MEDINFO 2023 — The Future Is Accessible
J. Bichel-Findlay et al. (Eds.)

doi:10.3233/SHTI230920

Evolving Interoperability Across a State Public Health Immunization Registry and Electronic Health Records

Sripriya RAJAMANI[a,1], Naomi JITER[b], Maureen LEEDS[b], Miriam MUSCOPLAT[b], Katie WHITE[a], Aaron BIERINGER[b] and Genevieve B. MELTON[a,c]
[a]*University of Minnesota, Minneapolis, Minnesota, USA*
[b]*Minnesota Department of Health, Saint Paul, Minnesota, USA*
[c]*Center for Learning Health System Sciences, Univ of MN, Minneapolis, MN, USA*
ORCiD ID: Sripriya Rajamani https://orcid.org/0000-0002-5941-7500, Genevieve B Melton https://orcid.org/0000-0001-5193-1663

Abstract. The critical need for system interoperability and robust information infrastructure in public health was highlighted during the COVID-19 pandemic. An assessment of the evolving interoperability between immunization information system (IIS) in a state-based public health agency and electronic health records (EHRs) including pandemic-driven evolution/use was conducted. The Minnesota Immunization Information Connection (MIIC), the IIS for Minnesota (US) supports interoperability with EHRs using HL7v2.5.1 standards-based queries. Structured interviews were conducted with 28 experts across 12 healthcare systems and public health clinics (n=286 sites) between April - July 2022. Though all reported use of MIIC, most (83%) had MIIC integration within their EHRs, and high EHR queries to MIIC (~6 million/month), numerous organizational/technical barriers were identified including standard vaccine-naming need in EHRs, app access issues, limited resources and informatics-staff shortage in public health. Results underscore vital role of IIS, on-going interoperability evaluation to address issues and promote standards-based bi-directional EHR-IIS data exchanges.

Keywords. Interoperability, standards, immunization information systems, electronic health records

1. Introduction

Immunization Information Systems (IIS), which are part of the evolving health information technology ecosystem of immunization registries, are secure, population-based systems typically hosted by public health agencies which serve as a hub for vaccination data over time across providers [1]. The COVID-19 pandemic has recently highlighted the critical role of IIS whereby vaccination history for an individual across various entities needed to be accessible accurately and timely for care providers, individuals, and interested entities (e.g., vaccination mandates of various types). Increasingly, IIS have the capability to receive internationally-supported HL7 standards-based (v2.5.1 recommended) reporting of vaccinations in real-time from electronic

[1] Corresponding Author: Sripriya Rajamani, email: sripriya@umn.edu.

health records (EHRs) [1]. A key aspect of EHR-IIS data exchange is bi-directional data exchange in which EHRs can access IIS data through query/response supported by HL7 international standards (v2.5.1) [2]. Additionally, many IIS have capabilities for vaccine forecasting utilizing clinical decision support for immunizations (CDSi) incorporating Advisory Committee on Immunization Practices (ACIP) recommendations [1,3]. Access to a comprehensive vaccination history and computed vaccination recommendations through CDSi are core drivers for EHR-IIS bi-directional exchange. Prior assessments of EHR-IIS data exchange have evaluated automated reporting from EHRs to IIS [4], access of IIS-CDSi within EHRs but have largely focused on a single setting and were completed several years ago [5, 6]. Recent policies and initiatives [7,8] as well as COVID-19 have changed the interoperability landscape making an updated IIS-EHR interoperability assessment timely and relevant.

Since 2002, the Minnesota Immunization Information Connection (MIIC) has served as the IIS for the state of Minnesota (US) [9]. It currently holds data for over 130 million immunizations on 8.6 million individuals (as of September 2022). The user base for MIIC includes over 6,000 organizations across primary care clinics, specialty providers, nursing homes, long term care facilities, retail pharmacies, and hospitals. The study objective was to assess current state of the evolving interoperability across provider EHRs in healthcare systems and MIIC (the Minnesota state IIS) specifically the access of MIIC from EHRs using HL7 v2.5.1 standards-based query [2] and to evaluate the post-pandemic evolution and use.

2. Methods

Data was collected from 28 subject matter experts (SMEs) across 12 integrated healthcare delivery systems and public health clinics representing 286 individual care sites through virtual interviews using a structured questionnaire. Due to the large number of integrated care delivery systems in Minnesota, these entities represent approximately three-fourths of Minnesota's population. Their expertise included clinical, public health, and technical subject matter experts with most having clinical and administrative roles. These experts were identified based on key personnel listed in MIIC and for their knowledge of MIIC-EHR interoperability. The questionnaire was developed by 4 members of the study team and pilot-tested first with a single healthcare system. The questionnaire included 25 questions across six subject areas (background, awareness and use of MIIC data, value of MIIC CDSi, value of MIIC data and reports, technical issues/troubleshooting and closing).

The questionnaire was shared ahead of time with SMEs to help prepare and invite colleagues, as needed. Data was collected over Zoom meetings from April - July 2022 by two study members with detailed note-taking and audio recordings. Verbal consent was obtained prior to the structured interview, which lasted for approximately 45 minutes. The use of EHRs to MIIC query functionality was analyzed with SQL queries of MIIC database. The responses to structured questions were analyzed using descriptive statistics. A thematic qualitative analysis was performed to identify the main organizational and technical barriers and facilitators.

3. Results

The volume of HL7 v2.5.1 standards-based queries from EHRs to MIIC (Figure 1) increased markedly in 2021 coinciding with the availability of COVID-19 vaccines, including ~6 million queries in November and December 2021).

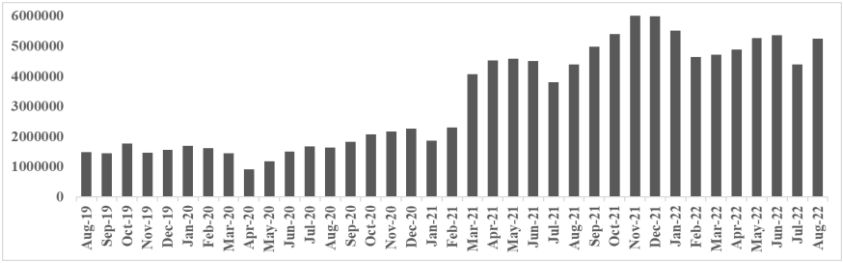

Figure 1. Volume of HL7 v2.5.1 standard-based queries to MIIC from EHRs to access MIIC data.

All organizations (100%) acknowledged the high use of MIIC during the pandemic, were aware of the functionalities and accessed MIIC on site to look up data and imported data from MIIC to EHRs (Figure 2). The MIIC-EHR integration was appreciated by the respondents as it saved time from separate log-ins and eliminated burden of duplicate data entries and data entry errors. Almost all (11 of 12, 92%) reported data to MIIC using HL7 v2.5.1 standards. All except two (83%) had MIIC access integrated within EHR and used the HL7 v2.5.1 standards-based query functionality to look up MIIC data. Though all interviewees (100%) used MIIC to look up vaccination history, only a third used MIIC CDSi or the MIIC reports, and the rest used the features available in their EHRs. This difference was due to organization type (with all public health entities using and the rest not). MIIC was mainly used by nurses, clinic assistants and care support staff (e.g., scheduling, billing) in all the organizations (12 of 12, 100%) and had limited access or use by providers (e.g., physicians).

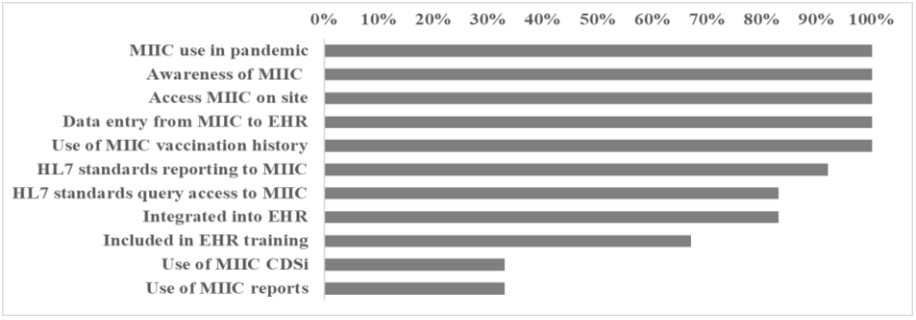

Figure 2. MIIC Data: Standards-based reporting, query, awareness, access and use.

The study identified certain organizational and technical facilitators and barriers as depicted in Table 1. Standards for exchange (HL7 international standard, v2.5.1 in use) and for representation (vaccine codes) along with increased awareness due to pandemic have been facilitators. The need for standardized vaccine naming/labels across entities to address data quality issues and varying user interfaces to access history/CDSi are barriers along with need for training, informatics-savvy workforce and resources.

Table 1. Technical and organizational facilitators and barriers for interoperability (% respondents).

Technical Facilitator	Technical Barrier
Standards for vaccination data exchange **(100%)**	Lack of standard vaccine labeling (varying naming in EHRs across entities) **(100%)**
Standards for representing vaccines **(100%)**	Need QR code for vaccine history **(100%)**
Some public health EHRs act as collaboratives to share costs and enhancements **(100%)**	Low app literacy in some stakeholders to access MIIC data via Docket **(100%)**
Bi-directional exchanges (report/query) are getting well established **(83%)**	Fix access issues to Docket app (multiple records access) **(100%)**
Integration of vaccine ordering in MIIC **(33%)**	Different EHR user interfaces to access MIIC vaccination history and CDSi **(50%)**
Standardized MIIC data in dashboards **(33%)**	No CDSi in few public health EHRs **(33%)**
	Need for robust CDSi for non-standard vaccine series (e.g., immigrants) **(33%)**
Organizational Facilitator	**Organizational Barrier**
COVID-19 pandemic increased appreciation of public health immunization registries **(100%)**	Lack of resources for interoperability enhancements **(100%)**
Prior successful MIIC collaborations (**100%)**	Training on key MIIC features **(100%)**
Public health clinics have more MIIC awareness **(33%)**	Data quality issues due to potential duplicate creation in EHRs and guidance for better use of data from MIIC query **(100%)**
MIIC is promoted in new client package by public health clinics **(33%)**	Need to increase collaboration for better use of bi-directionality **(100%)**
	Less public health informatics staff **(33%)**

Some ideas for improvements suggested with the top two being the need to address the variation in vaccine naming practices across organizations (same vaccine code with different naming/labels) leading to likely vaccine data duplicates in bidirectional data exchange (identified by all SMEs, 100%) and focusing on adding the missing pockets of data from certain providers (e.g., VA health system) (noted by all SMEs, 100%).

4. Discussion

This updated assessment of IIS-EHR interoperability in the state of MN highlights the increasing use of standards-based [2] bi-directional exchange. This is attributed to MIIC having a consolidated history of vaccinations by collating data feeds from various vaccine providers (e.g., clinics, mass vaccination sites) and over time. Most of the participating entities (83%) had access to MIIC embedded within care delivery (Figure 2). But there is variation in MIIC use between health systems and public health clinics with all entities utilizing the vaccination history, but only the public health sites using CDSi and reports. This is due to public health being low resourced and MIIC providing better functionalities than their EHRs. The different user interfaces to access MIIC history and CDSi in some EHRs needs to be addressed for better interoperability.

The study collection was designed to represent three-fourths of the clinical settings due to the integrated healthcare delivery system dominance in Minnesota. Likewise, these sites represent the dominant EHR in this market (Epic®). The participants were also selected to represent the two main EHRs in public health in Minnesota (PH-Doc and Champs). This study focuses on a single state IIS (MIIC in MN), but MIIC is part of an IIS consortium and results shared along with collaboration on enhancements.

This research also pointed to potential user needs/priorities. Training needs were identified and was addressed by the MIIC program through webinar series (Fall 2022) on various functionalities. A key take-away is the need to pay attention to quality of data

across systems with increasing bidirectional data exchange across EHRs and MIIC with potential for duplicates and errors propagating across systems, and requirement to implement data quality monitoring protocols/tools. Follow-up study with a focus on smaller providers with less resources (rural/community clinics) are needed to evaluate using equity perspectives [8] and to bridge the digital divide in interoperability.

5. Conclusions

The pivotal role of public health and need for robust information infrastructure was brought to forefront with the COVID-19 pandemic [7,10]. It is vital to evaluate the current state of interoperability and standards-based reporting to public health and importantly include the bi-directional exchanges between public health IIS and EHRs.

Acknowledgements

Authors acknowledge support from the Agency for Healthcare Research and Quality (AHRQ) [1R03HS028693-01] and the University of Minnesota Center for Learning Health System Sciences, a partnership between the University of Minnesota Medical School and the School of Public Health, and express gratitude to the study participants.

References

[1] Centers for Disease Control and Prevention (CDC). Immunization Information Systems (IIS). 2014. http://www.cdc.gov/vaccines/programs/iis/index.html (accessed Nov 18, 2022).
[2] Centers for Disease Control and Prevention (CDC). IIS HL7 version 2.5.1 Implementation Guide. 2014. https://www.cdc.gov/vaccines/programs/iis/technical-guidance/hl7.html (accessed Mar 2, 2023).
[3] Arzt NH. Clinical Decision Support for Immunizations (CDSi): a comprehensive, collaborative strategy. Biomed Inform Insights. 2016 Oct;8(Suppl 2):1-13, doi: 10.4137/BII.S40204.
[4] Stockwell MS, Natarajan K, Ramakrishnan R, Holleran S, Forney K, Aponte A, Vawdrey DK. Immunization data exchange with electronic health records. Pediatrics. 2016 Jun;137(6):e20154335.
[5] Rajamani S, Roche E, Soderberg K, Bieringer A. Technological and organizational context around immunization reporting and interoperability in minnesota. Online J Public Health Inform. 2014 Dec;6(3):e192, doi: 10.5210/ojphi.v6i3.5587.
[6] Rajamani S and Bieringer A et al. Stakeholder use and feedback on vaccination history and clinical decision support for immunizations offered by public health. AMIA Annu Symp Proc. 2017:1450-7.
[7] Council of State and Territorial Epidemiologists. Driving Public Health in the Fast Lane. Need for a 21st Century Data Superhighway. (2019). www.cste.org/data-superhighway (accessed Nov 5, 2022).
[8] Centers for Medicare and Medicaid Services. Promoting Interoperability Programs. 2020. www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms (accessed Nov 9, 2022).
[9] Minnesota Department of Health. Minnesota Immunization Information Connection (MIIC). (2016). http://www.health.state.mn.us/divs/idepc/immunize/registry/index.html (accessed on Nov 16, 2022).
[10] Centers for Disease Control and Prevention (CDC), Data Modernization Initiative. (2022). Available from: cdc.gov/surveillance/data-modernization/ (accessed on November 8, 2022).