AI-Enabled Learning Health System for TBI Care Transitions, Functional Recovery, and Readiness

Abstract ID: MHSRS-26-3943

Presenter: **Dr. Dong-Gil Ko**
Session: **Progress & Efforts toward the NASEM TBI Consensus Report – Eight Recommendations**

Make the gap visible

Trigger targeted support

Track recovery

Translate to readiness

Core stance

This is an implementation-progress report on a TBI LHS — not a claim that AI has already improved outcomes or return-to-duty.

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Project Team

AI-Enabled Learning Health System for TBI Care Transitions, Functional Recovery, and Readiness

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Disclosures and learning objectives

Required opening

Disclosures

Presenter and co-author disclosures: We have no relevant, real, or apparent personal or professional financial relationships with proprietary entities that produce healthcare goods and services.

Commercial-bias guardrail

No product, device, or brand-name claims are made.

Technology is discussed generically as data infrastructure, analytics, and workflow support.

Talk boundary

Focus: our work and NASEM alignment.

Not claiming causal outcome improvement, mature AI deployment, or proven return-to-duty effect.

Learning objectives

- Describe how a TBI LHS can link acute care, rehabilitation, outpatient recovery, and family-centered transition support.
- Analyze how dashboards, patient-reported outcomes, and readmission-risk analytics can identify transition risk and gaps in care.
- Discuss how multidisciplinary teams and continuous measurement reinforce integrated TBI care delivery systems.

One core claim

Problem

Recovery often remains poor after technically successful acute care. The critical gap is discharge and post-acute transition.

Intervention logic

Build an AI-enabled LHS that turns clinical, patient-reported, and workflow data into continuous improvement.

Evidence reported

Implementation architecture, five workstreams, dashboard/data mart, GOSE + PROMIS-10, prior readmission analytics, early process signals.

Claim boundary

This presentation reports implementation progress and learning signals — not a completed causal evaluation of AI, outcomes, or return-to-duty improvement.

Why this fits the NASEM eight-recommendation session

NASEM challenge

- TBI needs acute + long-term management
- Patients can be lost to follow-up after acute care
- Optimized care requires an integrated learning system

Abstract response

- Local TBI LHS built across transition points
- Patient / caregiver / community input shaped workstreams
- Data + review cycles create measurable learning signals

DoD relevance

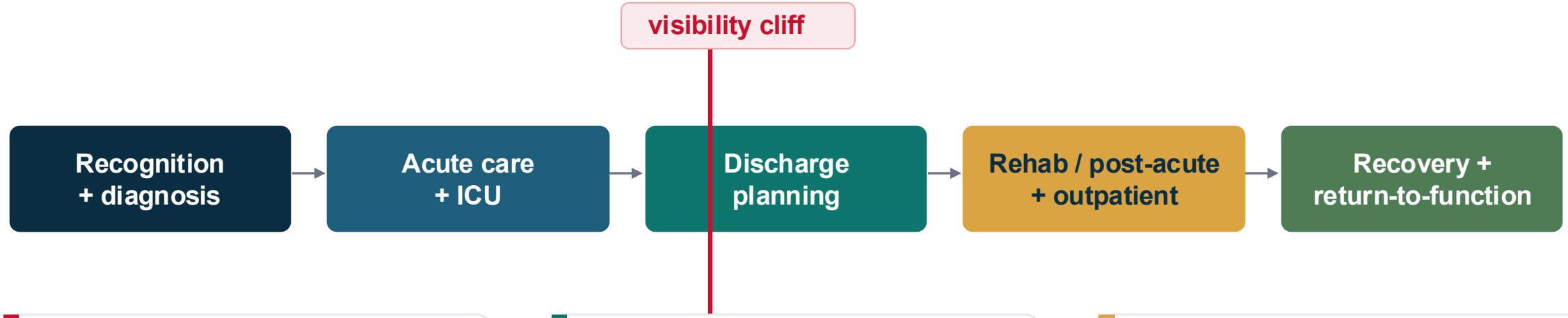
- NASEM task included readiness, retention, and return to service
- Return-to-duty depends on functional recovery over time
- Transition failures can become readiness-risk signals

Significance statement

Our work is a local implementation prototype of the NASEM optimized TBI system — with return-to-function as the bridge to military readiness.

The target failure: the discharge visibility cliff

Problem to solve



What NASEM frames

After acute treatment, many people with TBI lack reliable follow-up and the system lacks mechanisms to collect data and improve those shortfalls.

What the LHS learns

Which patients keep follow-up, start rehabilitation, connect to resources, report function, and return to work or role.

Why it matters to DoD

Transition failures can become readiness risk when delayed recovery, role loss, or insufficient support remain invisible.

Operating premise: if transition failure is not visible, it cannot reliably trigger support or learning.

Methods: implementation design, not a randomized trial

Feb 2023 – Mar 2026

Feb 2023
TBI LHS implementation begins

Mar 2024
Stakeholder symposium identifies transition failures

2024
Five monthly teams organized around patient-centered workstreams

Mar 2025
Second symposium shifts focus to baseline measurement + process tracking

Mar 2026
Implementation progress and maturity gaps

Participants / inputs

Multidisciplinary TBI leaders; patients; caregivers; clinicians; community partners; transition-failure mapping.

Data infrastructure

Operational dashboard; EHR-derived data mart; GOSE; PROMIS-10; prior readmission-risk analytics.

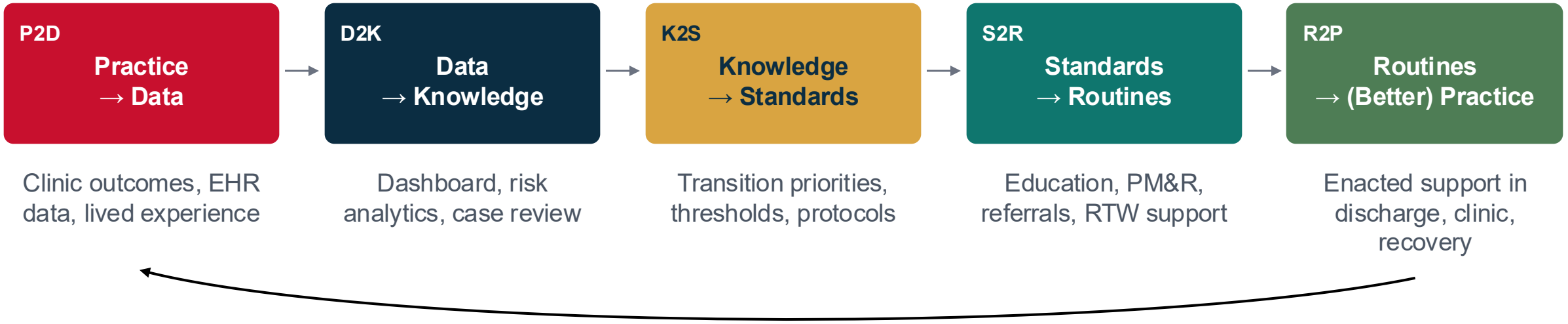
Evaluation posture

Baseline measurement; process tracking; case-review learning; clear limits on causal inference.

Design implication **The correct evaluation question is maturity of the learning system: can signals move from care experience into owned workflows and monitored action?**

LHS operating model*: conversion, not just data

Book concept applied



Continuous feedback: monitoring, governance, and adaptation feed the next cycle

AI/analytics create value only when a signal has an owner, a workflow, and monitoring.

* Ko, Dong-Gil, Umberto Tachinardi and Brett M. Kissela. *Healthcare That Learns: Value-Based Care and the AI-Enabled Learning Health System*, Routledge/Taylor & Francis, (forthcoming, Fall 2026).

What was built: workstreams plus a data backbone

Five monthly workstreams targeted transition failures identified by stakeholders

1. Post-acute education
2. ICU PM&R engagement
3. Multidisciplinary outpatient care
4. Community resources + mental health
5. Return-to-work support

Data backbone — EHR-derived data mart • operational dashboard • GOSE + PROMIS-10 • readmission-risk analytics

Review and action layer — multidisciplinary case review • baseline measurement • process tracking • workflow redesign

Early signals: visibility → action

The strongest evidence so far is that transition failures are becoming measurable and actionable.

52 → 36

community-resource linkage

Referrals from UC Medical Center to community partner; 36 completed initial intake

53%

baseline function signal

Assessed patients not working or working at reduced capacity on GOSE

23.73%

readmission-risk baseline

Prior TBI cohort 30-day readmission rate used in analytics work

3

workflow changes

Clinic education, case-review discussions, dashboard-enabled monitoring

Prior analytics added implementation discipline

Readmission modeling combined ML, workflow interviews, and simulation; simulated TBI readmission reduction was 23.64% → 21.20%, not a measured outcome effect.

Why the signals matter

They identify where recovery can fail after discharge and where support may need to be triggered before functional loss becomes durable.

Interpretation: process and linkage signals are readiness-relevant, but they are not yet proof of improved recovery or return-to-duty.

NASEM eight recommendations: where our work contributes

Direct alignment

1 Updated classification
Future data element: actual GCS, imaging, mechanism/blast exposure, biomarkers when available

2 Acute + long-term person/family care
Direct: transition support, follow-up, education, recovery monitoring

3 Reduce variability/guidance gaps
Direct: standard workflows, PM&R engagement, process tracking

4 Awareness + identification
Direct: structured TBI education and patient/family guidance

5 Integrated care delivery systems
Direct: acute, rehab, outpatient, community, return-to-function workstreams

6 Learning health care system
Primary: data mart, dashboard, GOSE/PROMIS-10, case review, feedback loops

7 Expanded study designs
Supportive: implementation science, workflow analysis, pragmatic evaluation

8 National framework + implementation plan
Local prototype: lessons for framework, not a national plan

Strongest contribution: Recommendations 2, 5, and 6.
Honest boundary: this is a local prototype, not a complete national framework.

Return-to-duty translation: functional recovery is the readiness bridge

Return-to-duty should be treated as a longitudinal functional outcome — not a discharge event.

Civilian LHS signal

- GOSE / PROMIS-10 trajectory; return-to-work status
- PM&R consult, follow-up kept, therapy start
- Community-resource intake; behavioral health and social-risk needs
- ED revisit, readmission, length of stay, no-show / cancellation

→

MHS readiness signal

- Functional recovery and return-to-duty trajectory
- Continuity of rehabilitation and readiness support
- Family/community support and risk mitigation
- Transition failure and readiness-risk monitoring

MHS implementation question: what minimum transition dataset and trigger thresholds would make readiness-relevant recovery visible across settings?

Critical assessment: what still must mature

What our work has not yet proven

- Causal improvement in recovery or readiness
- AI effectiveness as an intervention
- Generalizability beyond the local prototype
- Sustained visibility across all post-acute settings
- Systematic detection of social vulnerability

Next maturity tests

- Minimum TBI transition dataset
- Risk thresholds + owner/escalation path
- Track no-show, therapy start, intake, RTW/RTD
- Equity-stratified outcomes and burden
- Governance: scale, pause, or retire criteria

Critical question for the field: can the system act reliably on what it learns — before recovery failure becomes durable?

Take-home: a transition LHS for recovery and readiness

1 The operating target is the transition gap

TBI recovery failures often emerge after discharge, when responsibility and visibility fragment.

2 The LHS converts signals into routines

Practice → data → knowledge → standards → routines → practice, with monitoring and governance.

3 NASEM significance is implementation

This is a local prototype for integrated TBI care, learning-system methods, and readiness-relevant outcomes.

Discussion questions

1
Which transition signal should trigger targeted support first?

2
What minimum TBI transition dataset should MHS standardize?

3
What evidence threshold would make this model scalable?

Thank you

Discussion

Selected sources

Selected sources used to build this presentation

1. Accepted Abstract MHSRS-26-3943: AI-Enabled Learning Health System for TBI Care Transitions, Functional Recovery, and Readiness.

2. National Academies of Sciences, Engineering, and Medicine. Traumatic Brain Injury: A Roadmap for Accelerating Progress. 2022. DOI: 10.17226/25394.

3. Wu T-C, et al. A Neurosurgical Readmissions Reduction Program Leveraging Machine Learning, Workflow Analysis, and Simulation. Applied Clinical Informatics. 2024;15:479–488.

4. Bishop C'Asia, et al. Social Determinants of Health Influence Mild TBI Symptom Burden. Neurosurgery Practice. 2025;6(3):e000153.

5. UCGNI TBI LHS program materials and symposium/meeting transcripts.

6. Ko DG, et al. Healthcare That Learns: Value-Based Care and the AI-Enabled Learning Health System, Routledge/Taylor & Francis. 2026 (forthcoming).

Follow-up / Contact