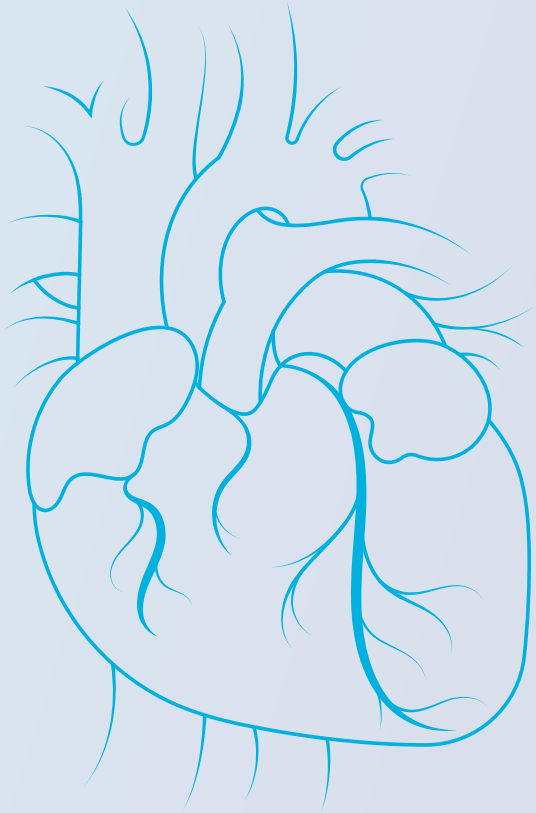
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Maximizing Value Days In Cardiac Surgical Care:

Real-World Evidence From Four Years Of Clinical Intelligence Technology Use At A Tertiary Medical Center's CTICU



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Executive Summary

Cardiac surgery programs operate at the intersection of clinical complexity and financial pressure, where outcomes, efficiency, and capacity are closely connected.

Hospital margins in cardiac surgery are driven by the ability to capture clinical complexity accurately, provide care efficiently, and preserve capacity for future patients, with the most significant financial impact realized when all three are improved together.

A retrospective analysis of 954 CABG hospitalizations at a tertiary medical center's CTICU, conducted alongside deployment of the Etiometry clinical intelligence platform, demonstrated improved cardiac surgery value driven by observed efficiency gains, with additional modeled upside from enhanced documentation capture and expanded capacity.

This dynamic can be summarized in a simple relationship:

Total Value = (Paid Days – Actual Days) × Total Cases

In this equation, (Paid Days – Actual Days) is the margin per case, and Total Cases determines how often that margin is realized.

The Etiometry clinical intelligence platform is designed to influence each part of this equation, and with new functionality cleared by the FDA in April 2026, its continuous physiologic monitoring surfaces complications and supports automated clinical documentation:

Paid Days ↑ – The platform's continuous physiologic monitoring surfaces complications, such as respiratory failure, acute kidney injury, and cardiogenic shock, that meet CMS criteria for Major Complications or Comorbidities (MCCs) but are often undocumented. Capturing these conditions appropriately shifts cases to higher-weighted DRGs with longer geometric mean LOS, increasing Paid Days. In the reported study, a retrospective analysis of 954 CABG hospitalizations quantified this gap: algorithmic screening would increase MCC rate from a baseline of 45% over the four years of observation to 59%.

Actual Days ↓ – A natural experiment among 954 CABG patients showed that platform use in the first 2 post-operative 12h-shifts was associated with 14% shorter ICU stays, 18% shorter hospital stays, and 24% fewer major complications, reducing the actual cost of care. These results reflect the deployed platform available today.

Total Cases ↑ – For ICUs and floors operating at or above ~85% occupancy, shorter stays translate beyond cost savings into additional capacity. Each freed bed-day creates an opportunity to treat another surgical patient who might otherwise be delayed or diverted. In a 300 cases per year CABG program, a 1.6-day reduction in length of stay yields ~480 days of capacity, and could support at least 65 additional cases annually.

The Value Days Framework

Under the Medicare Inpatient Prospective Payment System (IPPS), hospitals are paid a fixed amount per case based on the assigned DRG. Each DRG includes a geometric mean length of stay (LOS) - the number of days CMS expects a case of that complexity to require. This effectively defines the hospital's "Paid Days."

Each additional day beyond that benchmark erodes margin, while discharging earlier generates it. The number of cases a program can move through its beds each year then determines how much that per-case margin adds up, whether it's spread across 200 cases or 350.

Total Value = (Paid Days – Actual Days) × Total Cases

The difference between Paid Days and Actual Days reflects the margin on each case, and when applied across the total number of cases, it determines overall program performance.

For CABG surgery, the DRG landscape illustrates the stakes:

DRG	Description	Relative Weight	Geometric Mean LOS
231	CORONARY BYPASS WITH PTCA WITH MCC	8.4299	10.4
232	CORONARY BYPASS WITH PTCA WITHOUT MCC	6.0626	7.5
233	CORONARY BYPASS WITH CARDIAC CATHETERIZATION OR OPEN ABLATION WITH MCC	7.6452	11
234	CORONARY BYPASS WITH CARDIAC CATHETERIZATION OR OPEN ABLATION WITHOUT MCC	5.4627	8.2
235	CORONARY BYPASS WITHOUT CARDIAC CATHETERIZATION WITH MCC	5.8686	8
236	CORONARY BYPASS WITHOUT CARDIAC CATHETERIZATION WITHOUT MCC	4.1888	5.8

The difference between "with MCC" and "without MCC" DRGs can translate to nearly 3 additional Paid Days and a weight increase of about 2 points, equivalent to roughly $20,000 in reimbursement using an illustrative base payment rate of approximately $10,000. When a patient has a complication like respiratory failure that is not documented, the hospital bears the cost of a complex stay but is reimbursed as if it were uncomplicated. Conversely, when a patient develops a preventable complication and remains hospitalized several days longer, no amount of accurate documentation can recover the lost capacity and additional resources consumed.

Lever 1: Increasing Paid Days – The Undocumented Complication

The Problem

In a busy cardiac surgical ICU, evolving complications are often managed in real time - ventilator settings adjusted, pressors titrated, labs trended - without a formal diagnosis being entered into the chart. The clinical team responds to the patient's physiology, but the documentation does not always explicitly capture the severity. As a result, the patient consumes MCC-level resources while the hospital is reimbursed at a non-MCC rate.

What We Found

Across 954 CTICU CABG hospitalizations, we applied validated algorithmic screening rules to continuous physiologic data to identify conditions that qualify as MCCs under CMS definitions. The platform screens for four condition categories:

Hypoxemic Respiratory Failure (J96.01) - Severity-staged using P/F and S/F ratios combined with FiO_2/PEEP escalation above patient nadir, sustained for ≥60 minutes over a rolling 120-minute window. Graded mild, moderate, or severe per adapted Berlin criteria.

Hypercapnic Respiratory Failure (J96.02) - $PaCO_2$ >50 mmHg on two consecutive ABGs, or >60 mmHg on a single ABG.

Acute Kidney Injury, KDIGO Stage 3 (N17.x) - Creatinine ≥3x baseline over 48 hours or ≥4.0 mg/dL.

Cardiogenic Shock, SCAI Stages D–E (R57.0, R57.1, R57.8, R65.21, T81.11XA, T81.19XA) - Staged using an adapted SCAI framework integrating real-time hemodynamics (SBP, MAP, cardiac index), hypoperfusion markers (lactate clearance, ALT, pH), and treatment intensity (vasoactive-inotropic score, mechanical support device count) incorporated into a workflow for hospital-specific adaptation.

The Scale of the Gap

Patients meeting these screening criteria had dramatically worse outcomes than the baseline CTICU population - confirming these are real, resource-intensive clinical events, not coding artifacts:

Condition	Hospitalizations	Median Hospital LOS	30-Day Mortality	MCC Documented in EHR
Baseline (no detected complication)	605 (63%)	7.9 days	0%	31.9%
O2RF (any)	78 (8%)	13.3 days	6.4%	59.0%
CO2RF (any)	108 (11%)	12.6 days	5.5%	55.0%
AKI	91 (10%)	14 days	11.0%	85.7%
Shock stage D	99 (10%)	10.1 days	1.0%	43.4%
Shock stage E	136 (14%)	12.9 days	11.0%	57.4%

The documentation gap is most pronounced across respiratory failure and shock categories, where a substantial share of patients with physiologic evidence of MCC-qualifying complications had no MCC documented in the EHR. These patients incur costs 2-3x higher than baseline, yet are coded and reimbursed as uncomplicated.

The Paid Days Opportunity

In the CABG subpopulation, 45% of hospitalizations had an MCC documented in the EHR. With retrospective screening, that rises to 59%, a 14-percentage-point documentation opportunity.

This capability for automated, real-time identification of MCC-qualifying conditions with time-stamped physiologic evidence recently received FDA clearance. It does not rely on upcoding or retrospective chart review; instead, it provides clinicians and CDI teams with objective, device-derived evidence at the point of care.

Lever 2: Decreasing Actual Days - Proven Clinical Impact

A Natural Experiment in CABG Outcomes

Variation in platform use across rotating provider teams created periods of high and low utilization driven by staffing schedules - not by patient complexity or provider preference. This pattern created a natural experiment that isolates the platform's impact.

Among 954 CABG hospitalizations, 447 had platform use in the first postoperative day and 507 did not. Baseline demographics and comorbidities were well balanced between groups (all p>0.05).

Table 1. Baseline Balance (CABG Cohort, N=954)

Characteristic	No Use (N=507)	Platform Use (N=447)	p
Age ≥75 years	103 (20%)	107 (24%)	0.20
Male	395 (78%)	354 (79%)	0.69
Diabetes mellitus	248 (49%)	199 (45%)	0.20
Hypertension	401 (79%)	361 (81%)	0.58
Chronic lung disease	67 (13%)	79 (18%)	0.07
High creatinine at ICU admit	89 (18%)	60 (13%)	0.09
High lactate at ICU admit	208 (41%)	168 (38%)	0.31

Results: Fewer Days, Fewer Complications

Outcome	No Use	Platform Use	Reduction	p
ICU LOS (days)	3.5	3	14% (12 hrs)	<0.05
Hospital LOS (days)	8.9	7.3	18% (1.6 days)	<0.01
MCC rate	51%	39%	24% relative	<0.001
Post-op 30-day mortality	2.0%	1.1%	50% (not significant)	0.30

Where the Actual Days Reduction Comes From

The platform's impact was concentrated among patients who developed complications. Patients with uncomplicated CABG followed similar recovery trajectories regardless of platform use - as expected, given the limited opportunity to improve routine cases.

Patient Group	ICU LOS Reduction	Hospital LOS Reduction
Without MCC	No difference	No difference
With MCC	0.9 Days or 20% (p<0.05)	2.9 days or 24% (p<0.01)

This is exactly what we would expect: real-time monitoring enables earlier recognition and intervention. The platform does not change routine care, it changes the course for patients,

Lever 3: Increasing Total Cases - When Freed Bed-Hours Become New Cases

The Occupancy Threshold

Levers 1 and 2 improve the margin on each case, but it's the Total Cases multiplier that turns that margin into overall profitability. When ICU or floor occupancy is below roughly 85%, reducing Actual Days primarily lowers costs for the existing caseload. Above that threshold, however, each day freed up becomes more valuable - a bed that can accommodate a new surgical admission.

This is the difference between cost savings and true revenue growth. In cardiac surgery programs - where OR time, surgeon availability, and downstream ICU and floor capacity all depend on one another - ICU and floor throughput often become the limiting factor. A surgeon may be available and an OR ready, but without an ICU bed for postoperative care or a floor bed to support ICU discharge, cases are delayed or diverted. Reducing hospital length of stay directly relieves this constraint.

What the Data Implies

A 1.6-day reduction in length of stay per CABG patient, applied across a program's annual volume, creates meaningful capacity. In a 300-case program, this translates to roughly 480 days of freed capacity. Assuming an average LOS of 7 days for incremental cases, that capacity supports more than 60 additional cases per year. At an average reimbursement of $40,000–$60,000 per case, this represents $2.4M–$3.6M in incremental annual revenue - far exceeding the impact of per-case Value Days improvement alone.

Conclusion

Hospital Value Days in cardiac surgery are eroded from three directions: undocumented complications that limit DRG-based reimbursement, preventable or prolonged complications that extend actual length of stay, and reduced capacity due to extended occupancy of ICU and floor beds.

Etiometry is the only FDA-cleared clinical intelligence platform positioned to influence all three levers through deployed clinical impact, documentation support workflows, and capacity gains in high-occupancy programs.

These mechanisms compound across the profitability equation, expanding margin per case while increasing the case volume that margin is applied to, producing a multi-lever, measurable return that point solutions and dashboards structurally cannot deliver.

For program-specific profitability modeling or to discuss implementation, please contact: info@etiometry.com