Enhancing Biologics Adverse Event Surveillance via Scalable, FHIR-based Infrastructure: Pilot

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1. Background

The Center for Biologics Evaluation and Research (CBER) uses VAERS (Vaccine Adverse Reporting System) as a passive surveillance system of post-vaccination adverse events (AE), which relies on manual AE case reporting. This process starts with the manual recognition of AEs by a provider, a manual review of records, and manual data entry into case review forms for submission. Reports may also be submitted by patients. The multiple non-assisted steps lead to inaccuracies and incompleteness of the data, resulting in barriers to rapid assessment and comprehensive safety surveillance. For identified AEs, there is often a lengthy process for the FDA to obtain medical records, or electronic health records (EHR), for outcome validation. CBER's Office of Biostatistics and Pharmacovigilance (OBPV) team, in collaboration with eHealth Exchange (eHx), is developing a Fast Healthcare Interoperability Resources (FHIR)-based infrastructure under the Biologics Effectiveness and Safety (BEST) Initiative to address these challenges. The present pilot study describes a platform to showcase the added value in enhancing and scaling AE surveillance capacity across the United States.

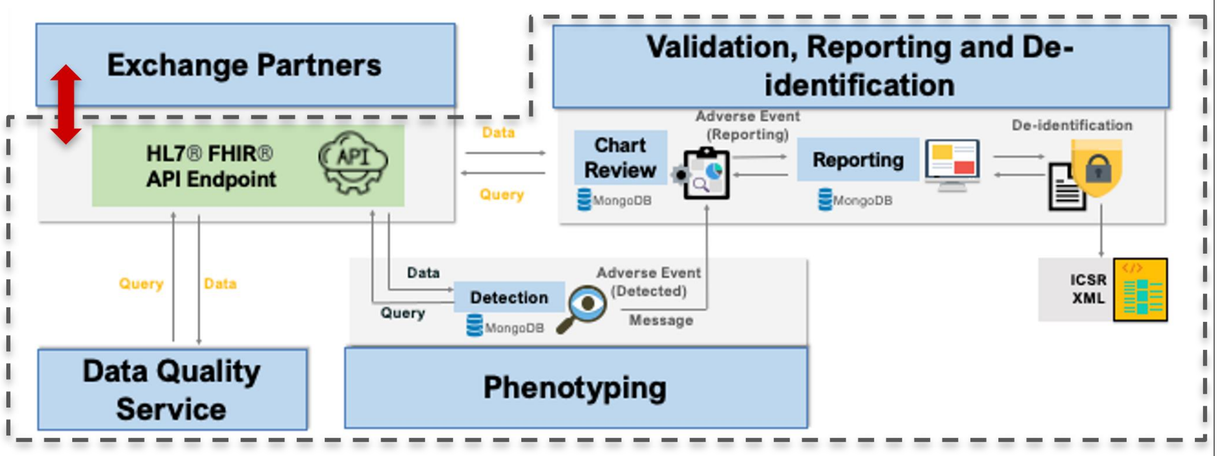

Figure 1: Components of BEST Platform

2. Objectives

1. Demonstrate the feasibility of semi-automated case validation, reducing time to obtain EHRs, while minimizing burden on providers
2. Examine data obtained from FHIR-based platforms and determine its fitness for AE surveillance use case
3. Streamline the process of recognizing, reporting and validating VAERS AEs
4. Increase platform visibility to raise awareness of innovative AE surveillance efforts

3. Research Design and Pilot Platform Description

The BEST team connected a cloud platform with tools for detection, validation, and reporting of AE with eHx, which has national coverage. For this pilot platform, 12 eHx network participants connected FHIR endpoints which enables the platform to retrieve/receive AE case data from the partners' EHR systems. Data was exchanged in the FHIR HL7 format for interoperability. This platform has two distinct use cases:

Table 1: BEST Platform Use Cases

Push Use Case (Figure 4)	Enables providers to push AE reports, either using their own, or claims comparable interoperable (FHIR CQL, OMOP) adverse event detection algorithms used by multiple agencies (e.g., FDA and CDC)
Pull Use Case (Figure 5)	Allows BEST Platform to pull data from a wide network of providers to confirm or add data to already AE reported cases or add additional information for a patient that may have their medical history spread across providers.

The data flow occurs across different secured platforms and allows processes to be initiated by FDA (Figure 2 #1) or the participants themselves (Figure 2 #4), routed through the eHx Hub.

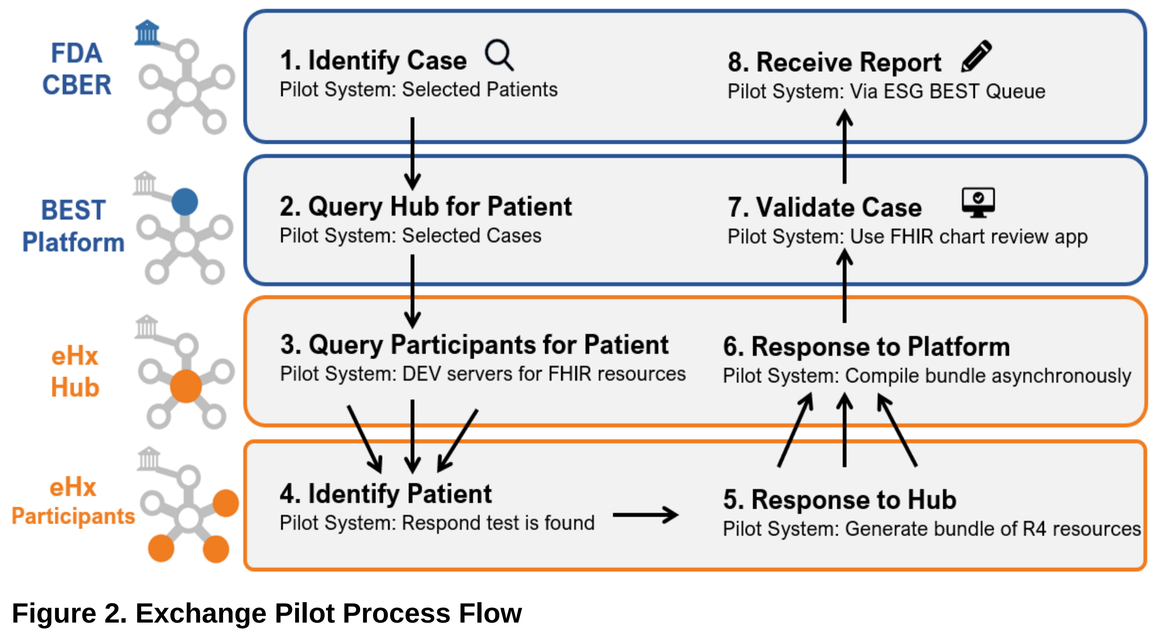

Figure 2. Exchange Pilot Process Flow

An automated data quality (DQ) service was developed, based on an existing framework, to characterize the current state of FHIR endpoints for conformance, completeness and plausibility of AE-relevant data. 210 different data tests were run on the data elements required/optional for a VAERS form or elements helpful for case AE analysis or validation.

4. Results and Evaluation

A data quality service analyzed 271 Epic post vaccination adverse event live patient records that were pulled into the platform from 11 different data partners' production EHRs**.** These records contained the FHIR elements associated with 19 resources, such as encounters, observations, and conditions. The DQ analysis revealed that generally the data had the necessary fields or workarounds for the FDA's use case, but we did uncover a few important gaps due to lack of inclusion in USCDI core data set, Epic FHIR API support or varying levels of completeness across data partner. Figure 3 below shows the range of field completeness across partners for required VAERS fields:

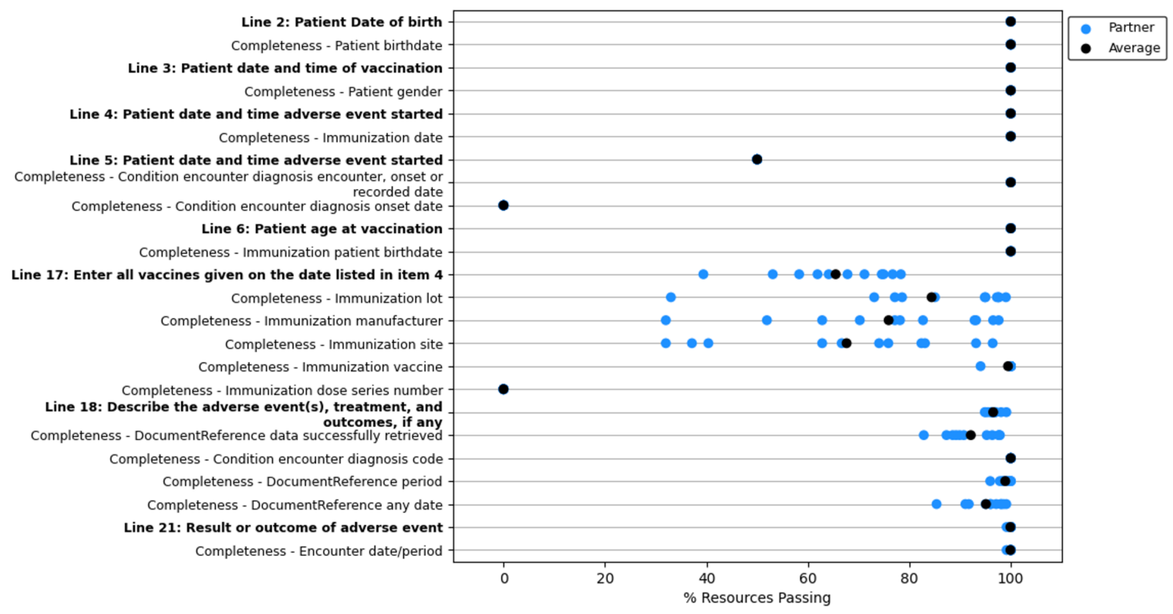

Figure 3: Data Completeness across Required VAERS Fields

5. Conclusion

Building on the FHIR data quality assessment, the BEST team continues to develop the infrastructure to efficiently federate AE detection logic and conduct clinical validations of identified cases, toward the goal of enhancing passive and active surveillance capabilities. This initiative will further CBER's goal of obtaining AE-relevant quality data to support the FDA's post-marketing safety and effectiveness surveillance mission.

6. Lessons Learned

The lessons learned from the pilot system include:

- Real patient data with the relevant FHIR resources able to be received/retrieved from several different data partner sites and used to clinically validated AEs.
- Overall data quality meets general requirements of FDA's use case with our partners' EHR FHIR APIs showing high adherence to the data completeness and interoperable coding requirements from the USCDI core data set. The APIs also support many fields key for our use case outside the USCDI requirements.
- Due to variability, even when using the same EHR vendor, in data partner's security authorization settings, the only way to initially connect was through trial and error at an individual partner site. We worked with EHR vendors to create a new policy that standardizes this process across partners to greatly reduce the per-site connection time.

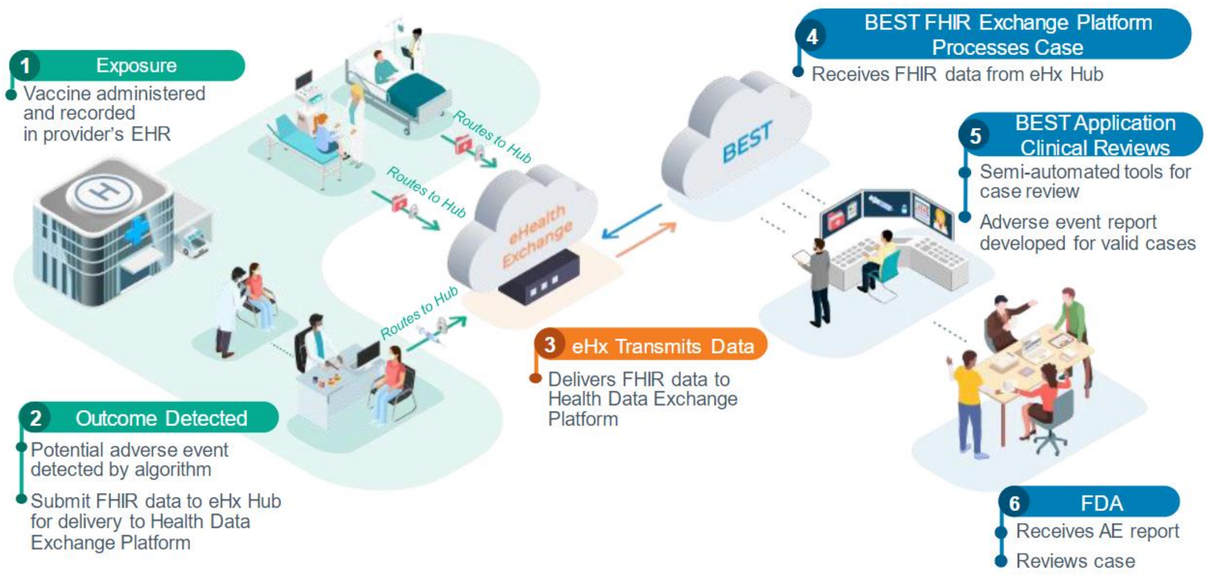

Figure 4: eHealth Exchange and BEST Platform Design, Push Use Case

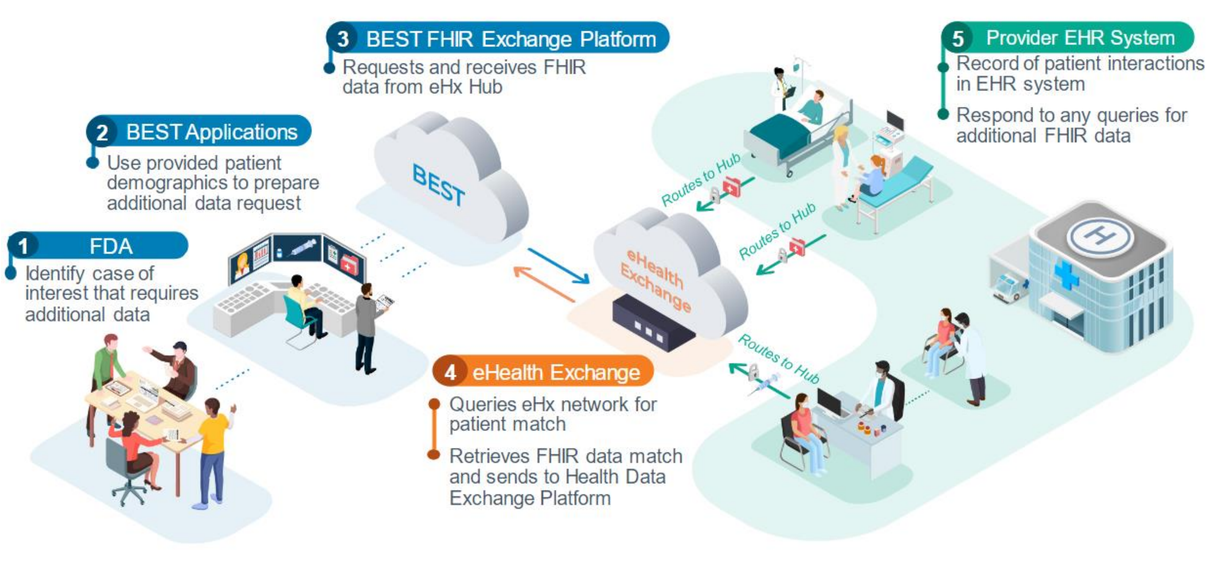

Figure 5: eHealth Exchange and BEST Platform Design, Pull Use Case