Medication Interoperability: Improving Medical Integration Between Healthcare Systems

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Abstract

The U.S. healthcare system lacks patient medication interoperability:

- Causing Drug-to-Drug Interactions (DDIs) and Adverse Drug Reactions (ADRs)
- In turn increasing healthcare provider burden, raising medical costs, and negatively impacting patient health
- >20% of ADRs [1] result from a lack in medication reconciliation and account for 7,000 to 106,000 deaths annually, costing between $30.1 [2] to $136 billion [3]

This research aims to inform a **patient medication interoperability standard:**

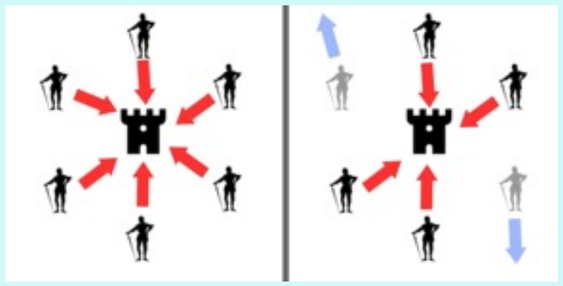
- We are looking for **community feedback** to aid in prototype and standard development
- Implementation would provide a complete patient medication history, thereby:
  - ***Preventing avoidable ADRs and DDIs***
  - ***Reducing overprescription***
  - ***Lowering healthcare costs***
  - ***Improving national health***

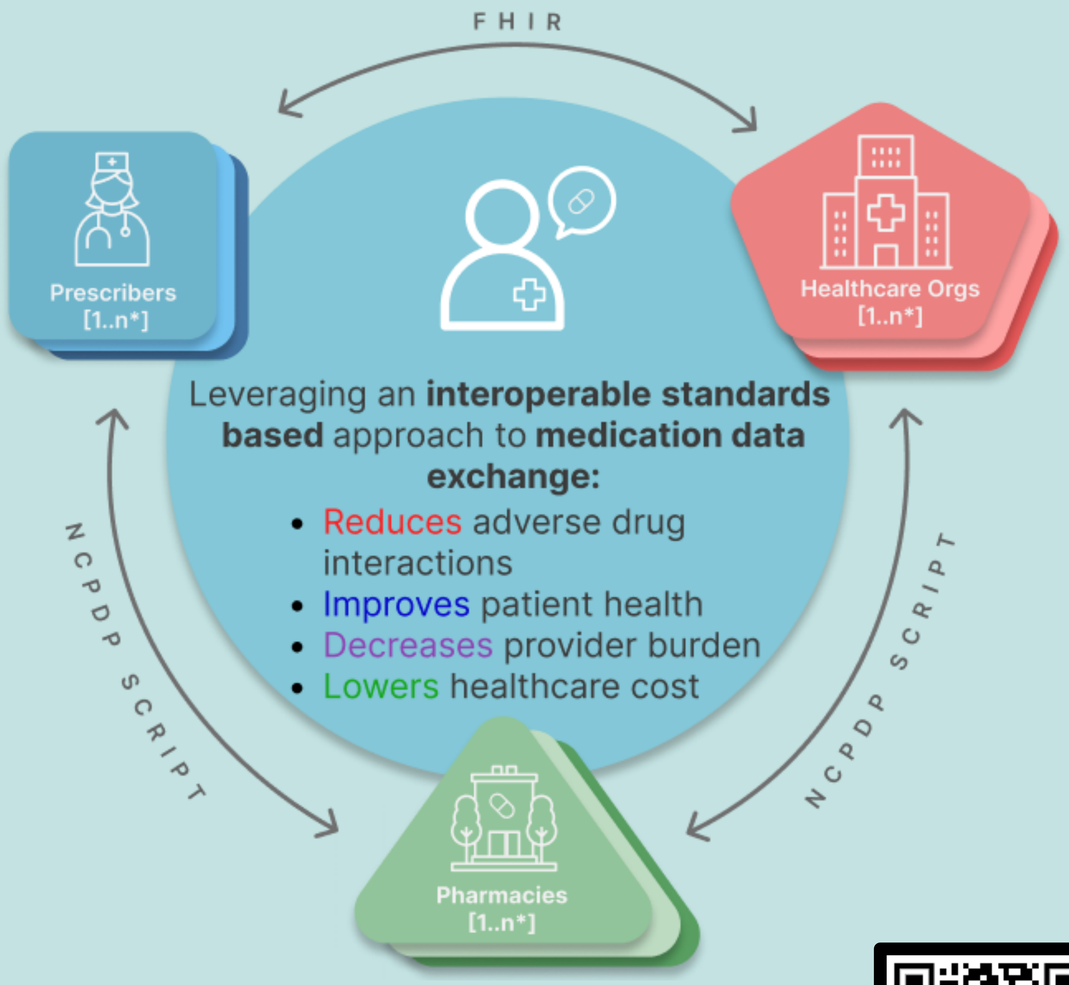
Research Questions

- How can an interoperable medication exchange standard be designed such that it works with current industry systems?
- How can existing standards/algorithms be leveraged to reduce the provider burden/ error and improve overall patient care?

Generalized Problem

- The problem space was reduced to a generalizable problem for comparison to work completed in other domains/industries
- It was found that the Medication History Problem mirrored that of the Byzantine Generals Consensus Problem
- Byzantine Fault Tolerant consensus algorithms, like RAFT, facilitate data synchronization





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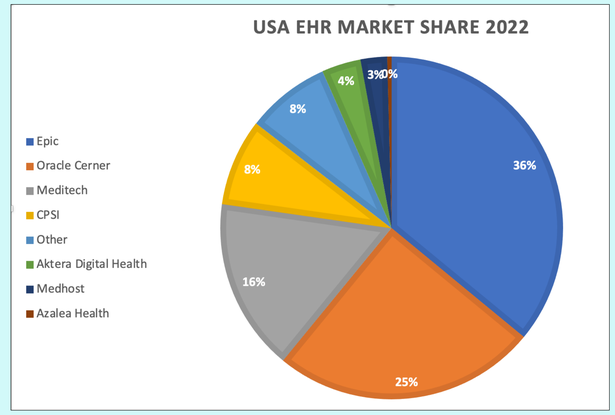
[1] M. J. Makiani, S. Nasiripour, M. Hosseini, and A. Mahbubi, "Drug-drug Interactions: The Importance of Medication Reconciliation," J. Res. Pharm. Pract., vol. 6, no. 1, pp. 61-62, Jan.-Mar. 2017.
[2] J. Sultana, P. Cutroneo, and G. Trifirò, "Clinical and economic burden of adverse drug reactions," J. Pharmacol. Pharmacother., vol. 4, no. Suppl 1, pp. S73-S77, Dec. 2013.
[3] D. Flockhart, P. Honig, S. Yasuda, and C. Rosenberg, "Preventable Adverse Drug Reactions: A Focus on Drug Interactions," U.S. Food and Drug Administration, Mar. 06, 2018.

Current Approach

- Current systems lack proper cross-communication to track all the medications for a patient
- They are often limited to medications within their network and those self-reported
- The fragmented EHR market in the US places the burden on patients to remember and report all their medications
- This process is cumbersome and prone to human errors



G. Bruce, "EHR vendor market share in the US," *Beckers Health IT*, May 23, 2023.

Technical Considerations

- Collaboration with the community could establish a standard definition for patient medication interoperability
- Standard could be based on the RAFT protocol and FHIR, utilizing CDS-Hooks and SMART on FHIR where necessary
- Standard could also interface with NCPDP SCRIPT to enable communication with pharmacy management systems
- A translation layer between the FHIR and NCPDP Script standards could exist within the EHR or through an Intermediary System