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A Vendor Agnostic Radiation Treatment Plan Quality Assurance Software Implemented for an Integrated Health System

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ABSTRACT

Automated chart-check tools have been shown to reduce errors and improve efficiency in radiation therapy plan reviews. However, existing solutions are typically limited to single-vendor systems. This study describes the development and evaluation of an in-house, vendor-neutral chart-check software designed for a large integrated health system operating within a mixed-vendor environment.

INTRODUCTION

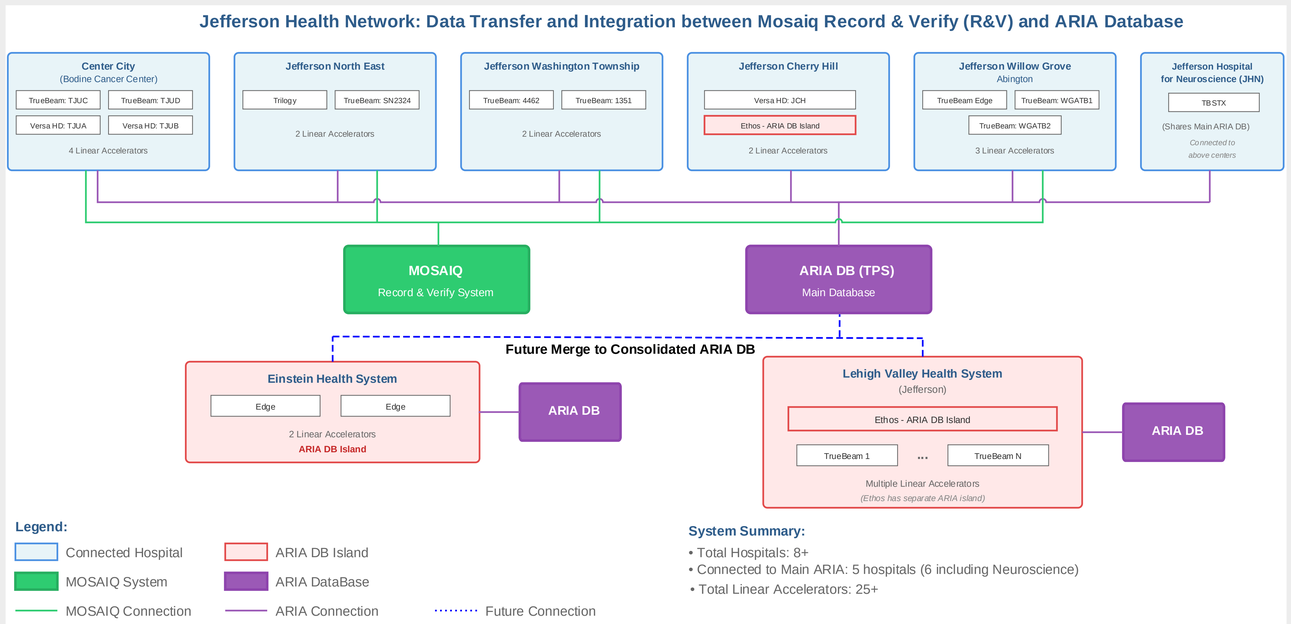
Prevalent automated chart-checking solutions are typically restricted to single-vendor ecosystems, creating operational silos in integrated health systems with mixed equipment. This limitation is particularly critical in large networks where the lack of interoperability hinders the deployment of standardized safety nets. Our developed tool addresses this gap by introducing a vendor-agnostic software architecture that unifies data from disparate Treatment Planning (TPS) and Record-and-Verify systems. By decoupling the user interface from proprietary databases, the platform demonstrates that interoperable, in-house software can successfully standardize safety workflows across complex, multi-vendor environments.

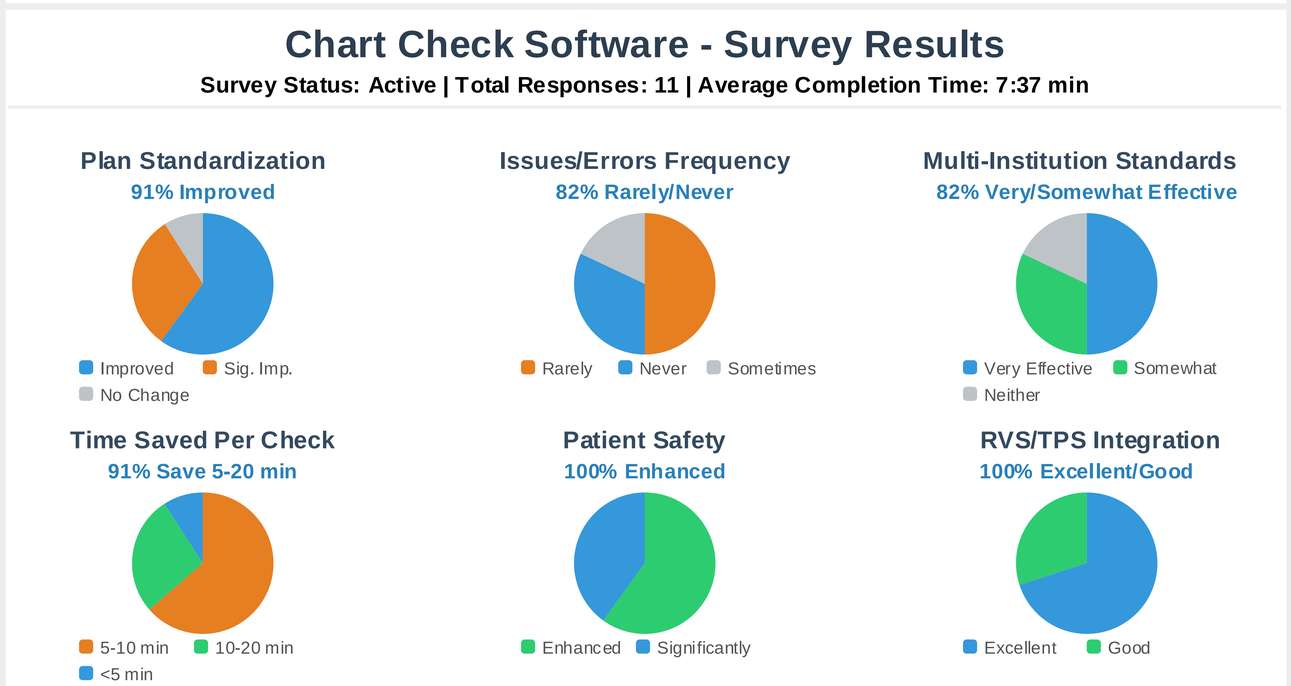
METHODS AND MATERIALS

A custom software platform was created using the Model-View-ViewModel architecture to ensure modularity, maintainability, and extensibility. The system provides secure data access across multiple vendors' record-and-verify systems, treatment planning systems, and linear accelerators. A user-friendly graphical interface enables verification of treatment sites, documents, fields, and control points, streamlining the chart-check workflow. Software performance was evaluated through two approaches:

1) Efficiency Analysis: Chart-check times for prescription and beam data review were recorded for 81 radiation treatment plans, both with and without the software.

2) User Experience Surveys: Eleven medical physicists across multiple departments completed Likert-scale questionnaires assessing usability, efficiency, and integration.





RESULTS

Average review time decreased from 188 seconds without the software to 45 seconds with it, demonstrating a substantial efficiency improvement. Survey responses showed strong user satisfaction, with an overall effectiveness rating of 4.8/5. Approximately 91% of physicists reported saving 5–20 minutes per chart check, and 82% indicated improved patient safety. Integration with existing Record-and-Verify and Treatment Planning Systems was rated as excellent by 82% of respondents.

DISCUSSIONS

The impact of this work is threefold:
1. Efficiency: It delivers a four-fold increase in plan review speed, reducing the average chart-check time from ~3 minutes to 45 seconds, allowing physicists to shift focus from routine data verification to clinical decision-making.

2. Interoperability: It breaks the "vendor lock-in" of commercial QA tools, providing a single, unified interface that connects seamlessly to multiple back-end systems (e.g., Varian Aria, Elekta Mosaiq) without requiring expensive middleware.

3. Scalability: The modular MVVM architecture allows for rapid adaptation to new treatment modalities or software updates, ensuring the health system's QA capabilities remain robust as clinical technology evolves

CONCLUSIONS

The developed vendor-neutral chart-check software significantly improves efficiency, standardization, and patient safety across diverse radiation oncology programs. Its ability to interface with multiple clinical systems makes it a valuable and scalable tool for supporting consistent and reliable verification of radiation therapy treatment plans.

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