Supporting Artificial Intelligence (AI) in Healthcare

Data is the fuel, and AI is the engine. Data quality is the key to AI because the accuracy, reliability, and relevance of the outputs generated by these systems are directly dependent on the quality of the data that they are trained on; essentially, "garbage in, garbage out". Poor data leads to inaccurate and unreliable AI results, while high-quality data ensures that AI models learn accurate patterns and produces meaningful insights.

NIST efforts in healthcare standards development, interoperability, conformance testing, and data analysis have direct impact on the quality of healthcare IT data, including electronic health records (EHRs).

Leveraging Healthcare Records for AI Advancement

Healthcare records contain vast amounts of data, including treatment histories and patient outcomes. AI can analyze this data to help develop more effective healthcare plans for patients with similar conditions. A robust knowledge base is essential—ensuring that this data is accurate, complete, consistent, relevant, and up to date is critical for effective AI-driven healthcare solutions.

Aspects of good data quality for AI include:

- Accuracy: Ensuring that information is correct and factual.
- Completeness: Providing a comprehensive dataset that covers all relevant aspects.
- Consistency: Maintaining uniformity in data formatting and labeling.
- Relevance: Selecting data that aligns with the intended use case
- Timeliness: Ensuring data is up to date to prevent outdated or misleading insights.

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NIST's work is crucial for providing quality healthcare data. Figure 1 illustrates a healthcare data exchange scenario:

1. Providers initiate lab request orders via HL7 messages

2. Patients visit collection facilities where specimens are drawn and sent to laboratories

3. Laboratories perform tests and report results back to ordering providers via HL7 messages

4. Data is processed and stored in EHR systems as part of patient records

5. Doctors review results, determine diagnoses, and make informed decisions

6. Doctors access clinical decision support through AI tools built on LLMs trained with collective patient EHR data

7. Treatment plans are matched to candidate patient profiles based on successful outcomes

8. System data can be retrieved through the HL7 Fast Healthcare Interoperability Resource (FHIR) API, which enables AI systems to access and analyze healthcare data effectively.

This represents one example use case of AI for improving patient care and outcomes. The success of AI-driven healthcare depends on both data accessibility and data quality.
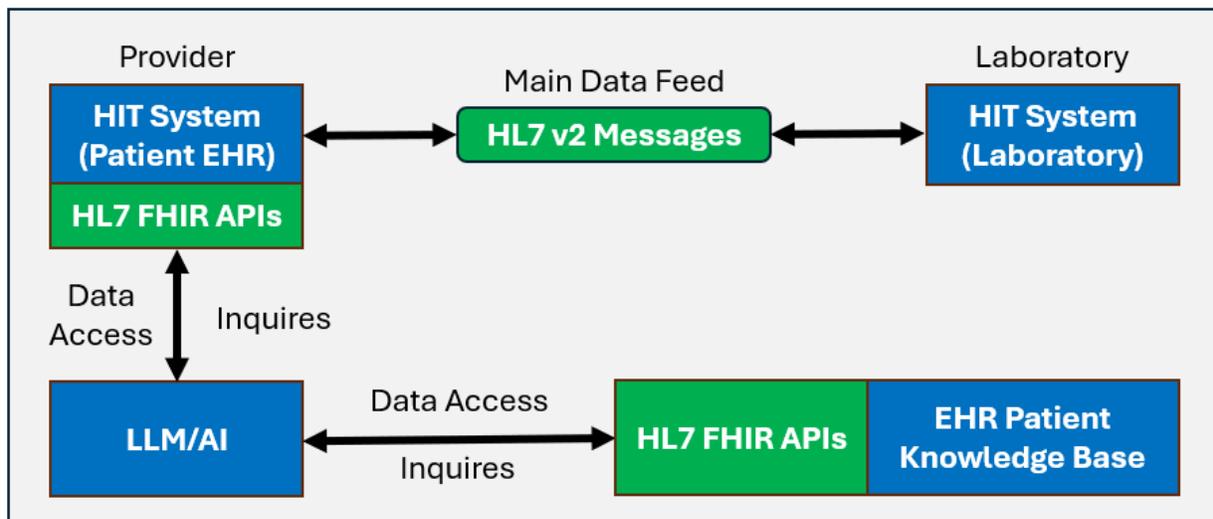

Figure 1: Healthcare Scenario and Use of AI

NIST's Critical Contributions

NIST plays several essential roles in this ecosystem:

1. Standards Development: NIST has worked extensively on improving the HL7 v2 standard—the primary vehicle for healthcare data exchange nationally and globally. As principal author of the Conformance Methodology ANSI standard, NIST enables precise specifications for message interfaces, including syntax and semantic data requirements.

2. Implementation Tools: Through the NIST HL7 v2 platform, developers can build computable specifications using:

- GUI Implementation Guide Authoring and Management Tool (IGAMT)
- Test Case Authoring and Management Tool (TCAMT) for creating computable test plans

- Automatically generated conformance testing tools with interactive GUIs; These conformance tools have been used to certify EHR systems and assess Immunization Information Systems (IIS).

Ensuring Data Quality in Health IT Systems

NIST also evaluates data quality in health IT systems, including IIS. The Quality of Data-at-Rest (qDAR) tool helps identify poor-quality data by analyzing system records against defined thresholds. The tool generates reports highlighting data inconsistencies, allowing system administrators to address issues and improve data integrity.

The qDAR tool can be adapted to assess data quality in general healthcare systems, ensuring AI-driven applications rely on high-quality data.

Expanding AI Healthcare Capabilities with HL7 FHIR

NIST has also contributed to the HL7 FHIR standard, which provides a standardized API for individual patient records, filtered searches, and bulk data access. The FHIR standard is essential for efficiently accessing large datasets to train LLMs for healthcare applications.

Supporting AI Healthcare Initiatives

NIST's work in data quality and interoperability supports major healthcare AI initiatives, such as the Stargate AI Healthcare Project, a collaboration between OpenAI, SoftBank, and Oracle. Announced in January 2025, this initiative aims to leverage AI and EHRs to improve healthcare processes and patient outcomes.