in healthcare as providers, payers and life sciences organizations use a wide variety of complex, integrated applications in their critical day-to-day processes. Application downtime or malfunction can inconvenience users, damage an organization's reputation and impact the quality of care a patient receives — even leading to a fatal outcome.

iQA in healthcare

iQA focuses on all aspects in the software development lifecycle (SDLC). By involving QA in the early phases of the SDLC, such as requirements gathering and design reviews, iQA resources can contribute their expertise and knowledge of the industry and systems to help define requirements (and prevent invalid or unclear requirements) for application development. They can also provide feedback on design to prevent the use of a design that doesn't meet the coding requirements. Generally, the earlier in the SDLC a defect is detected, the less costly it is to fix. The cost of fixing a defect increases based on how far a project is into the SDLC. During our extensive experience

in testing services, we've observed that fixing a defect found in the test execution phase costs up to 15 times more than a defect identified during the design phase. And a defect found in production can be up to 100 times more costly to fix than one detected during the requirements phase.
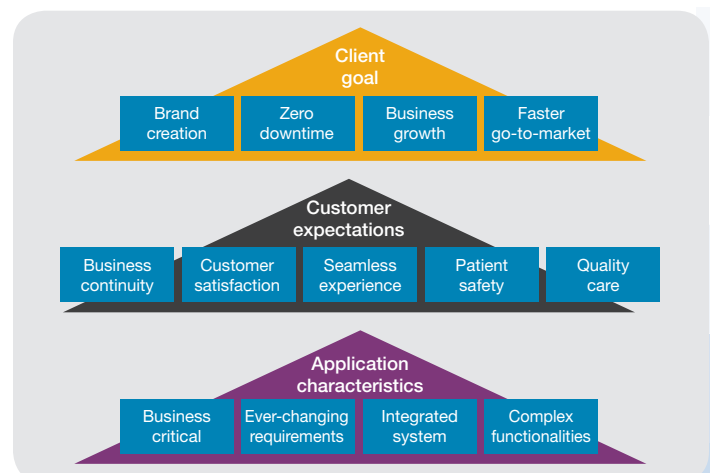

Figure 1: QA can help define requirements, and prevent invalid/unclear requirements in the SDLC.

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Written by:
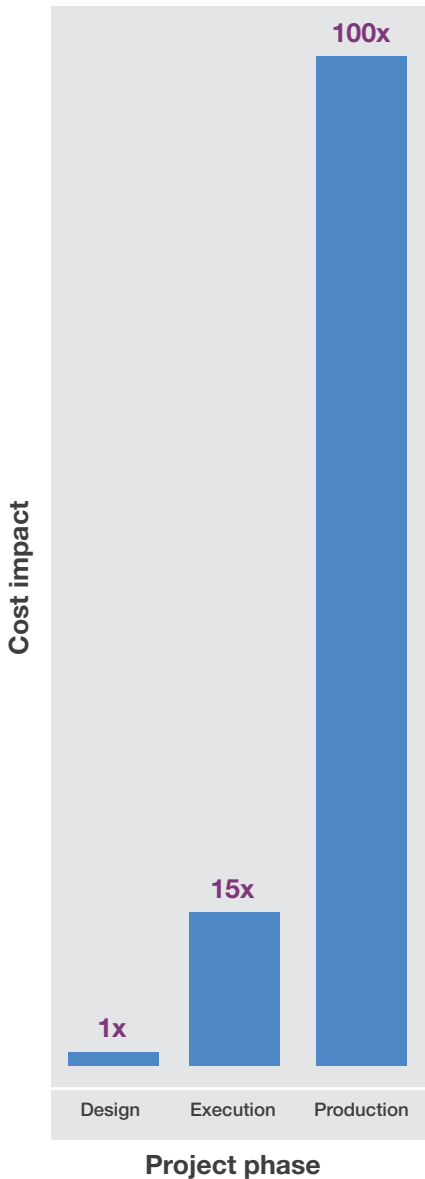JP Vijayvargia
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Figure 2: The cost of fixing a defect increases markedly from the design phase to the production phase.

iQA provides many different types of testing — from functional, integration and regression testing to automation, performance and security testing. QA teams use a wide variety of these methods for healthcare application systems to prevent failures and increase productivity. Thorough testing of these systems can prevent any problems and improve a patient's safety and the quality of medical care.

In-depth systems testing

At NTT DATA Services, we support healthcare systems — from consumer websites and hospital bed tracking to human resources and clinical platforms — with comprehensive testing services.

Consumer hospital websites

If a potential patient is looking for a specialty physician at a hospital and the Find a Physician search function doesn't provide relevant results, the patient might move on to another hospital — resulting in a frustrated potential patient and the loss of that patient's revenue. NTT DATA Testing Services uses an orthogonal array approach to testing internet- and intranet-based web applications. This allows us to find the most effective strategy for testing multiple OS and browser combinations. We can test any business process management-based workflow system for tasks such as new charge activation, rate change submission and approval.

And our consulting solutions help hospitals by evaluating test processes and developing a roadmap for improved testing effectiveness and an increased return on investment for consumer websites. We can help:

- Assess current testing state/needs and develop improved processes and tools
- Establish a testing center of excellence
- Automate testing
- Implement performance and security testing solutions

Patient admission, discharge and transfers

When a hospital admits a patient, administrators need to record patient data, such as the patient's address and insurance details with billing information, and successfully send to other integrated systems. If the information is incorrect or incomplete, this leads to problems for other departments and applications, and requires patient follow-up later to retrieve the mandatory data. It also means more time spent on administrative processes for the hospital and a delay in patient care and revenue collection.

At NTT DATA, our team has in-depth experience with testing scenarios for patient registration, transfer and discharge. We use a proven methodology for end-to-end testing of planned, unplanned, expedited or emergency release testing. NTT DATA provides complete test coverage based on the desired timeframe. In case of a quick release, we offer risk-based testing to cover all possible challenges for go live.

Hospital bed tracking

During a patient's stay, hospitals use location tracking to ensure two patients aren't assigned to the same bed. A malfunction in this system can result in multiple patients being assigned to one bed and/or inaccurate data being sent to other systems. This could also impact a patient awaiting an operation if multiple patients are scheduled to be in the same operating room at the same time. Again, in this scenario, the quality and safety of the patient's stay is compromised.

For example:

- When a patient is out of his/her room for tests or X-rays, the system needs to be able to hold the bed automatically.
- When a patient is discharged, the system should automatically notify environmental services to expedite bed turnover.
- When environmental services has completed their work, the system needs to automatically mark the room as available again.

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The system should be able to integrate easily with any electronic medical record (EMR) system, such as Epic or Cerner, to update patient bed assignments/transfers.

At NTT DATA, we utilize automation to reduce the cost and increase the accuracy of critical applications. We help hospitals maximize value by ensuring accurate, up-to-date hospital bed tracking.

Patient supply accounting
It's important that patients are accurately charged for the cost of medicine and supplies used during their stay. Defects in the patient supply accounting system can cause a patient to be overcharged, leading to inaccurate statements that a patient will have to dispute if they want the full return on their medical care. This results in patient dissatisfaction and can lead to poor reviews on social media and customer insurance portals, damaging an organization's reputation.

NTT DATA has developed a test data accelerator tool that helps de-identify critical patient data, and then generate and compare the data between two different systems. This tool has helped set up test data faster as well as provide wider coverage in less time.

Identity and access management
If physicians and hospital staff are unable to successfully log in to electronic health records and other critical care applications, they can't access patient information. This potentially leads to costly mistakes when treating a patient without information like medication allergies or pre-existing conditions. On the other hand, if unauthorized users are able to access patient information (including Social Security and credit card numbers), the hospital risks fines for not complying with security and privacy regulations, including the Health Insurance Portability and Accountability Act and Payment Card Industry standards.

NTT DATA offers evidence-based testing capabilities to ensure that identity and access management systems are foolproof and working as designed. Our scenarios take role-based functional requirements and map them to evidence-based guidelines to ensure compliance with all guidelines.

Human resources
Employee information is stored and updated in a healthcare organization's human resources system. If not tested exhaustively, an organization could possibly send out inaccurate paychecks and taxes. The employees and physicians will then have to spend time resolving these issues, instead of attending to and treating patients.

NTT DATA provides end-to-end testing for non-clinical applications. This includes human resources management, billing, payroll, finance and revenue cycle management — both for commercial off-the-shelf applications (such as Lawson and PeopleSoft) and for homegrown applications.

Document management
Document management applications are responsible for scanning, importing, retrieving and indexing patient-related documents. Testing these applications ensures end users are able to complete tasks such as patient check-ins, payment collections and insurance co-pay verification. The inaccurate transmission of these documents can lead to incorrectly indexing patient data and information, resulting in mistakes in patient care and a loss of productivity for physicians and staff to correct the issues.

At NTT DATA, we recommend exhaustive system integration and regression testing, powered by our test automation framework, to ensure minimal production bugs for all document management applications.

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Decision report and statistical analysis
Decision report and statistical analysis applications use data collected from healthcare organizations to anticipate future staffing needs. Inaccurate reporting of these statistics can result in insufficient staffing and an increased wait time for patients. Not only does this lead to unhappy patients, but it can also affect a patient's health if they aren't attended to in a timely manner.

NTT DATA routinely performs data testing for completeness, transformation, quality, integration, regression, reporting and performance to ensure compliance with Meaningful Use guidelines. Our test data accelerator tool features data masking, data generation and data comparison between source and target systems. This business intelligence tool can compare 1 million records between source and target systems in less than two minutes.

Electronic medical records
EMRs allow healthcare professionals to electronically store, capture and access patient health information in acute and ambulatory care settings. They provide real-time access to patient results and clinical information across care disciplines. For example, if an X-ray order is not populating in the radiology system, this leads to a delay in patient care. The systems must also provide accurate calculations for patient care. If drug administration information is miscalculated, it can result in either over- or under-medicated patients.

At NTT DATA, our testing team has in-depth experience with leading EMR applications including Cerner, Epic and MEDITECH, as well as homegrown EMR systems. We offer end-to-end testing — from new implementations and upgrades to planned or unplanned release testing. Our solutions include a variety of testing types such as sanity, application, system integration, performance and automation of regression test pack. Testing is performed from cost-effective offshore locations that help reduce costs and increase the accuracy of EMRs.

Patient clinical analysis and resource systems
Patient clinical analysis and resource systems provide integrated access to clinical patient information. This gives healthcare practitioners the resources they need to document, track and analyze patient information. The data provided in this system, such as allergy information, is critical to patient safety. Defects in this system could put a patient at risk of an allergic reaction or worse.

NTT DATA developed a data traceability and transformation testing framework that ensures these critical data elements are being properly transformed and can be traced accurately. We also use an accelerator to rapidly test the data accuracy from the source to the destination.

> Our testing consultants can conduct a gap analysis, comparing current testing process with industry best practices.
> They will suggest an implementation roadmapfor any new processes, explaining how to achieve the best results.

Payer services and patient accounting and billing

Payer and patient accounting and billing services applications are responsible for receiving, transforming, processing and transmitting insurance and patient payments to the patient billing and accounting systems. If payments are not in the correct format in a timely manner, patient balances will be incorrect. This can lead to delays in payment, financial disruption and patient dissatisfaction.

At NTT DATA, we have experience with a wide variety of electronic data interchange formats and business-to-business integration testing senarios, which can help improve the performance and testing time of payment applications. Our accelerator scripts automate these and require minimal additional effort for any new payer scenarios.

Why NTT DATA?

End-to-end integration capabilities

Our experts test patient data flow from one system to another — inbound and outbound messages — to ensure effective integration. NTT DATA has in-depth experience with Health Level-7 interface engine tools and Microsoft BizTalk, Ensemble or Cloverleaf for testing various business rules. We also have experience with Gallio Icarus automation tools for rapid regression testing.

Performance and security

We have broad expertise in conducting stress, load, volume and endurance performance testing. NTT DATA can utilize market-leading commercial tools, as well as open source tools for performance and security testing. Our team can also provide penetration, vulnerability, network and evidence-based testing.

Automation of regression test pack

For accelerated go-to-market, we recommend an automated regression test pack. This automation provides a wide variety of benefits, including:
- Saving end users' time
- Improving risk coverage
- Enabling more accurate testing
- Expediting regression testing
- Implementing quick log analysis
- Freeing up manual testing resources

It also allows organizations to execute the regression test pack at any time.

Testing mode

Testing Services are based on six pillars: test process improvement, demand consolidation, cycle time reduction, knowledge management enhancement, metrics standardization and test management tool adoption. These help us improve overall quality, resource utilization, test optimization, decision making and test effectiveness. It can also help reduce test cycle time, enable early detection of critical defects, reduce post-production defects and minimize testing effort with better utilization of testing resources.

In-depth consultation

Our consultants can conduct a gap analysis, comparing current testing process with industry best practices. They will suggest an implementation roadmap for any new processes, explaining how to achieve the best results.

Test environment management

We can set up various test environments, including system, integration, performance, stage or user-acceptance testing, as well as data masking. The goal for each test environment is to ensure 24x7 uninterrupted test execution.

Homegrown and package application testing

Our offerings incorporate a mature testing process that organizations can customize using different methodologies (such as agile, waterfall or iterative). Our testing team has extensive healthcare knowledge that helps them understand specific requirements quickly and deliver excellent outcomes. NTT DATA can test any homegrown application on any technology stack, as well as any commercial off-the-shelf product.

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Conclusion

With the growing challenges of cost competitiveness and meeting regulatory requirements, healthcare organizations need software applications that are compliant with federal and security requirements — and perform at expected quality levels. Utilizing best processes and an integrated framework can help deliver superior and secure applications. NTT DATA Testing Services offer a highly mature set of capabilities backed by experts that have experience with a wide variety of automation methodologies and tools — delivering maximum business value.

We can help transform QA end to end, ensuring an agile and productive workforce. Unlike highly commoditized, traditional models of manually intensive, end-of-software lifecycle activity, NTT DATA has developed unique intellectual property that supports a large variety of healthcare functions and systems.

Our services include:
- Testing methodologies and skills to adopt and achieve the full benefits of an agile methodology
- Component-based testing to detect defects early
- Automation beyond a regression suite, including testing activities such as test case creation, test data management, defect capturing and metric reporting
- A focus on non-functional testing to ensure that apps are fast, secure and reliable
- Cost-effective testing tool alternatives, such as Quantum Test Management and industry-specific test packs

Visit **nttdataservices.com** to learn more.

NTT DATA partners with clients to navigate the modern complexities of business and technology, delivering the insights, solutions and outcomes that matter most. We're a top 10 global IT services and consulting provider that wraps deep industry expertise around a comprehensive portfolio of infrastructure, applications and business process services.

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