

WHITE PAPER

Leveraging Electronic Health Record Data to Create Actionable Insights



Executive Summary

Electronic health records (EHRs) contain rich clinical details, which are an important source of real-world data. The advantage of using EHRs to generate practical clinical evidence lies in the documented capture of comprehensive patient data across providers, settings, conditions, and treatments. Clinical granularity encompasses patient identifiers, demographics, diagnoses, patient progress notes, current and past medications, vital signs, laboratory test results, allergies, and immunizations — as well as operative, radiology, and pathology reports. With appropriate data security and required Health Insurance Portability and Accountability Act (HIPAA) patient privacy safeguards, EHRs are a potentially robust source for life sciences research, with important caveats.

Use of EHRs as a data source presents challenges for real-world researchers. EHRs may be associated with missing, incomplete, and/or inaccurate records if a patient encounter is not properly documented. Moreover, the incompatibility of EHRs between vendors may make normalizing patient data across disparate health systems difficult. Evaluating data quality for clinical applications includes representativeness, completeness, timeliness, and cleanliness. Poor-quality data is characterized by inconsistent, incomplete, inaccurate, and duplicate data entries; delayed and outdated records; and fragmented information across multiple electronic health records and systems. These examples of deficient data impair the generation of real-world evidence and its reliability and usability by researchers. Bridging these gaps with external solutions that standardize, analyze, and reveal trends from electronic health record (EHR) data is essential.

To fully realize the potential and impact of EHRs for clinical data connectivity and utility, seamless integration of clinical support tools is fundamental. Inovalon, using cloud-based software, provides data governance, standardization, and techniques to improve data quality collected from EHRs. Data cleaning, validation, and harmonization create opportunities for data to be used for healthcare insights and research. A collaboration between Inspira Health, a large healthcare network serving Southern New Jersey, and Inovalon's VigiLanz Pharmacy Surveillance Pro™ solution illustrates how an innovative integration of a suite of software solutions facilitated the use of the Inspira EHR network to support, advance, and manage an Opioid Stewardship Program initiative inclusive of support from the Substance Abuse and Mental Health Services Administration (SAMHSA).



Electronic Health Records

Overview

EHR data is a key source used to generate real-world evidence (RWE) as a stand-alone source or in combination with other real-world data (RWD) sources, such as administrative medical claims data, randomized clinical trials, healthcare registries, patient-reported outcomes, laboratory testing data, and pharmacy data.¹ RWD collected from these various sources during the delivery of healthcare may include demographics, diagnoses, treatments, laboratory results, and patient outcomes. When formally analyzed, RWE transforms the raw RWD into actionable insights that influence healthcare decisions.²

Clinical granularity of EHRs encompasses patient identifiers, demographics, diagnoses, patient progress notes, current and past medications, vital signs, laboratory test results, allergies, and immunizations — as well as operative, radiology, and pathology reports. Core EHR functions include capturing health information, managing orders and results, supporting clinical decision-making, exchanging health information, facilitating electronic communication among providers and patients, and simplifying administrative processes.³ With appropriate, required HIPAA patient data privacy safeguards in place, linking EHRs to RWD sources using unique identifiers provides a robust analytic tool for clinical management, health economics and research outcomes, and financial analyses.

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1. "Electronic health records to facilitate clinical research," Martin R. Cowie, Juuso I. Blomster, Lesley H. Curtis, et al., *Clinical Research in Cardiology*, August 24, 2016, doi: 10.1007/s00392-016-1025-6
 2. "Real-World Evidence," U.S. Food & Drug Administration, accessed April 17, 2025, <https://www.fda.gov/science-research/science-and-research-special-topics/real-world-evidence>
 3. "Obtaining Data From Electronic Health Records," Vera Ehrenstein, Hadi Kharrazi, Harold Lehmann, et al., in *Tools and Technologies for Registry Interoperability, Registries for Evaluating Patient Outcomes: A User's Guide*, 3rd Edition, R.E. Gliklich, M.B. Leavy, N.A. Dreyer, editors, Rockville, MD, U.S. Agency for Healthcare Research and Quality, Chapter 4, October, 2019, <https://www.ncbi.nlm.nih.gov/books/NBK551878/>

Strengths and limitations

EHRs are readily accessible comprehensive digitalized versions of patient paper records that centralize information and document the patient healthcare journey across providers, settings, conditions, and treatments. EHRs are a combination of structured and unstructured data captured through the practice of routine clinical care.⁴ They serve as stand-alone resources but also complement other RWD sources to facilitate and enhance data analyses and research at the patient and population levels.

Structured data in EHRs is predominately used to record patient information such as demographics, physical measures (height, weight, blood pressure), laboratory test results, prescription data, and diagnoses. The information is organized in a predefined, consistent format readily accessible for analysis. Unlike computationally ready structured data, unstructured information such as text-based documents and notes requires transforming the data into a reliable computable format for analysis, which may create potential for errors and biases. To minimize this potential, converting unstructured data requires trained clinical data science experts to follow standardized procedures and policies. Artificial intelligence (AI), machine learning (ML), and natural language processing (NLP) technologies may be employed to convert unstructured data into structured data.

Inherent limitations of EHRs may include missing, incomplete, and/or inaccurate records if the patient encounter is not properly documented or if the patient receives care at multiple unlinked networks. The life sciences industry and healthcare researchers generating RWE from the EHR need to recognize and describe the potential impact of missing data or loss to follow up for specific use cases.

In addition to inherent limitations, challenges exist regarding the interoperability between EHR systems.⁵ EHR software vendors differ in their interfaces, applications, standards, and supported data structures. This makes normalizing data across disparate EHR systems difficult. Use of structured fields versus text notes across EHR systems may be inconsistent. The lack of national standards in data formats, terminologies, and definitions contributes to these limitations. Furthermore, combining EHRs from multiple institutions to create regional or national federated EHR networks compounds issues present in single health systems/networks. Subject matter knowledge and technology are required to create EHR data networks that can be used to generate high-quality life sciences and healthcare research.

Moreover, to fully realize the potential and impact of EHRs for clinical data connectivity and utility, seamless integration of clinical decision support tools is vital (see Inovalon's Approach to High-Quality Data). The path from data to decision requires innovative technology that can transform fragmented records into meaningful, near real-time intelligence. Without these external solutions to standardize, analyze, and reveal trends from EHR data, critical quality improvement and research efforts risk being delayed or incomplete.

4. "Assessing Real-World Data From Electronic Health Records for Health Technology Assessment: The SUIABILITY Checklist: A Good Practices Report of an ISPOR Task Force," Rachael L. Fleurence, Seamus Kent, Blythe Adamson, et al., *Value in Health*, June 27, 2024, doi: 10.1016/j.jval.2024.01.019

5. "EHR interoperability challenges and solutions," Naheed Ali, *EHR in Practice*, December 10, 2024, <https://www.ehrinpractice.com/ehr-interoperability-challenges-solutions>

Electronic Health Records Are Not Enough

EHRs were designed to document patient care, not drive insights, presenting key challenges to their broader use. For example, siloed and static documentation data within different healthcare systems hinders seamless patient care and data sharing. Although EHRs store significant amounts of data, limited advanced analytical and reporting capabilities within their own technical infrastructure prevent diverse integration of data to derive meaningful insights and make data-driven decisions. EHRs have time-consuming workflows, such as excessive documentation and redundant tasks, contributing to frustration and burnout of healthcare professionals. By virtue of their monolithic nature and vendor lock-in, EHRs have limited flexibility, customization, and innovation, making it difficult to adapt technologies for their healthcare workers' needs. Due to complex interfaces, inadequate training, and data overload, EHRs lack strong clinical support and communications.

Understanding Quality of Real-World Data and Its Implications

Quality of EHRs and large administrative databases is critical to informed decisionmaking; patient care, safety, and outcomes; and suitability for clinical research and innovation.⁶ High-quality data enables information sharing among healthcare providers to facilitate coordinated care and improve patient management. Moreover, data that is accurate, reliable, and easily accessible allows analysis of population-level trends and patterns, public health initiatives, and life sciences research.

Metrics fundamental to evaluating data quality for clinical application include representativeness, completeness, timeliness, and cleanliness. Poor quality data may be characterized by inconsistent, incomplete, inaccurate, and duplicate data entries, along with delayed and outdated records. Fragmented data across multiple records and systems, and siloed data, such as laboratory values not integrated with other patient data, reflect lack of data quality. Inadequate patient privacy and security safeguards against unauthorized access and breaches, lack of standardization across software solutions, and inadequate data governance similarly reflect poor quality.⁷ Ultimately, poor data quality impairs the generation of RWE and its usability by healthcare professionals and researchers.

6. "Methods and dimensions of electronic health record data quality assessment: enabling reuse for clinical research," Nicole G. Weiskopf and Chunhua Weng, *Journal of the American Medical Informatics Association*, June 25, 2012, doi: 10.1136/amiajnl-2011-000681

7. "Data quality in healthcare – Benefits, challenges, and steps for improvement," Ehsan Elahi, *Data Ladder*, June 27, 2022, <https://dataladder.com/data-quality-in-healthcare-data-systems/>

Inovalon's Approach to High-Quality Data

Inovalon's care management solutions improve patient outcomes by optimizing care plans, enhancing coordination of services, and advancing data-driven care. Moreover, they provide data governance, standardization, and techniques to improve data quality gathered from EHRs.⁸⁻¹⁰ Inovalon's VigiLanz Pharmacy Surveillance Pro software leverages rules-based AI to generate meaningful alerts in a variety of clinical settings to prompt clinical interventions, enabling faster response times for improved patient outcomes. EHR data is surfaced in near real time from sources across acute care, ambulatory care, and other healthcare settings, including Admission-Discharge-Transfer (ADT), electronic Medication Administration Record (eMAR), laboratory and microbiology records, medical order history, and more.

Additionally, the award-winning software, ranked "Best in KLAS" for eight consecutive years, converts disparate information into uniform data for research purposes.¹¹ The ability to use rules-based AI to alert when criteria are satisfied streamlines workflows to improve patient safety and provides high quality healthcare.^{10,12} Patient privacy and security is accomplished through multiple administrative, physical, and technical safeguards. Data cleaning, validation, and harmonization create opportunities for data to be used for healthcare insights and research. Inovalon's care management software has demonstrated benefit in a variety of settings including pharmacy surveillance; infection prevention; and quality, safety, and audit management.¹³⁻¹⁷ See descriptions of each in the table on the next page.

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7. "Data quality in healthcare – Benefits, challenges, and steps for improvement," Ehsan Elahi, Data Ladder, June 27, 2022, <https://dataladder.com/data-quality-in-healthcare-data-systems/>
 8. "Inovalon Care Management Software," <https://www.inovalon.com/products/provider-cloud/care-management/>
 9. "Inovalon and the EHR – A Powerful Synergy for Patient Safety," <https://www.inovalon.com/blog/vigilanz-and-the-ehr-a-powerful-synergy-for-patient-safety>
 10. "Inovalon Acquires VigiLanz; a Leading Clinical Surveillance and Patient Safety SaaS and Data Company," Business Wire, February 5, 2024, <https://www.businesswire.com/news/home/20240205874377/en/Inovalon-Acquires-VigiLanz-a-Leading-Clinical-Surveillance-and-Patient-Safety-SaaS-and-Data-Company>
 11. "Inovalon's Pharmacy Surveillance Software Achieves Best in KLAS for Eight Years in a Row," Inovalon, February 5, 2025, <https://www.inovalon.com/news/inovalons-pharmacy-surveillance-software-achieves-best-in-klas-for-eight-years-in-a-row/>
 12. "Development, Validation, and Assessment of Clinical Impact of Real-time Alerts to Detect Inpatient As-Needed Opioid Orders With Duplicate Indications: Prospective Study," Elsie Rizk and Joshua T. Swan, Journal of Medical Internet Research, October 25, 2021, doi: 10.2196/28235
 13. "VigiLanz Pharmacy Surveillance," Inovalon, <https://www.inovalon.com/products/provider-cloud/care-management/pharmacy-surveillance/>
 14. "Infection Prevention," Inovalon, <https://www.inovalon.com/products/provider-cloud/care-management/infection-prevention/>
 15. "Quality Management," Inovalon, <https://www.inovalon.com/products/provider-cloud/care-management/quality-management/>
 16. "VigiLanz Safety Management," Inovalon, <https://www.inovalon.com/products/provider-cloud/care-management/safety-management/>
 17. "Audit Management," Inovalon, <https://www.inovalon.com/products/provider-cloud/care-management/audit-management/>

Solutions	Descriptions
<u>VigiLanz Pharmacy Surveillance</u>	• Leverages clinical and business data to facilitate better decision making and improved quality of care • Rules-based AI standardizes practices • Works with outpatient EHRs to collect data and perform healthcare analytics via a rules library that can be modified to create new rules that are customized for the ambulatory care location to address new challenges as they emerge • Tailored outpatient clinic solution streamlines workflows, enabling clinicians to manage patient visits more effectively, minimizing administrative burdens • Supports clinicians in monitoring and managing patient medications, reducing the risk of adverse drug events and ensuring that patients adhere to their treatment plans • Automated surveillance decreases adverse drug events and reactions, and ensures safe and appropriate antibiotic use • Integrated antibiogram allows clinicians to access and interpret local antibiotic susceptibility patterns, facilitating informed decisions about antibiotic prescribing, while combating antibiotic resistance • Intuitive clinical rounding views reduce manual chart review • Patient Worklist enables clinicians to view patients' lab results quickly, prioritizes those who need immediate attention, and uses advanced algorithms to highlight critical cases • Access to alerts and intelligence within the EHR enhances clinical productivity • Analytics and reporting assist clinicians to monitor and evaluate key metrics related to patient care, clinical activities, and operational efficiency • Comprehensive metrics and reports are accessible at any time to share progress
<u>Inovalon's VigiLanz Infection Prevention™</u>	• Easy-to-navigate dashboard provides views in near real time of infection alerts, tasks, reports, and analytics • Advanced tracking capabilities for presence of hospital-acquired infections, community-acquired infections, and present-on-admission infections assist with timely prevention and intervention • Interactive infection map detects potential clusters and assists with implementing appropriate precautions • Direct submission to Centers for Disease Control and Prevention's National Healthcare Safety Network without separate file handling saves time • Advanced antibiograms offer on-demand and trending antibiogram data
<u>Inovalon's VigiLanz Quality Management™</u>	• Enhance sepsis management with timely alerts, automated data completion, and case analyses • Modified Early Warning Score dashboard monitors patient acuity changes in near real time • Detect, manage, and receive clinical guidance for glycemic events to support glucose management • Configurable workflow offerings include core measures, behavioral health, dietary management, trauma services, and admission/readmission management
<u>Inovalon's VigiLanz Safety Management™</u>	• Simplified cloud-based incident reporting captures safety events and identifies root causes of harm, offering auto-populated forms that standardize event capture • Easily view and manage reported events with reporter, investigator, and administrative dashboards • Comprehensive investigations improve the incident management lifecycle, helping to achieve a better insurance premium • Automated event detection locates safety incidents that may have gone unreported so the most effective strategies can be implemented to improve patient care
<u>Inovalon's VigiLanz Audit Management™</u>	• Audit practices, processes, and environmental guidelines to meet regulatory and accreditation guidelines and quality improvement initiatives • Automatically receive cases meeting audit criteria to improve accuracy and data collection • View audit status and performance, selecting from configurable audit forms • Locate emerging risks and quickly evaluate improvement initiatives to enhance data-driven decision making • Customize data with Dashboard Builder and Ad Hoc Report Builder

To enhance clinical surveillance software, Inovalon strategically integrates AI, ML, and NLP to derive deeper insights from healthcare data. Inovalon utilizes ML to deliver predictive insights and intelligent automation, enhancing alert accuracy, optimizing workflows, and enabling proactive interventions. Furthermore, these solutions leverage NLP to intelligently codify and reveal critical information within unstructured text-based documents and clinical notes in patient records to enhance clinical workflows for acute care and ambulatory organizations. Inovalon's processes identify significant risk factors and treatment trends by analyzing population-level data, thereby empowering healthcare providers with actionable intelligence to improve patient care and safety.



Inspira Health Network Converted Raw EHR Data into an Opioid Stewardship Dashboard to Drive Measurable Outcomes

Opioid stewardship programs have been established nationally to combat the opioid epidemic.¹⁸ They seek to ensure that opioids are prescribed safely, correctly, and for the appropriate indications. Overall objectives of these programs include educating healthcare professionals and providing them with the tools to reduce opioid-related morbidity and mortality; improve pain management; minimize misuse and diversion; promote patient-centered decision making; and improve communication between patients and prescribers. Inspira Health Network, serving communities in Southern New Jersey disproportionately affected by opioid overdoses and death, has ongoing consequential opioid quality improvement projects using real-world clinical data from its EHR network.¹⁹ The Inspira Opioid Stewardship initiative tracks opioid prescribing behaviors in its network of emergency department (ED) practices with grant support from SAMHSA to evaluate the use of opioid alternatives prescribed in the ED.²⁰

Inspira Health leveraged VigiLanz Pharmacy Surveillance Pro to convert raw EHR data into an opioid stewardship dashboard, driving measurable outcomes across EDs. Early in data collection efforts, Inspira Health identified gaps in its EHR system's ability to provide crucial metrics, such as morphine milligram equivalents (MME), and generate useful analytics for data display. Integrating Pharmacy Surveillance Pro software and configuring customized data queries augmented the capabilities of the EHR network to advance and manage key performance indicators. The software calculated MMEs to compare the many prescribed opioids using a standard value based on morphine and its potency.²¹ Moreover, providing near real-time monitoring of opioid prescriptions and usage, coupled with weekly detailed reports and raw data extracts, permitted Inspira Health to build Power Business Intelligence (Power BI) dashboards to examine, trend, and visualize opioid and alternative prescribing practices in the ED, as well as inpatient and discharge settings.

18. "What is 'Opioid Stewardship'? An Overview of Current Definitions and Proposal for a Universally Acceptable Definition," Sunil Shrestha, Asmita P. Khatiwada, Binaya Sapkota, et al., *Journal of Pain Research*, February 10, 2023, doi: 10.2147/JPR.S389358

19. "Community Action Against Opioid Abuse: Inspira's Efforts in South Jersey," Inspira Health, April 27, 2023, <https://www.inspirahealthnetwork.org/news/provider-inspiration/community-action-against-opioid-abuse-inspiras-efforts-south-jersey>

20. "Celebrating Innovation and Healthcare Excellence: Meet the 2024 Impact Award Winners," Inovalon, <https://www.inovalon.com/impact-awards/winners/>

21. "Opioid2MME: Standardizing opioid prescriptions to morphine milligram equivalents from electronic health records," Juan Antonio Lossio-Ventura, Wenyu Song, Michael Sainlaire, Patricia C Dykes, and Tina Hernandez-Boussard, *International Journal of Medical Informatics*, March 16, 2022, doi: 10.1016/j.ijmedinf.2022.104739

With VigiLanz Pharmacy Surveillance Pro, dashboard data may be filtered by facility, prescriber, number of prescriptions, type of medication, administrations, demographics, and average total MME per prescription/dose/day/hospital unit. In addition to this data modeling and visualization, raw data extracts enable detection of outliers and erroneous data, highlighting the need to combine multiple data sources and apply data cleansing techniques. Metrics measure patient prescription rates, physician prescribing practices, and potential opioid misuse. Other ancillary data associated with opioid use such as benzodiazepine use, pain scores, substance abuse consultations, urine drug screens, medication for opioid disorder, diagnosis, and pain conditions are available for study.

In summary, important lessons were gleaned from the collaboration between Inspira Health and Inovalon. First, use of the EHR as a RWD source for clinical research and data analysis had limitations, which were identified as SAMHSA grant requirements and resolved early during the grant period. These limitations were successfully addressed by VigiLanz Pharmacy Surveillance Pro, including provision of essential data, such as calculation of MME for prescribed opioids. Raw data extracts generated by VigiLanz Pharmacy Surveillance Pro were used by Inspira Health for informed decision making. Thus, the integration of VigiLanz Pharmacy Surveillance Pro with their EHR software solution was key to transforming EHR data to perform clinical data analysis. Through this innovative partnership, Inspira Health can track opioid prescribing rates and behaviors to measure progress toward key performance indicators and opioid stewardship success.

Read Success Story



About us

Inovalon is a leading provider of cloud-based SaaS solutions empowering data-driven healthcare. The Inovalon ONE® Platform brings together national-scale connectivity, real-time primary source data access, and advanced analytics into a sophisticated cloud-based platform empowering improved outcomes and economics across the healthcare ecosystem. The company's analytics and capabilities are used by over 50,000 active, licensed customers.

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