etiometry

Retrospective Assessment Of The Etiometry Platform For Cardiogenic Shock

Executive Summary

Cardiogenic shock (CS) is a high-mortality syndrome driven by progressive hemodynamic compromise, heterogeneous presentation, and inconsistent clinical recognition. This white paper presents a retrospective evaluation of the Etiometry Platform across medical and surgical cardiac populations, assessing its utility in [1] automated shock severity detection,[2] continuous tracking of hemodynamic and oxygen deficit, and[3] improved clinical recognition and coding of cardiogenic shock.

Using high-frequency physiologic data fused with EHR, laboratory, and device information, Etiometry demonstrates earlier identification of shock progression, strong associations between quantified hemodynamic compromise and outcomes, and substantial opportunity to reduce under-documentation and missed reimbursement.

Background

Despite advances in invasive monitoring, vasoactive therapy, and mechanical circulatory support (MCS), cardiogenic shock remains difficult to identify consistently and early. Reliance on intermittently charted EHR data limits the ability to recognize evolving hypotension and hypoperfusion, resulting in delayed staging, undertreatment, and under-documentation. These challenges span both medical cardiac ICU patients and post-cardiac surgery populations.

The Etiometry Platform continuously acquires second-by-second physiologic data, integrates it with labs, medications, procedures, and devices, and applies analytics to quantify hemodynamic deficit relative to a desired physiologic state (Figure 1). This framework enables automated shock detection, staging, and longitudinal assessment of response to therapy.

Study Hypotheses

Hypothesis 1 – Automated Shock Severity Assessment

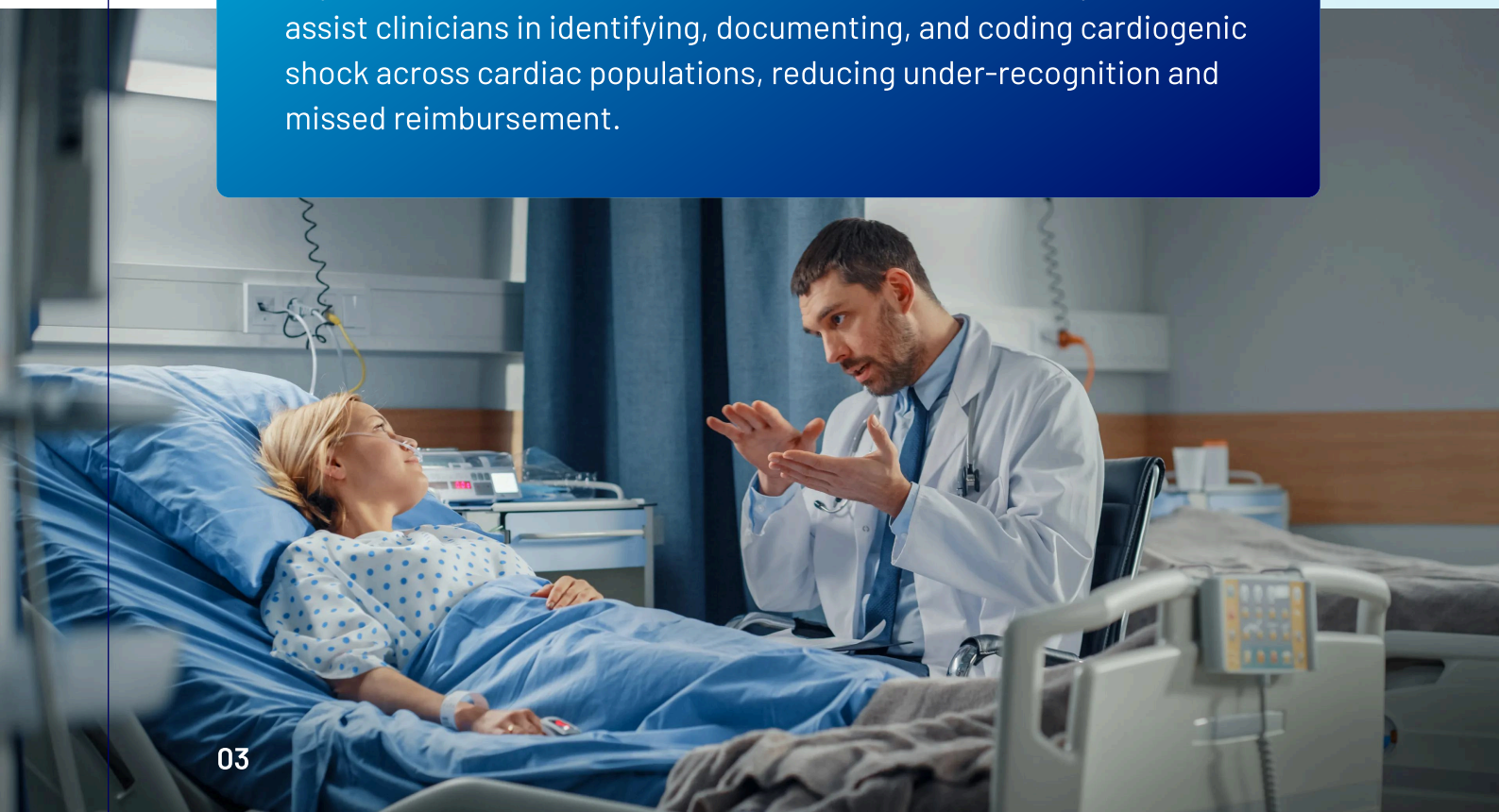
Fusion of high-frequency physiologic monitoring with EHR, laboratory, and device data enables earlier and more accurate identification of cardiogenic shock severity compared with EHR-derived assessment alone.

Hypothesis 2 – Hemodynamic and Oxygen Deficit Tracking

Continuous quantification of hypotension and hypoperfusion provides actionable metrics that are strongly associated with mortality and can reflect effectiveness of therapeutic interventions.

Hypothesis 3 – Enhanced Clinical Recognition and Coding

Objective, data-driven evidence of shock severity and trajectory can assist clinicians in identifying, documenting, and coding cardiogenic shock across cardiac populations, reducing under-recognition and missed reimbursement.



Study Populations and Analysis Cohorts

Analyses were conducted retrospectively at a single tertiary academic medical center over a 12-month period.

Medical Cardiac ICU

- All medical cardiac ICU admissions over 12 months
- Used for Hypotheses 1, 2, and medical cohort of Hypothesis 3

Surgical Cardiac ICU (CABG)

- All patients undergoing CABG admitted to a dedicated cardiothoracic ICU over 12 months
- Used for surgical cohort of Hypothesis 3 and economic analysis

	Medical Cohort	CABG Cohort
Hospitalizations, n	571	406
Patients, n	556	406
Male, n (%)	350 (63%)	296 (73%)
Age, years median [IQR]	65 [54 - 74]	67 [59 - 74]
Hospital LOS, days median [IQR]	9.8 [4.6 - 18.8]	12.0 [8.0 - 18.0]
ICU LOS, days median [IQR]	2.8 [1.3 - 6.9]	2.7 [1.1 - 4.8]
Mortalities, n (%) 30-day post-discharge	171 (31%)	26 (6.4%)

Methods

Hypothesis 1 – Shock Severity Detection

Shock severity was classified using SCAI staging derived from two parallel data sources:

1. **EHR-only data:** charted blood pressure, laboratory values, medication administration, and procedures indicating MCS initiation.
2. **Etiometry-acquired data:** all EHR data plus second-by-second invasive arterial pressure and automated cuff blood pressure.

Comparisons included:

- Maximum SCAI stage reached
- Associated mortality and readmission rates
- Time delay to recognition of maximum shock stage

Hypothesis 2 – Hemodynamic Deficit Metrics

Using high-frequency data, Etiometry quantified:

- Cumulative time spent in hypotension
- Cumulative time spent in hypoperfusion

Logistic regression models were developed to associate time under hemodynamic compromise with mortality.

Hypothesis 3 – Documentation and Coding

Two shock definitions were applied:

- **Medical cardiac patients:** shock severity defined by SCAI stage
- **CABG patients:** binary shock definition requiring sustained hypotension ≥30 minutes plus evidence of hypoperfusion (SvO_2 <60% or CI <2.0 L/min/m^2) and VIS >5

These definitions were compared against documented ICD-10 diagnoses for shock or major complication/comorbidity (MCC). Associations with ICU length of stay and mortality were assessed, along with estimated reimbursement impact.