

# Maximizing healthcare Business Intelligence (BI) report accuracy

## Why is rigorous testing the key to effective BI migrations?



**Hitangi Matalia**

Sr. Solution Architect, Quality & Validation Services, CitiusTech

### Introduction

Today, every organization is generating tremendous volumes of data, and healthcare businesses are no different. To put it into perspective, individual patient data can go upward of 80MB in terms of just EHR and medical images. When you consider various other healthcare data, it goes well above 200-250MB. Now multiply that by the ever-growing patient population, and you will get a huge volume of data.

This deluge of patient information offers healthcare businesses an unprecedented opportunity to derive previously inaccessible intelligence and optimize their data-driven processes. Business intelligence can help in various ways. On the patient-facing side, it can help in population health management, patient health trends analysis, and more. On the operational side, healthcare BI can help optimize hospital resources, manage facilities and supply chains, detect fraud, improve revenue, and report quality. Healthcare BI can even play a critical role in clinical trials and drug development.

**PERSPECTIVE PAPER**





However, traditional BI tools aren't capable of dealing with the vastness or complexities of data or advanced clinical requirements. There is a dire need to migrate to modernized AI and cloud-based tools. Moreover, the exponential growth of healthcare data demands modernized BI platforms capable of handling this data to generate accurate reports. It is thus no wonder that more and more care providers are now turning to business intelligence solutions that are imbued with AI capabilities and tuned for the specifics of healthcare, driving the growth of the healthcare Business Intelligence (BI) market to USD 6.9 billion by 2032.<sup>(1)</sup>

BI testing, in this context, plays a crucial role. It is a critical component for ensuring data reliability while transitioning to a new platform. BI testing confirms that your AI-enabled BI tools are a perfect fit for your business model and deliver precise insights for informed decision-making.

## Why are testing BI reports non-negotiable?

BI report migration isn't a simple "lift and shift" or "drag and drop" exercise. Extensive testing is essential because these reports are the foundation for critical business decisions. Why? Inaccurate healthcare reports could directly impact patient well-being. Testing the BI solution will also help you ensure the platform supports your end-to-end insights journey, from data modeling, architectures, and semantics to all the major cardinalities. That's why rigorous testing of migrated reports is paramount to ensure data integrity and protect patient safety.

Here are the objectives behind testing BI reports:

- **Functionality:** Beyond simply migrating reports, the process must meticulously maintain core functionality, design, and user interface elements. This ensures a seamless transition for healthcare users who rely on these reports for critical decision-making.
- **Data integrity:** Maintaining data accuracy is the primary concern behind BI report testing. Rigorous testing verifies data flowing through the ETL process is flawless. This eliminates the risk of misleading data and ensures reports deliver reliable insights for patient care and clinical research.



- **Data security compliance:** Healthcare organizations deal with sensitive patient data that must comply with strict regulations like HIPAA. During the upgrade, ensure data security measures are in place to prevent potential breaches or non-compliance issues.
- **Regulatory compliance:** Healthcare regulations are constantly evolving. Ensure the upgraded Sitecore platform complies with all current healthcare regulations and standards to avoid legal issues.
- **Performance:** All reports must undergo thorough performance assessments. This includes load testing, cross-browser compatibility, cross-operating system functionality (Windows/Linux, macOS), link access, and download/upload speeds. Optimized performance ensures timely access to vital information, potentially impacting patient outcomes.
- **Security:** Security testing is crucial in healthcare. It guarantees reports are accessible only to authorized users based on their designated roles, with additional safeguards in place for administrative access. This protects sensitive patient data from unauthorized access or breaches.
- **User acceptance:** Beyond technical functionality, testing must involve healthcare professionals and key stakeholders. Their acceptance of the migrated reports ensures alignment with clinical needs and workflows. This fosters user adoption and maximizes the value of the new BI system for patient care.
- **Report compliance:** Strict regulations like HIPAA govern data handling in healthcare. BI report migration testing must ensure the new platform can uphold these regulations. This involves verifying functionalities for data encryption, access control, audit trails, and other security measures, potentially warranting a platform shift if compliance needs aren't met.

## Put more emphasis on performance testing

---

Among different tests that need to be performed before BI migration, one crucial factor you need to test is the performance of your preferred BI platforms under different use cases. It is the most burning issue than any functional aspects in validation. While many of the market-leading BI platforms today ensure security, functionality, data integrity, and compliance, performance might vary depending on various factors. The following is a breakdown of three core use cases that you should test before zeroing on a BI platform.





### **The ability to handle different user loads:**

Performance testing tools mimic real-world user traffic by simulating multiple users accessing reports and dashboards and performing queries concurrently. This helps identify bottlenecks in the system that might cause slowdowns or crashes during heavy usage in the future.

### **Response time:**

From report load and query execution time to data refresh, the response time of your BI platform is a crucial determinant of time-to-insight. That's why you should test how long it takes for the BI system to respond to user actions like fetching reports or running complex queries. Ideally, these response times should meet pre-defined benchmarks to ensure a smooth user experience.

### **Scalability of the BI platform:**

Performance testing helps assess how the BI system scales with increasing user load. This is particularly important if you anticipate a growing number of users or larger datasets in the future. You can test the system with different user loads (i.e., test it for 25, 50, 100 users, and more) to ensure that it is capable of handling an ever-growing user base and snowballing healthcare data.

In addition to these three-core metrics, you should also test the performance of your BI systems in terms of dashboard interactivity, system uptime and availability, user concurrency vs. resource utilization (CPU, memory, network, and disk matrices), request hit vs. throughput and their correlation with your business KPIs. For the performance testing, you can use tools like JMeter, Azure Monitor, and Power BI performance analyzer.

---

## **The right approach to report validation following BI migration**

We have outlined some standard validations BI testers must consider for effective reports post-migration.

## What to consider

## The test case approach

### Testing the connectivity between the legacy source & the target

- Validate the connection with source and destination systems is established successfully.
- Verify the credentials used for authentication are correct and that necessary permissions are granted.
- Review and verify that after every data refresh, the new data should sync between the source & target.

### Comparing the source and target report according to GUI/design specifications

- Validate that source and target reports match required GUI and design elements such as layout, colors, fonts, and tooltip text across all sections (Home Page, Graphs/Charts).
- This should also include checking interactive elements such as the Range Selection Field.

### Comparing the source and target report data

#### Metadata Validation:

- Validate adherence to defined naming conventions for both source and target reports.
- Ensure the number of columns in the source and target reports matches.
- Verify data types, column lengths, and precision for all corresponding source and target reports columns.
- If minor discrepancies exist (e.g., naming variations, data length), outline a plan for standardizing these elements in the target report to ensure consistency.

#### Data Validation:

- Confirm that the data reflects the expected date range and adheres to the defined format in both reports.
- Validate currency symbols, decimal places, and formatting consistency between source and target reports.

### **Comparing the source and target report data**

- Verify null values and zeros are handled consistently (e.g., displayed as blank, represented by a specific character) in both reports.
- Ensure minimum and maximum values fall within the expected range for all relevant data points in the target report, matching the source.
- For specific date ranges or filters applied, compare and validate the accuracy of aggregated values (e.g., sums, averages) between source and target reports.
- Verify the default sorting order of data in the target report matches the source report.
- Test critical business rules applied to calculations within the reports. Ensure these rules are reflected accurately in the target report's data.
- Identify and investigate any significant discrepancies in data values between source and target reports. Identify the root cause and take corrective action to ensure data integrity.

### **Ensuring filter validation**

- Validate that all filter options available in the source report are present and functional in the target report.
- Test various filter combinations (single, multi-select, date range) with representative data samples to ensure filtered results accurately reflect the applied conditions in both reports.
- Verify filtering logic (e.g., AND, OR) functions as expected in the target report, matching the source report's behavior.
- Test filtering on different data types (numeric, text, dates) to ensure accurate filtering based on the selected criteria.

## Ensuring drill-through and drill-down report accuracy

### Drill-through Report:

- Confirm that the drill-through report naming adheres to defined conventions and that the layout/alignment remains consistent with the source report.
- Assure all data elements (column names, data types, formatting) within the drill-through report match the underlying data source accessed through the drill-through action. Validate data accuracy for the filtered subset presented in the drill-through report.
- Confirm any pre-defined filters are applied correctly upon navigating to the drill-through report.

### Drill-down Report:

- After applying filters within the drill-through report (reached via drill-through action), verify the resulting drill-down report's name, layout, and alignment remain consistent.
- Ensure the drill-down report's data elements (column names, types, formatting) accurately reflect the filtered data set. Validate that the data displayed in the drill-down report matches the underlying details.
- Confirm the default sorting order in the drill-down report aligns with expectations.

## Key learnings to ensure BI report accuracy

---

Now that we've established the objectives and approaches for BI report validation, let's explore the best solutions for some common pain points and challenges with real-life Healthcare examples.

### Challenge 1: Limited familiarity with legacy BI tools and functionalities

**Solution:** To bridge this gap, you can leverage a two-pronged approach:



- Deep dive into detailed checklists and reference materials to understand the legacy tool's default behaviors.
- Foster open communication with developers and stakeholders familiar with the legacy tool to understand the limitations and current capabilities.

### **Challenge 2: Resurfaced user acceptance testing (UAT) issues post-deployment**

**Solution:** To minimize post-UAT defect leakage, you must:

- Develop a standardized, reusable template for test cases, ensuring thorough and consistent coverage across functionalities. This reduces the risk of overlooking vulnerable areas.
- Ensure each test case is meticulously detailed, explicitly outlining expected behavior and potential failure scenarios. This empowers testers to identify and address even subtle discrepancies during UAT.
- Engage in exploratory testing to complement the structured testing approach. This allows testers to delve beyond the scripted scenarios and uncover potential issues that might otherwise slip through the cracks.

### **Challenge 3: Increased manual efforts and delivery time**

**Solution:** Combining best practices with automation helps to achieve optimal efficiency and quality. Here's how:

- Developing a custom automation utility that intelligently extracts the semantic layer inventory from the legacy BI tool and translates it into comprehensive test cases.
- Strategically employing automation tools to perform a comprehensive validation of migrated report data.
- Prioritizing automation for regression testing scenarios while employing manual testing for initial data validation.

## **Looking forward**

---

Now, more than ever, healthcare organizations, whether providers or payers, seek to leverage the power of modern BI tools, particularly for visual data exploration. However, ensuring the seamless migration of legacy reports requires meticulous planning, well-crafted test cases, and a commitment to continuous monitoring and validation.



However, it is important to note that effective data validation goes beyond simply replicating reports. Validation demands rigorous testing to identify discrepancies and errors that might compromise data accuracy, integrity, and overall quality. Testers play a critical role in this process, meticulously verifying data against expected results. By adopting a comprehensive testing approach that uses diverse industry-specific test cases, they become key contributors to the success of healthcare BI migration.

Thus, with the right approach and right partner for BI data validation, it's easier to yield the best results out of a planned BI migration

## References

---

1. Global healthcare Business Intelligence market overview  
[[marketresearchfuture.com](https://www.marketresearchfuture.com)]





Shaping Healthcare Possibilities

CitiusTech is a global IT services, consulting, and business solutions enterprise 100% focused on the healthcare and life sciences industry. We enable 140+ enterprises to build a human-first ecosystem that is efficient, effective, and equitable with deep domain expertise and next-gen technology.

With over 8,500 healthcare technology professionals worldwide, CitiusTech powers healthcare digital innovation, business transformation and industry-wide convergence through next-generation technologies, solutions, and products.

[www.citiustech.com](http://www.citiustech.com)

# Shaping Healthcare Possibilities

