

When Worlds (Should) Collide: Promoting Clinician-Informatician Collaboration and Engagement Towards Realization of Learning Health Systems.

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Background

Learning Health Systems (LHSs) improve their delivery of care through cyclical processes that involve collection and assembly of data (“practice to data flow”), analysis of data and interpretation of results (“data to knowledge flow”), and the application of that knowledge to practice (“knowledge to practice flow”)^{1,2}. The effectiveness of this cycle depends on close integration across clinical, informatics, and implementation expertise. However, LHSs remain hindered by division of responsibilities between those with clinical expertise and those with data science expertise. The separation of expertise has led to inefficiencies in research workflows and reduced uptake of the knowledge extracted from this research³. It is not uncommon for clinicians to be primarily responsible for implementation phases, and informaticians and data scientists to be responsible for analytics phases. As a result, LHS work often becomes a “baton-passing” process, in which clinical, informatics, and implementation decisions are made sequentially rather than collaboratively. This creates additional risk of error at each transition.

Re-envisioning the LHS process as one that actively engages multi-disciplinary expertise at all phases can address these silos and transition failures. Johns Hopkins Medicine (JHM) has already established a culture and infrastructure to enable a LHS⁴; recent focus has increasingly been on training clinicians and informaticians to effectively collaborate and engage at all phases of a LHS. In this organizational case report, we examine programs, tools, platforms, and educational infrastructure at JHM, many of which leverage OHDSI and the OMOP, to facilitate greater engagement of multi-disciplinary expertise across all components of LHSs.

Methods

We conducted a single-institution organizational case report of JHM with a focus on LHS educational infrastructure for clinicians and informaticians, drawing on faculty and affiliate input, and documentation and publication describing these resources.

We first define steps of the LHS process in the context of three established LHS phases, then identify institutional resources that support multi-disciplinary engagement in each of those steps. Then we discuss the resources and their roles in depth.

Results

Practice to data consists of identifying interventions, storing outputs, and navigating IRB requirements. Data to knowledge consists of establishing semantic interoperability, conducting data analysis, and interpreting results. Knowledge to practice consists of representing knowledge, applying knowledge in practice, and generating new practice-based data that feeds the next LHS cycle [Table 1].

Table 1: Resources for Multi-disciplinary Facilitation in the Context of the LHS Process

LHS Phases	LHS Steps	Johns Hopkins Resources
Practice to Data	Identify Interventions	OHDSI Courses; Open Lab Meetings.
	Store Outputs	REACH; FHIR and CDS Courses.
	Navigate IRBs	REACH.
Data to Knowledge	Semantic Interoperability	OHDSI Courses.
	Data Analysis	OHDSI Courses; ATLAS; HADES; RAMP/RAISE; ExCITE (Broadsea).
	Result Interpretation	ATLAS (for outcome result generation); HADES; ExCITE (Broadsea).
Knowledge to Practice	Represent Knowledge	Knowledge Engineering and CDS Courses.
	Apply Knowledge	ExCITE and WintEHR; CDS Courses.
	Generate Data	ExCITE; CDS Interoperability Courses; REACH.

OHDSI Courses

The OHDSI course sequence builds the conceptual grounding, collaborative study-design skills, and technical proficiency for end-to-end observational research within the OHDSI ecosystem⁵.

1. Observational Health Research Methods on Medical Records covers OMOP fundamentals, transforming source data for large-scale analytics, framing research questions, data quality & characterization, and reproducible, interoperable study design.
2. Large Scale Observational Research Preparation guides team-based development of OHDSI network studies, from use case and study design to IRB, protocol, and phenotype development.
3. Observational Research Methods in R teaches hands-on, R-based EHR analytics covering characterization, time-at-risk, and causal inference, and leverages the HADES suite for cohort building and statistical analysis.

RAMP (Research Advancing Medical Practice)

RAMP standardizes components of the LHS and serves as guidance for the JHM RAISE (Responsible AI, Data Sciences, and Education in Medicine) Center⁶. Progress has included streamlining cohort discovery and standardizing clinical concepts, streamlining IRB and data projections, grant accelerators, direct connection to the OHDSI evidence network and EHR interoperability, and supporting incorporation of evidence back into practice.

ExCITE (Educators' Clinical Informatics Training Environment)

ExCITE is a digital education environment that connects a FHIR-native EHR (WintEHR) with robust data exchange protocols and common data model analytics (ATLAS), and wraps it within a learning management system (Informatics Classroom)⁷. Trainees collaboratively engage in the full LHS lifecycle in a shared workspace, from clinical workflow execution to analysis through OHDSI/OMOP methodologies deployed via Broadsea.

CDS, FHIR, Knowledge Engineering, and Interoperability Courses⁵

1. HL7 FHIR and Interoperability course for data storage and communication.
2. Knowledge Engineering and CDS courses for ingesting feedback data generated from CDS Hooks.
3. CDS course to demonstrate completion of the LHS cycle for improving ongoing implementations from feedback.

REACH

REACH contains EHR data from the six-hospital JHHS in a deidentified, research-ready resource mapped to the OMOP⁸. By layering OMOP and OHDSI tooling atop high-fidelity EHR data tables within a HIPAA-compliant secure enclave, REACH enables portable cohort definitions, standardized analytics, and reproducible network studies on 8.2 million patients and over a decade of longitudinal data.

ATLAS

ATLAS provides a shared, web-based platform where users can define, inspect, and reuse cohorts against the institutional OMOP without writing code from scratch.

1. In courses, ATLAS gives students a hands-on environment to explore standardized vocabularies, build phenotypes, and run characterization and data-quality analyses.
2. In research, it's a collaborative workspace where cohort definitions, concept sets, and analysis specifications are version-tracked and portable across JHM and the OHDSI network.
3. In the LHS, ATLAS lowers the barrier to evidence generation through REACH, enabling clinicians, informaticians, and trainees to translate a research question into a standardized, reproducible analysis within a common platform.

Open Lab Meetings

Lab meetings associated with this infrastructure have been made open to facilitate exchange for ideas. These include meetings on EHR/OMOP, the HADES Evidence Network, Imaging, Clinical Language Lab, Decision Analysis, Education, and Ops Research.

Conclusions

To fully realize the goals of a Learning Health System (LHS), the clinical, data science, and technical experts must effectively collaborate and engage in all phases of the process. In this case report, we highlight educational resources that have been implemented at Johns Hopkins Medicine (JHM) to enable this.

References

1. Flynn AJ, Friedman CP, Boisvert P, Landis-Lewis Z, Lagoze C. The Knowledge Object Reference Ontology (KORO): A formalism to support management and sharing of computable biomedical knowledge for learning health systems. *Learn Health Syst.* 2018;2(2):e10054. Published 2018 Apr 16. doi:10.1002/lrh2.10054
2. Friedman CP, Flynn AJ. Computable knowledge: An imperative for Learning Health Systems. *Learn Health Syst.* 2019;3(4):e10203. Published 2019 Oct 6. doi:10.1002/lrh2.10203
3. Celi LA, Davidzon G, Johnson AE, et al. Bridging the Health Data Divide. *J Med Internet Res.* 2016;18(12):e325. Published 2016 Dec 20. doi:10.2196/jmir.6400
4. Pronovost PJ, Mathews SC, Chute CG, Rosen A. Creating a purpose-driven learning and improving health system: The Johns Hopkins Medicine quality and safety experience. *Learn Health Syst.* 2016;1(1):e10018. Published 2016 Dec 15. doi:10.1002/lrh2.10018
5. Courses. Biomedical Informatics & Data Science (BIDS). Accessed June 5, 2026. <https://bids.jhmi.edu/student-info/courses/>.
6. Clinical Research. Responsible AI, Data Sciences, and Education in Medicine (RAISE) Center. Accessed June 5, 2026. <https://raise.jhmi.edu/how-to-get-involved/clinical-research/>.
7. ExCITE Informatics Platform. Accessed June 5, 2026. <https://github.com/ExCITE-Informatics-Platform>
8. Research Enclave for Analyzing Clinical Health Data (REACH). inHealth Precision Medicine. Accessed June 5, 2026. <https://pm.jh.edu/reach/>