STS Quality Webinar Series: Phase of Care Mortality Analysis (POCMA)

December 2019

Welcome

Frank Shannon, MD

Presented by the STS Task Force on Quality Initiatives

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POCMA
Phase of Care Mortality Analysis

Frank Shannon, MD

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Beaumont Health
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Disclosures

ARMUS Corporation

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St. Jude Medical — More control. Less risk.

MIVS Trainer

Edwards

TAVR Trainer

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MIVS Instrument Design

A Novel Method to Evaluate Surgical Mortality

POCMA

- Systems method of analysis to identify the ***root cause*** of death following cardiac surgery
- Based on assumption that there are 3 primary components which interact within each episode of surgical care
  - **Patient configuration**: constellation of physiological attributes, organ system reserve, co-morbidities and responses to care
  - **Elements of surgical care**: evaluation, diagnosis, monitoring, treatment, errors of omission and commission
  - **Random clinical events**: unexpected reactions to treatment, natural history of disease or *de novo* catastrophes

Phase of Care

- Interval defined by its temporal relationship to the primary surgical procedure

- Each phase has a characteristic set of therapeutic goals, care pathways and recovery expectations
- Divides process of care into interdependent compartments that contain multiple agents and layers of interaction
- Parsing clinical course into time segments facilitates focus on specific elements for quality improvement
- Derived from Fred Grover's QI project involving VA Cardiac Surgery Services

Grover FL et al, Ann Surg, 2001

Root Cause = Seminal Event

- One of the 3 primary elements in the episode of care which *triggers a cascade of deterioration* culminating in death
- Is the most *proximal component* in the sequence of care
- Similar to “Outlandish Proverb No. 499”

‘For want of a nail a horseshoe was lost,
for want of a horseshoe a horse went lame,
for want of a horse a rider never got through,
for want of a rider a message never arrived,
for want of a message an army was never sent,
for want of an army a battle was lost,
for want of a battle a war was lost,
for want of a war a kingdom fell,
and all for want of a nail.’

George Herbert, 1640

Avoidable Surgical Death

Avoidable:

1. Processes of care are available to *prevent seminal event* or *rescue the patient from* the cascade of decompensation
2. System *lacks the expected* resources, competence or personnel for primary prevention or rescue

Unavoidable:

1. Seminal event *could not have been* prevented or attenuated with more than 50% likelihood
2. Patient's constellation of attributes constitute an unavoidable risk for death or inability to be rescued

Avoidable Surgical Death

STS Record ID: ___________ Surgeon _______ DOS ___/_____/_____ DOD ____/____/_____ Transferring Hospital Name: _______________ ________

Procedures (1) ____________________________ (2) _______________________________ (3) ____________________ EuroScore: ________ Autopsy: Yes No

CASE Summary:

PHASE OF CARE MORTALITY ANALYSIS:

Pre-Operative Phase

Cardiac risk factor profile e.g.
Cardiogenic shock
Myocardial viability

Non-cardiac risk factor profile
Renal failure on dialysis
COPD
Cirrhosis
Combination

Judgment
Timing of surgery
Risk > benefit

Patient preparation
Medical optimization failure

Patient evaluation
Functional class
ID occult disease(s)

Other: ________________

Intra-Operative Phase

Anesthesia
Technical (lines, TEE, ET)
Pharmacologic management
Recognition/treatment of decompensation

Surgeon
Judgment
Technical (lacs, grafts, emboli)
Myocardial protection

Cardiopulmonary By-Pass
Parameters (hct, MAP, mVO^2)
Fluid management

CVA

Catastrophic event (specify):
____

Other: __________________

Post-Op ICU Phase

Hemodynamic management
Inotrope titration
Adequate O^2 delivery

Respiratory care
Prevent lung injury and VAP
Appropriate support plan

ICU care (Keystone criteria)
DVT/PE prophylaxis
Sepsis prevention/treatment
Nutritional support

Multi-System Organ Failure

Failure to Thrive

Surveillance/recognition/Rx of Decompensation

Catastrophic event (specify):
____

Other: __________________

Post-Op Floor Phase

Pharmacologic management
Coumadin
Other

Pulmonary embolism

CVA

Dysrhythmia (Atrial or Vent)

Surveillance/recognition/Rx of decompensation

Sepsis prevention/treatment

Catastrophic event (specify):
____

Other: __________________

Discharge Phase

Appropriate disposition: e.g.
Nursing home/ECF vs. home

Pharmacologic details

Adequate instruction and support network

Catastrophic event (specify):
____

Other: __________________

Seminal event and Mortality Avoidable? Yes No If Yes: How:
____
____

If Avoidable: What has been implemented to prevent future similar event:
____
____

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POCMA 2012 v. 3.0

Conceptual Foundation of POCMA - Part 1

Results of a Regional Study of Modes of Death Associated With Coronary Artery Bypass Grafting

Gerald T. O'Connor, PhD, John D. Birkmeyer, MD, Lawrence J. Dacey, MD, Hebe B. Quinton, MS, Charles A. S. Marrin, MB, BS, Nancy J. O. Birkmeyer, PhD, Jeremy R. Morton, MD, Bruce J. Leavitt, MD, Christopher T. Maloney, MD, Felix Hernandez, MD, Robert A. Clough, MD, William C. Nugent, MD, Elaine M. Olmstead, BA, David C. Charlesworth, MD, and Stephen K. Plume, MD, for the Northern New England Cardiovascular Disease Study Group*

Dartmouth-Hitchcock Medical Center, Lebanon, New Hampshire; Maine Medical Center, Portland, Maine; Fletcher Allen Health Care, Burlington, Vermont; Optima Health Care: Catholic Medical Center, Manchester, New Hampshire; and Eastern Maine Medical Center, Bangor, Maine

- Defined modes of death after CABG
- Seminal event equated to "different processes and systems of clinical care yield different results" (i.e. surgeons)
- "better understanding of (different) processes of care and …their relationship to …heart failure" – avoidability implied

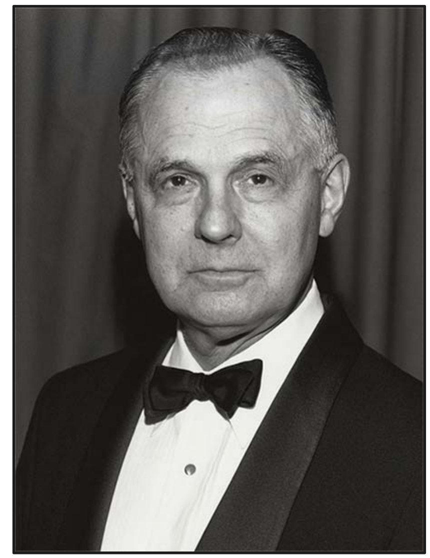
O'Connor et al, Ann Thor Surg 1998

Conceptual Foundation of POCMA - Part 2

Deductive Reasoning
in the Lifelong Continuing Education
of a Cardiovascular Surgeon

Frank C. Spencer, MD

- 80% of a CV surgeon's education <u>*should occur*</u> after formal residency training
- "Imperfect results" of surgery are reviewed by analysis of "serial decision-making …in detail"

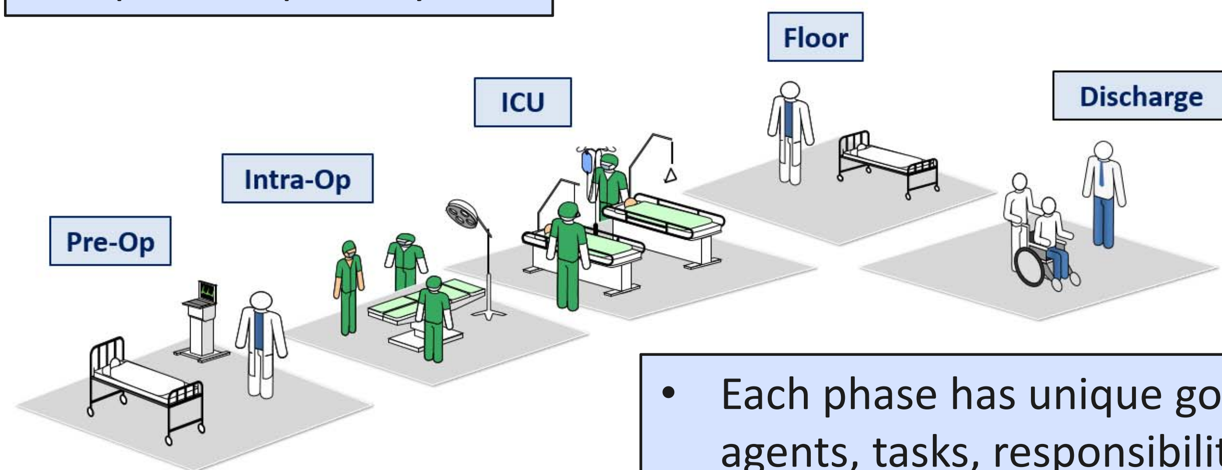


Frank Cole Spencer, MD
President of STS

Spencer FC, Arch Surg, 1976

POCMA – Phases of Surgical Care

Complex Adaptive System



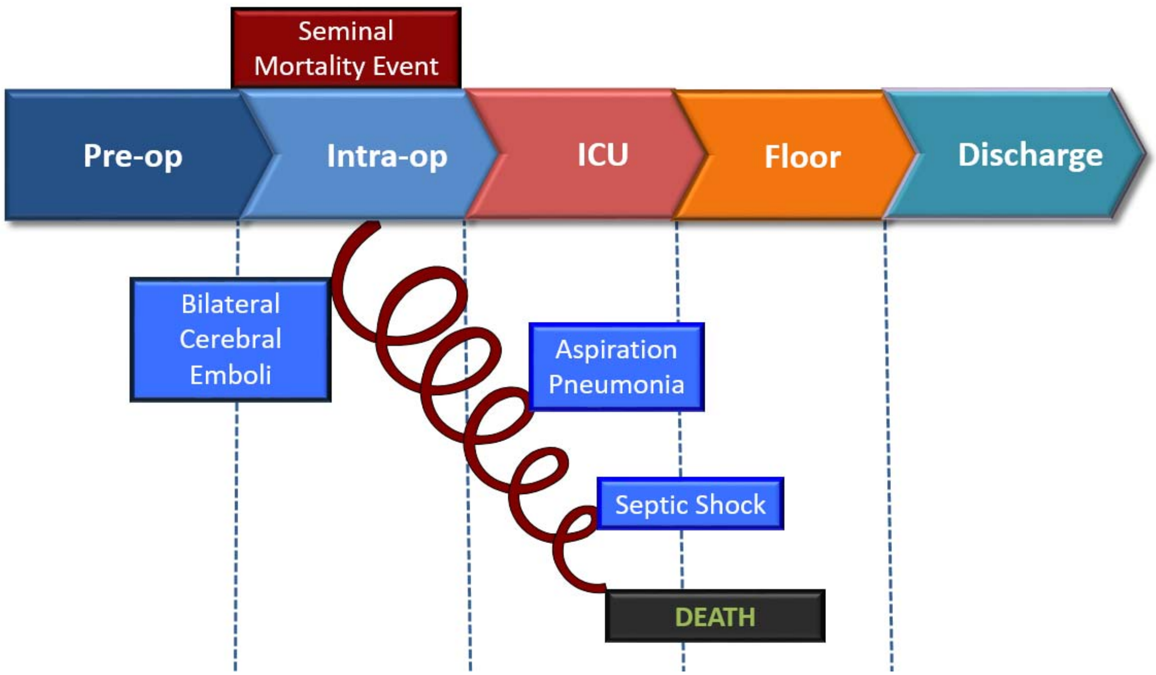
- Each phase has unique goals, agents, tasks, responsibilities and interactions
- Surgeon is not primary agent

Evolution of Quality Improvement in Cardiac Surgery

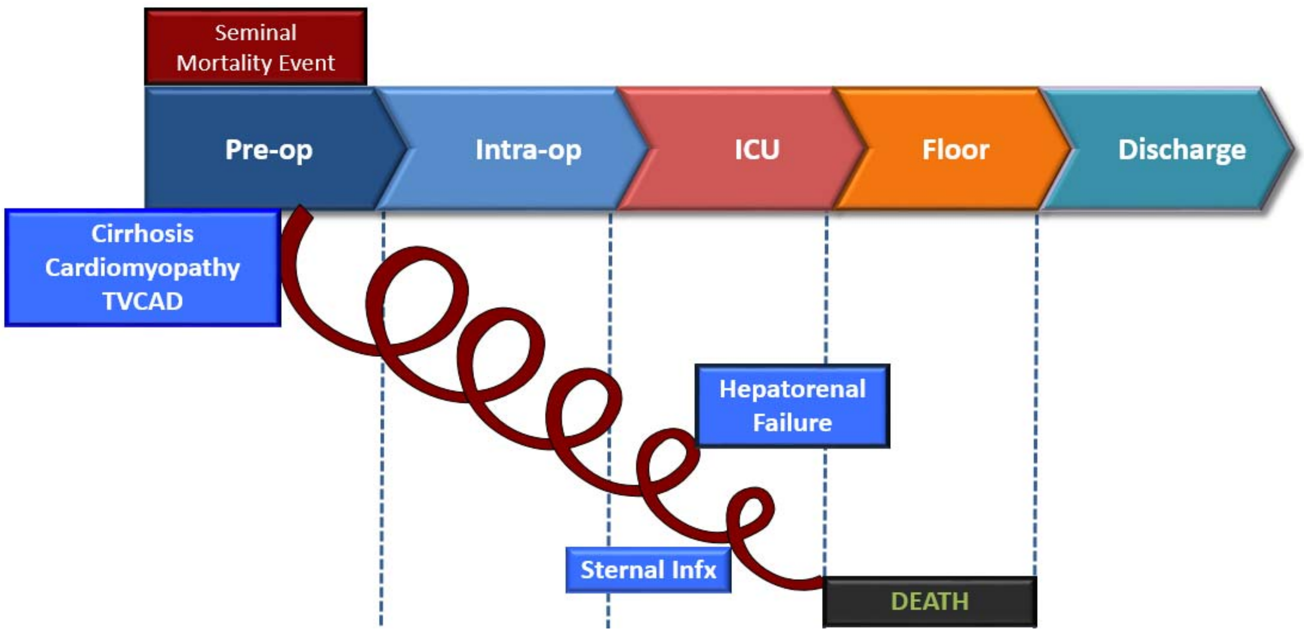
Salient Features	Old School 1960 - 2000	Current 2000 - present
Organization	Vertical – Chain of command	Horizontal - Team
Communication Style	Military Command & control	Mindful Defer to expertise
Improvement Methods	M & M conference "Blame & Shame"	Systems analysis Human factors
Focus	Work harder and devise better operation	Work smarter and better in teams

Clinical Scenarios

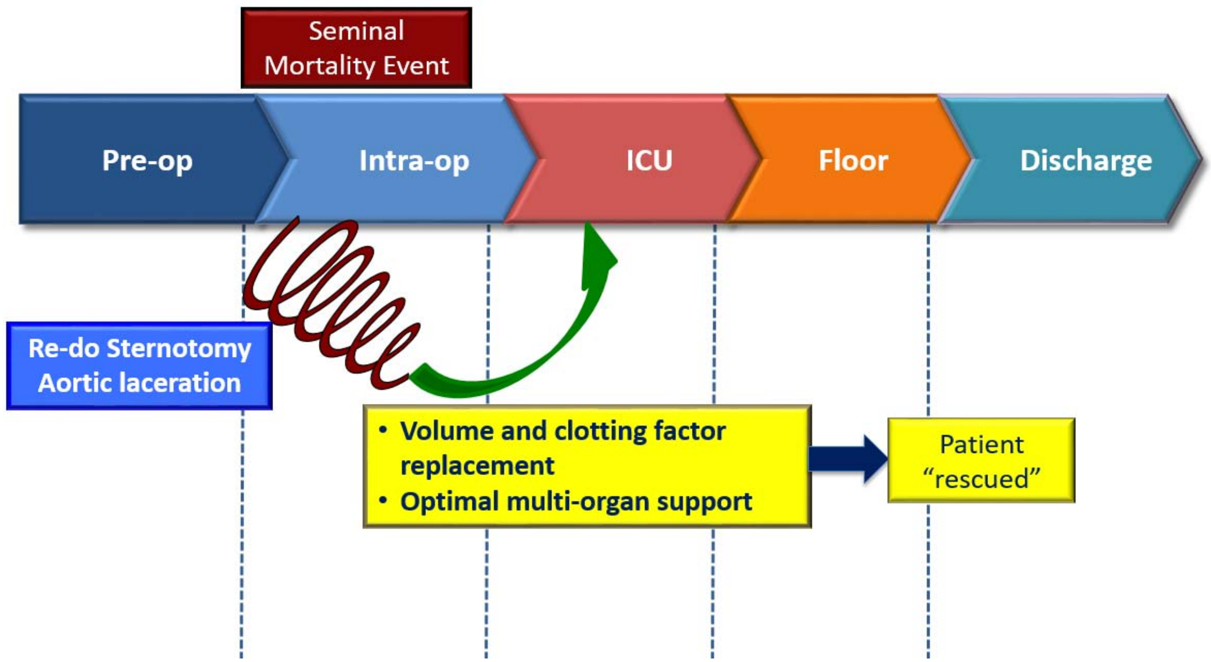
Case Scenario 1: Analysis



Case Scenario 2: Analysis



Case Scenario 3: Analysis



TAVR POCMA

TAVR POCMA:
STS Record ID #____________ Operator 1 ____________ Operator 2____________DOS ___/_____/_____ DOD ____/____/_____ Age: ____ STS Risk Score: __________
Procedures (1)________________________(2) ________________ _________ Urgent conversion to open Yes No STS Score with incremental risk: ___________
Incremental Risk (Circle): nocturnal BiPap, BNP>550pg/ml, pro BNP $\geq$ 3200pg/ml, prohibitive chest, hostile mediastinum, pulmonary systolic HTN 60-80 mmHg, Pulmonary HTN > 80, wheelchair bound, does not live independently, frailty
CASE SUMMARY:

PHASE OF CARE MORTALITY ANALYSIS (POCMA): Please select one *Phase* (Pre-op, Intra-op, etc.) and circle one *subcategory* (Judgment *or* Patient Preparation etc.

Pre-Procedure Phase

Cardiac risk factor profile
- Cardiogenic shock
- Myocardial viability

Non-cardiac risk factor profile
- RF on HD
- COPD
- Cirrhosis
- Combination

Judgment
- Timing of surgery
- Risk > benefit
- Poor candidate

Patient preparation
- Optimize functional status

Patient evaluation
- CT evaluation
- Inadequate Valve sizing
- Functional class
- ID occult disease(s)

Other: __________________

Procedure Phase

Anesthesia
- Technical (lines, TEE, ET)
- Pharmacologic management
- Recognition/tx of decompensation
- Judgement

Operator
- Technical (deployment)
- Approach converted: Reason ________________________
- Judgment
- Evaluation

Catastrophic event (specify):
- Perivalvular leak
- CVA
- Aortic Dissection

Perforation/rupture/laceration
- DIC/Shock Tamponade
- Severe MR AMI
- Vascular/bleeding complication
- Conduction disturbance
- Other:

Post-Procedure ICU Phase

Hemodynamic management
- Inotrope titration
- Adequate O^2 delivery

Respiratory care
- Prevent lung injury and VAP
- Appropriate support plan

ICU care (Keystone criteria)
- Infection/Sepsis
- DVT/PE prophylaxis

Multi-System Organ Failure

Failure to Thrive

Surveillance/Recognition/Rx of decompensation

Catastrophic event (specify):
- Aspiration CVA
- Pulmonary embolism
- GI Ischemia
- Vascular/bleeding complication
- Lower extremity ischemia
- Thrombosis AMI
- Conduction disturbance

Post Procedure Evaluation

Other:__________________

Post-Procedure Floor Phase

Pharmacologic management
- Coumadin
- Other

Dysrhythmia(atrial/ventricular)

Infection/Sepsis

Surveillance/Recognition/Rx of decompensation

Multi-System Organ Failure

Catastrophic event (specify):
- Vascular/bleeding comp
- Lower extremity ischemia
- CVA
- Pulmonary embolism
- AMI
- Embolization

____

Discharge Phase

Appropriate disposition

Pharmacologic details

Adequate Instruction and safety network

Catastrophic event
Found unresponsive cause of death unknown

Readmission: reason
____

Other: (specify):
____

Seminal Event and Mortality Avoidable? Yes No How:
____
____

If Avoidable: What has been implanted to prevent future similar event?
____
____

POCMA 2016 v.1.0

Michigan Society of Thoracic and Cardiovascular Surgeons (MSTCVS)

MSTCVS

A Method to Evaluate Cardiac Surgery Mortality: Phase of Care Mortality Analysis

Francis L. Shannon, MD, Frank L. Fazzalari, MD, MBA, Patricia F. Theurer, BSN, Gail F. Bell, MSN, Kathleen M. Sutcliffe, PhD, and Richard L. Prager, MD; for the Michigan Society of Thoracic and Cardiovascular Surgeons

Division of Cardiovascular and Thoracic Surgery, William Beaumont Hospital, Royal Oak; University of Michigan Cardiac Surgery at Crittenton Hospital, Rochester; Michigan Society of Thoracic and Cardiovascular Surgeons Quality Collaborative, Ann Arbor; Stephen M. Ross School of Business, University of Michigan, Ann Arbor; Section of Cardiac Surgery, University of Michigan, Ann Arbor, Michigan

- Initial report on statewide adoption of POCMA as analytic and quality improvement tool for cardiac surgery
- Review of 1,905 mortalities out of 53,674 adult cardiac operations from January 1, 2006 to June 30, 2010 yielded a POCMA profile of seminal events and determination of avoidable death in 41%

Ann Thorac Surg 2012;93:36-43

MSTCVS

- Founded 1965
- Currently 91 Board Certified Thoracic Surgeons
- Statewide quality initiative
  - 2001: 17 hospitals met to review STS NCD results for 1998 to 2000
  - 2006: Grew to include 28 hospitals and POCMA started
  - 2008: Site visit program initiated (O/E ratio > 1.5)
  - 2011: BCBS hospital "bonus" for collaborative participation and improved outcomes

MSTCVS

Local Case Review
- Concurrent
- Surgeon-directed
- Multi-disciplinary

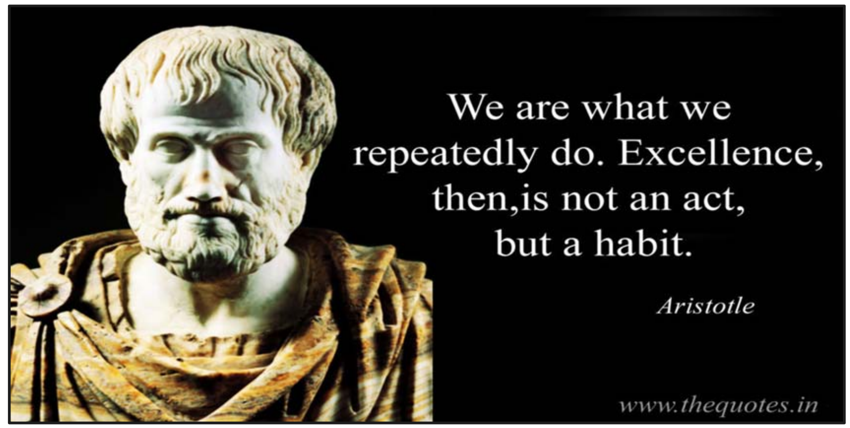
Collaborative Review
Review mortality summary and POCMA record

85% - Agree

15% - MORG Adjudication

Decade of POCMA: 2006 - 2015

Rich Prager, MD



Decade of POCMA: 2006 - 2015

2006 – 2015
112,581
Cardiac Procedures

↓

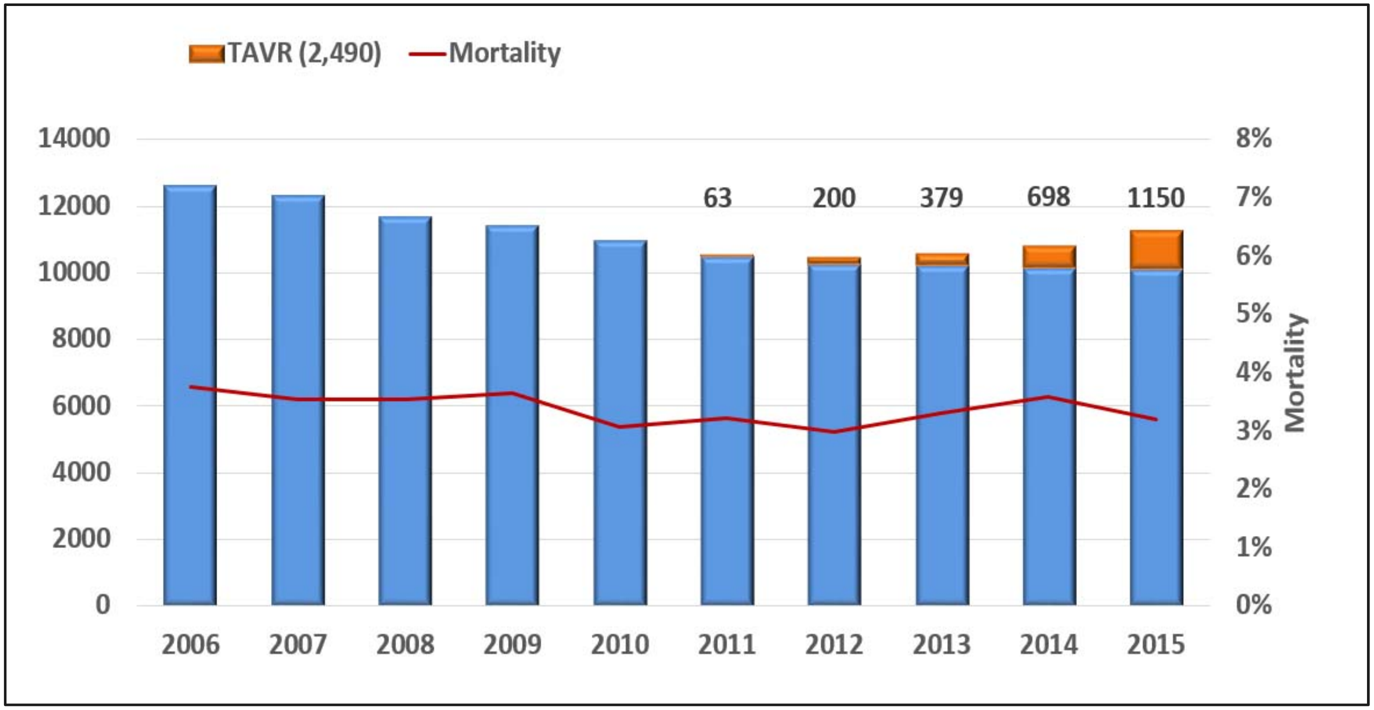
3.4% Mortality
(3824)

↙ ↘

+ STS Risk Model
84,067

No Risk Model
28,514

Annual Procedure Trends

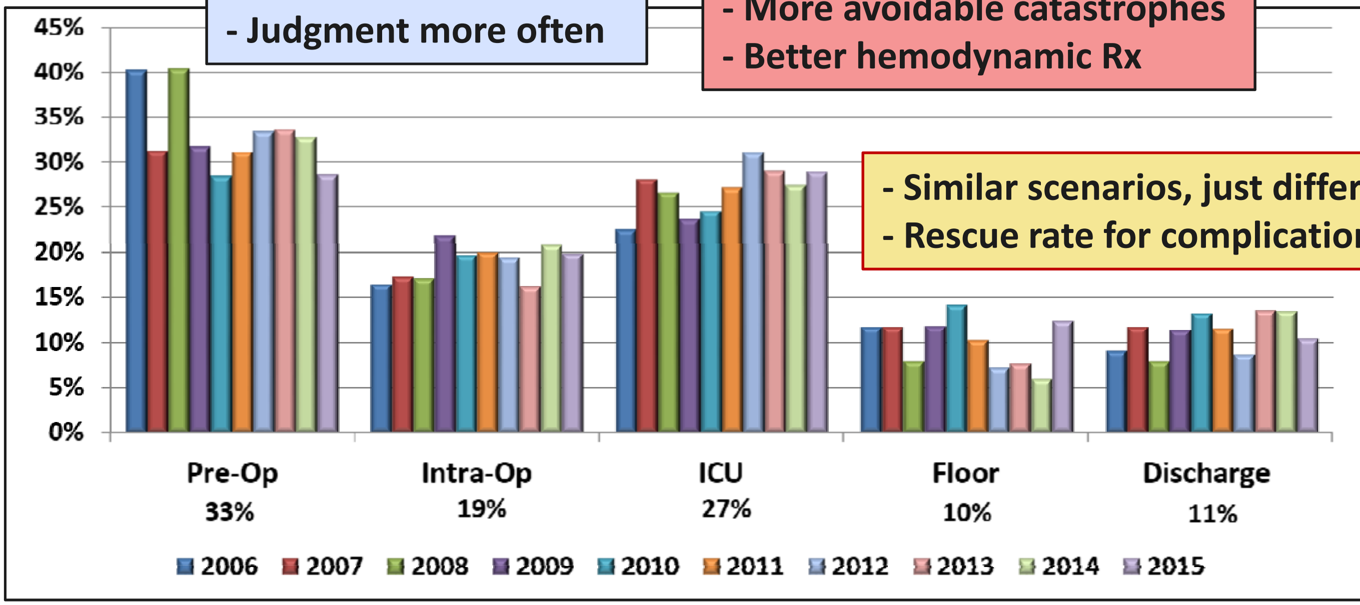


POCMA – Phase Distribution

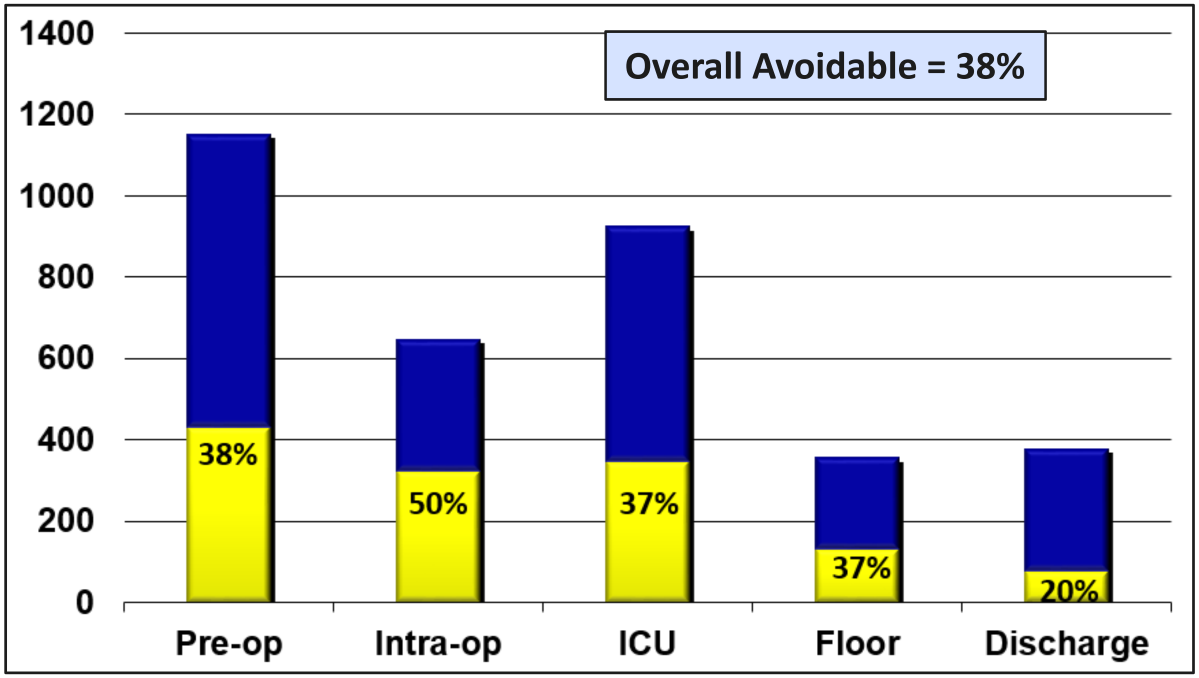
- Cardiac RFP less often
- Judgment more often

- More avoidable catastrophes
- Better hemodynamic Rx

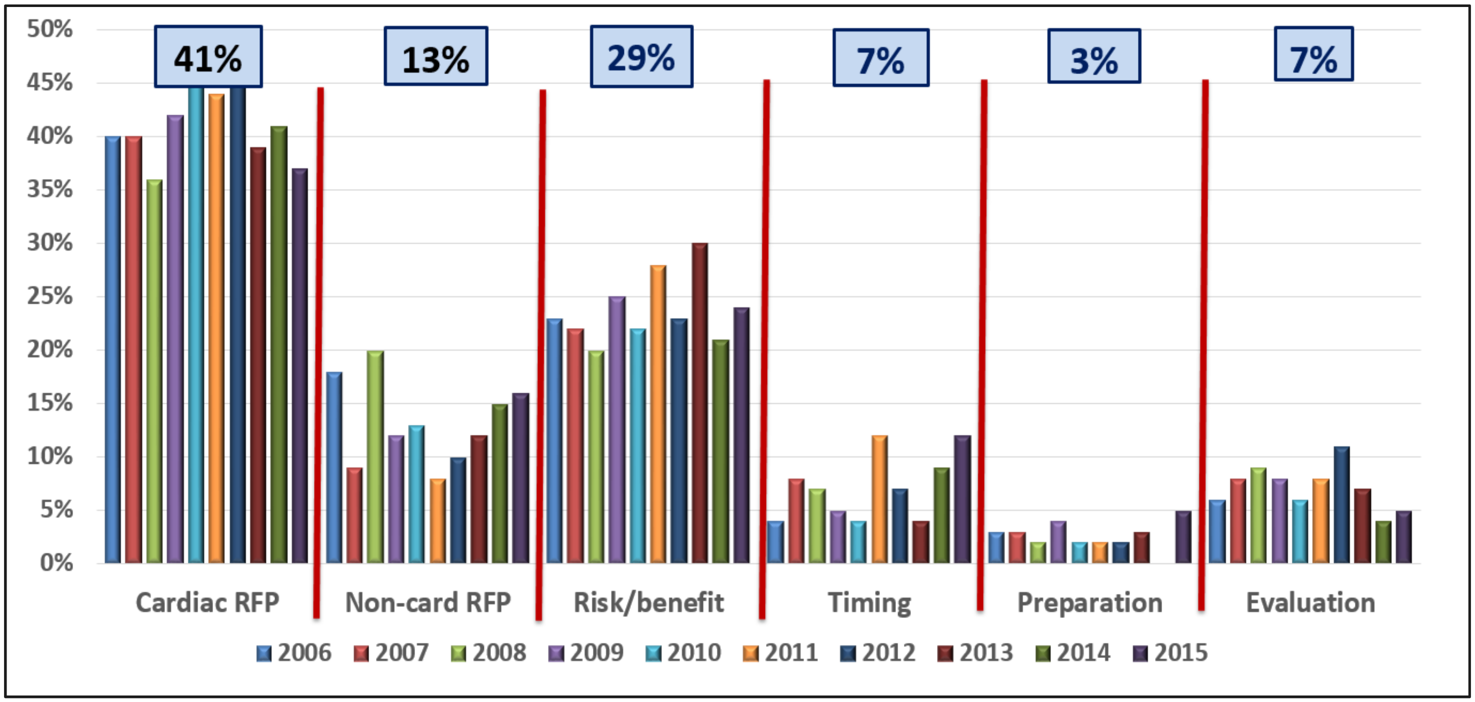
- Similar scenarios, just different context
- Rescue rate for complications variable



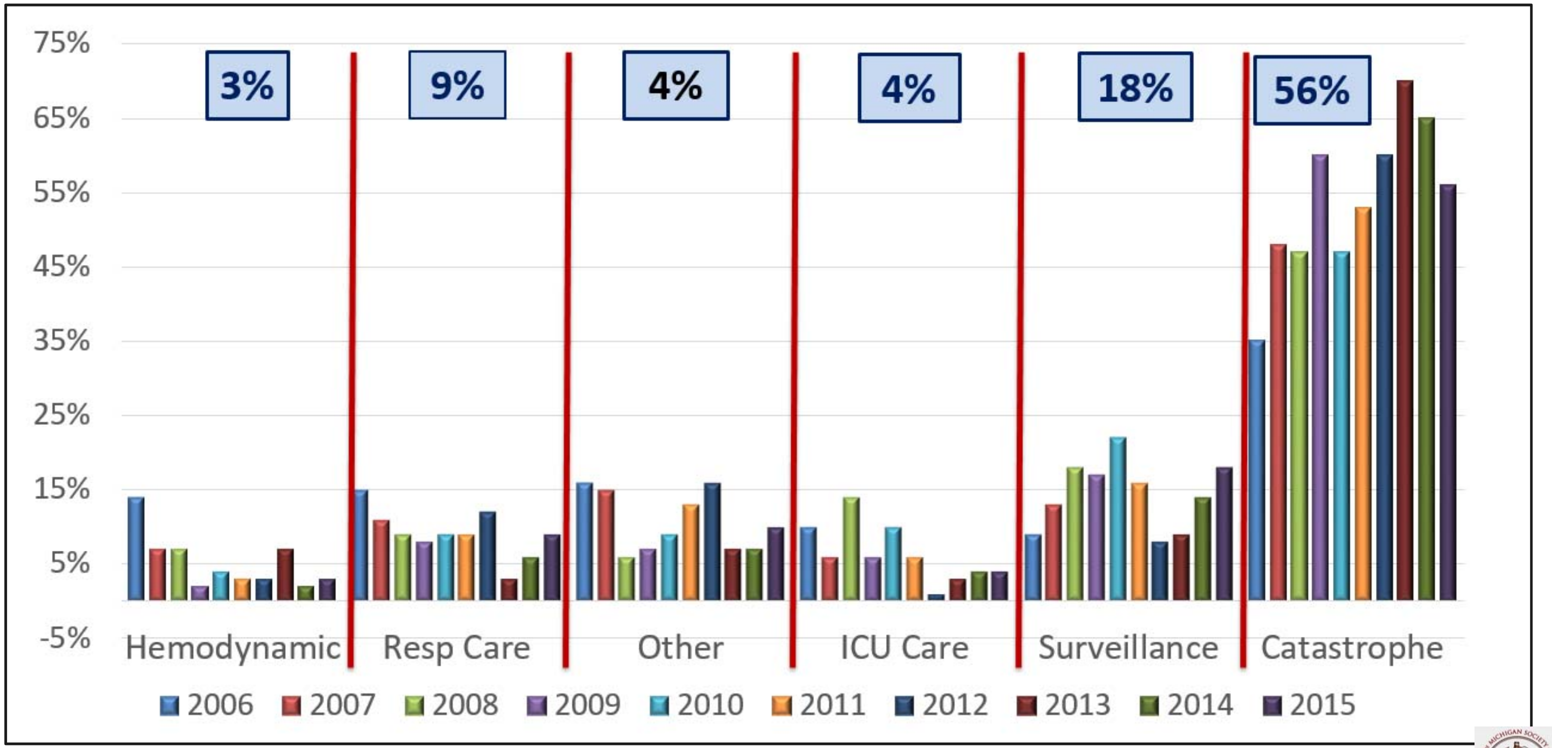
Avoidable Deaths – All Procedures



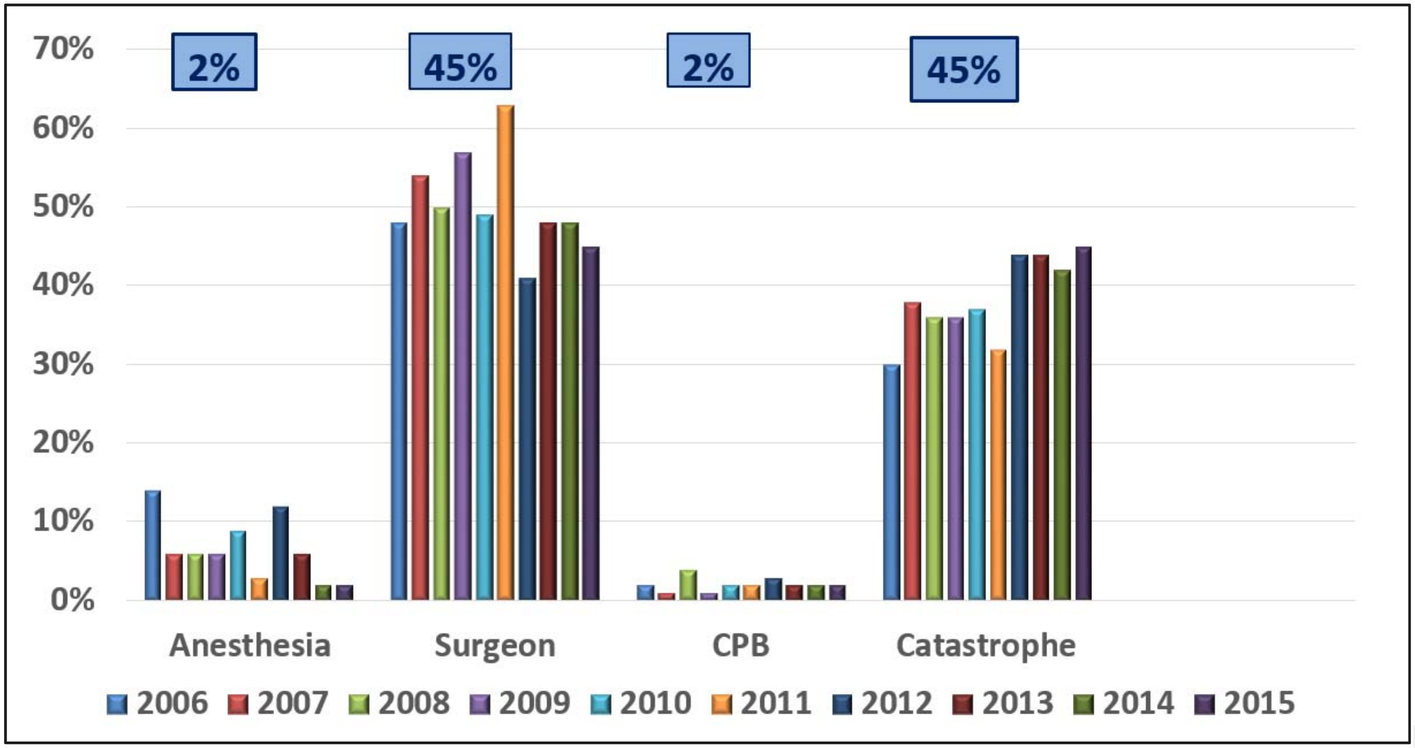
Pre-op Phase: Sub-categories



ICU Phase: Sub-categories



Intra-op: Sub-categories



Top Seminal Events

Phase	Sub-category	n	% Total Deaths
ICU	Catastrophe	506	14.4%
Pre-op	Cardiac RFP	476	13.6%
Pre-op	Judgment	358	10%
Intra-op	Surgeon	334	9.5%
Intra-op	Catastrophe	252	7.2%
Surveillance	ICU & Floor	209	5.9%
Floor	Catastrophe	206	5.8%

Catastrophic Events

Events	Intra-op		ICU		Floor		Total
	% phase	n	% phase	n	% phase	n	
CVA	17%	447	8%	75	6.5%	23	545
Cardiac arrest	12%	79	21%	197	51%	184	460
Respiratory failure	2%	13	10%	94	6%	22	129
GI	-	-	10%	94	8%	29	123
Other	4%	26	4%	37	2%	7	70

Focused Improvement Topics and Projects

- Focus list derived from top 5 avoidable mortality list
- Improvement plans elaborated by MSTCVS physicians

Pre-op → Intra-op → ICU → Floor → Discharge

Pre-op / Intra-op

- Surgeon Judgment
- Myocardial viability
- High risk patient evaluation
- Operative choice/execution

ICU / Floor

- Appropriate staffing
- Enhanced monitoring
- Dedicated intensivists
- Better O^2 delivery

Discharge

- Support systems
- Earlier follow-up

Optimization

- Improved communication and hand-offs
- Better recognition and prevention of catastrophes

Conclusions

- POCMA is a reproducible and efficient approach to identifying the root cause of surgical mortalities
- Process of conducting the POCMA analysis is conducive to surgical "team" participation and learning
- Identification of avoidable surgical deaths and rescue pathways facilitates focused quality improvement
- Analytic framework of POCMA allows elaboration of new seminal events as surgical care evolves

Insights Derived from POCMA

Glenn J.R. Whitman, MD

Director, CVSICU
Johns Hopkins Hospital
Baltimore, MD

Disclosures

- None

Phase of Care Mortality Analysis: Comparing Mortality Differences Among TAVR and Surgical AVR Patients

Todd C Crawford, MD[1], J Trent Magruder, MD[1], Joshua C Grimm, MD[1], Kaushik Mandal, MD[1], Joel Price, MD[1], Jon R Resar, MD[2], Matthew Chacko, MD[2], Rani K Hasan, MD[2], Glenn J Whitman, MD[1], John V Conte, MD[1]

1 Division of Cardiac Surgery, Johns Hopkins University School of Medicine, Baltimore, MD.

2 Division of Cardiology, Johns Hopkins University School of Medicine, Baltimore, MD.

Background (POCMA)

- Introduced in 2012 by the Michigan Society of Thoracic & Cardiovascular Surgeons (MSTCVS)
- Principle: each in-hospital mortality is rooted in a seminal event
- Promotes a culture of transparency
- Has led to quality initiatives and ultimately resulted in improved morbidity and mortality

Shannon FL, et al. A Method to Evaluate Cardiac Surgery Mortality: Phase of Care Mortality Analysis. Annals of Thoracic Surgery. 2012.

Background (POCMA)

- Aortic Stenosis
  - 1-2% of patients > 65 yo
  - 1 year mortality for symptomatic AS -> 25-30%, 50% in those denied surgery
  - Available Interventions
    - SAVR – traditional approach to aortic valve disease, involves cardiopulmonary bypass
    - TAVR – transcatheter aortic valve replacement
      - High risk or extreme risk patients that are not fit to undergo SAVR
      - PARTNER A trial – TAVR mortality at 1 year was non-inferior in comparison to SAVR in high risk patients
      - CoreValve US Pivotal Trial – superior mortality at 1 year compared to SAVR in high risk patients

Smith CR, et al. PARTNER Trial Investigators. Transcatheter versus surgical aortic-valve replacement in high risk patients. N Engl J Med. 2011.
Mack MJ, et al. PARTNER 1 trial investigators. 5-year outcomes of transcatheter aortic valve replacement or surgical aortic valve replacement for high surgical risk patients with aortic stenosis (PARTNER 1): a randomized controlled trial. Lancet. 2015.

Objective

- To utilize a novel analytical tool to compare differences in sentinel events among TAVR and SAVR populations that ultimately culminate in in-hospital mortality

Methods

- Patient Selection
  - Any adult patient that underwent isolated TAVR or SAVR at our institution between 1/1/2011 and 3/31/2015 and expired during the postoperative hospital course
  - Included patients enrolled in research trials as well as those receiving commercially-available valves
  - TAVR population included both extreme and high risk patients

POCMA Methodology

- Five "Phases" of Care
- Subcategories within each phase of care
- Goal: identify mortality triggers

Johns Hopkins Cardiac Surgery – Phase of Care Mortality Analysis - Privileged & Confidential

Surgeon:________ DOS ___/____/_____ DOD ____/___/_____ Transferring Hospital Name: ________________________STS Record ID: _________

Medical Record Number: _________________ Patient Name: ____ Age___________

Procedures & Dates____

EuroScore: ________ STS Risk Score: _______ Location of Death: OR CVSICU CVCPU Other: _______________ Autopsy: Yes No

CASE Summary:

PHASE OF CARE MORTALITY ANALYSIS:

Pre-Operative Phase

Cardiac risk factor profile e.g.
- Cardiogenic shock
- Myocardial viability

Non-cardiac risk factor profile
- Renal failure on dialysis
- COPD
- Cirrhosis
- Combination
- High risk

Judgment
- Timing of surgery
- Risk > benefit

Patient preparation
- Medical status optimized

Patient evaluation
- Functional class
- ID occult disease(s)

Other: ______________

Intra-Operative Phase

Anesthesia
- Technical (lines, TEE, ET)
- Pharmacologic management
- Recognition/Treatment of Decompensation

Surgeon
- Judgment
- Technical (lacs, grafts, emboli)
- Myocardial protection

Cardiopulmonary By-Pass
- Parameters (hct, MAP, mVO^2)
- Fluid management

CVA

Catastrophic event (specify):

____

Other: ______________

Post-Op ICU Phase

Arrhythmia management

Hemodynamic management
- Inotrope titration
- Adequate O^2 delivery

Respiratory care
- Prevent lung injury and VAP
- Appropriate support plan

ICU care (Keystone criteria)
- DVT/PE prophylaxis
- Sepsis prevention/treatment
- Nutritional support

Recognition of Decompensation

Treatment of Decompensation

Catastrophic event (specify):

____

Other: ______________

Post-Op Floor Phase

Pharmacologic management
- Coumadin
- Other

Pulmonary embolism

CVA

Dysrhythmia (Atrial or Vent)

Surveillance/recognition/Rx of decompensation

Sepsis prevention/treatment

Catastrophic event (specify):

____

Other: ______________

Discharge Phase

Appropriate disposition: e.g.
- Nursing home/ECF vs. home

Pharmacologic details

Adequate instruction and support network

Catastrophic event (specify):

____

Other: ______________

Primary Cause of Death (Circle first significant event which led to death): Cardiac Neurologic Renal Vascular Infection Pulmonary Valvular Unknown Other

Seminal event and Mortality Avoidable? Yes No If Yes: How: ______________________________________

Next steps to prevent in the future : ______________________________________

Completed by (Resident) ______________________ Reviewed by (Surgeon) ______________________ Complete (Yes / No)

The JHH POCMA Committee

- Every in-hospital death reviewed in the Cardiac Surgery Mortality & Morbidity Conference
- Conference includes:
  - Cardiac Surgery Faculty
  - Cardiac Surgery Fellows
  - Cardiac Surgery ICU Intensivists (anesthesia, cardiac anesthesia, pulmonary and critical care physicians)
- JHH modified POCMA form completed during conference
- For TAVR mortalities, interventional cardiologists provided input regarding the phase of care associated with the mortality

Results

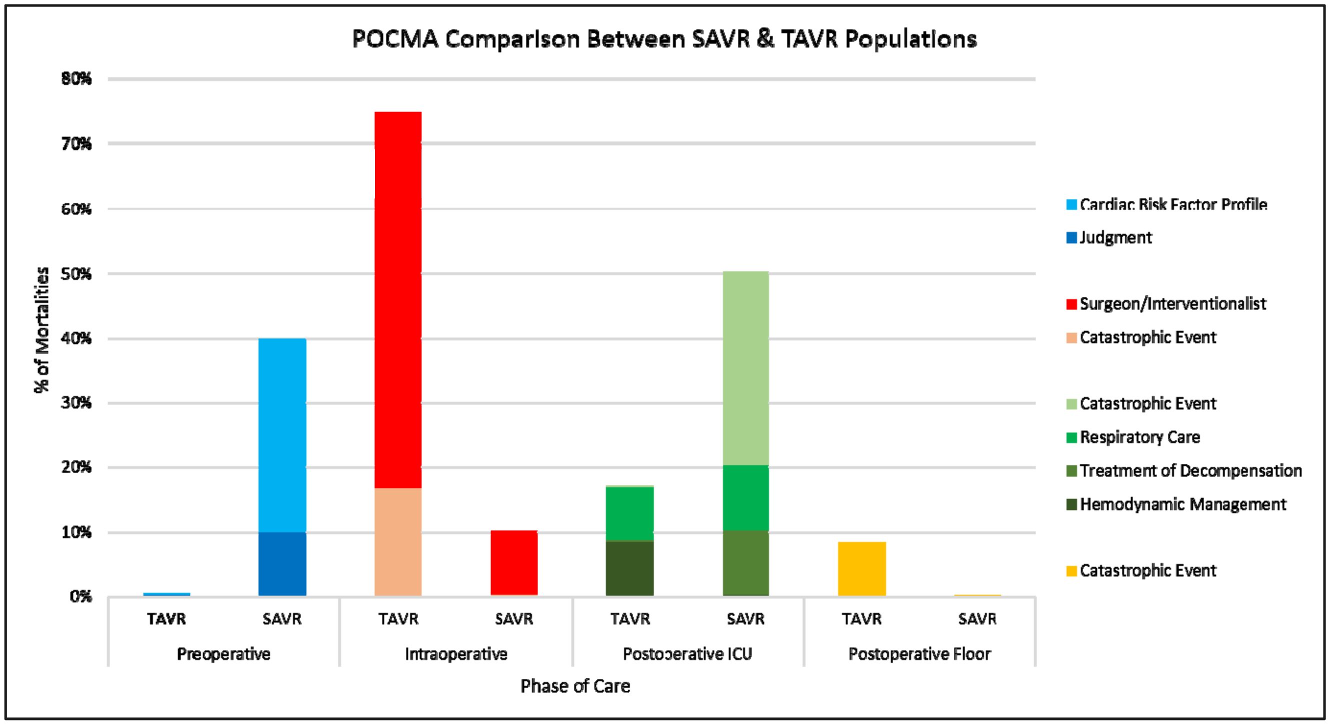
- Study Population: n=770 (isolated SAVR or TAVR)
  - 240 TAVR, 12 in-hospital mortalities (5.0%)
  - 530 SAVR, 10 in-hospital mortalities (1.9%)
- TAVR
  - Transfemoral – 93.8%
  - Hemi-sternotomy (direct aortic access) – 2.5%
  - Transaxillary – 2.1%
  - Transapical – 1.7%

Characteristics of Those Who Died

Variables	SAVR (n=10)	TAVR (n=12)	p-value
Age (years)	74 (66-84)	84 (81.5-88.5)	**0.008**
Male Gender	6 (75.0%)	2 (16.7%)	0.074
Calculated BMI (kg/m²)	28.0 (25.1-29.6)	24.2 (21.1-25.7)	0.114
Pre-operative GFR (mL/min)	41.4 (19.3 - 50.3)	21.8 (17.3-39.0)	0.262
Hypertension	10 (100%)	11 (91.7%)	1.000
Diabetes	4 (40.0%)	1 (8.3%)	0.135
Peripheral Vascular Disease	3 (30.0%)	3 (25.0%)	1.000
Pre-existing Lung Disease (Mild, Moderate, or Severe)	5 (55.6%)^	8 (66.7%)	0.673
Previous Myocardial Infarction	2 (20.0%)	5 (41.7%)	0.381
LVEF (%)	50.0 (40.0-60.0)	62.5 (60.0-72.5)	**0.016**
Congestive Heart Failure	7 (70.0%)	12 (100%)	0.078
NYHA I	0	1 (9.1%)	
NYHA II	3 (42.9%)	2 (16.7%)	
NYHA III	3 (42.9%)	3 (25.0%)	
NYHA IV	1 (14.3%)	6 (50.0%)	
Prior Balloon Aortic Valvuloplasty	0	4 (33.3%)	0.096
STS Predicted Risk for Mortality (%)	8.0 (3.5-8.2)	11.7 (6.7-23.6)	0.08
STS Predicted Mortality for Entire Study Population (%)	1.7 (1.0-3.1)	9.7 (5.4-12.0)	<0.01

^= out of 9 patients

Characteristics of Those Who Died



In-Hospital SAVR Mortalities

- Pre-operative Phase (n=4, 40% of Mortalities)
  - Cardiac Risk Factor Profile (3 out of 4)
  - Two of these patients presented with endocarditis
- Post-operative ICU Phase (n=5, 50% of Mortalities)
  - Catastrophic Events (3 out of 5)
  - Refractory GI bleed, intestinal ischemia, intracranial hemorrhage
- Only one mortality attributable to intra-operative phase

In-Hospital TAVR Mortalities

- Intra-operative Phase of Care (75% of mortalities)
  - Technical Errors (Surgeon/Cardiologist)
    - Coronary Ischemia
    - Acute aortic valve insufficiency
    - Wire perforations/tamponade
- Catastrophic Events
  - Embolic stroke
  - Vascular complication
- Pitfalls
  - Narrow Sinus of Valsalva
  - Low-lying coronary ostia
  - Bulky aortic valve leaflets

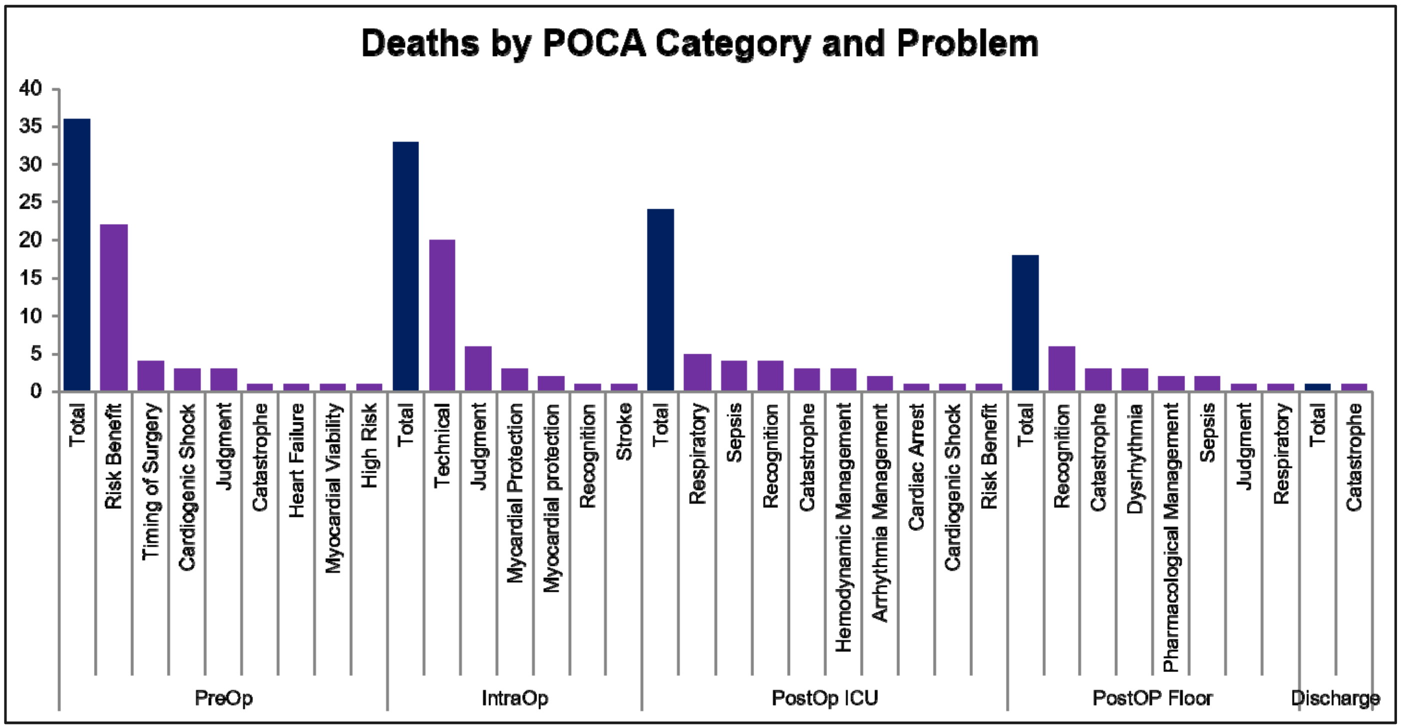
Limitations

- Single institution
  - Low event rate
    - TAVR program initiated in 2011
    - ~100 isolated AVRs annually
- Preoperative phase of care consideration for TAVR
  - High risk/Extreme risk population
  - Preoperative comorbidities and anatomical features may contribute to technical challenges and postoperative complications

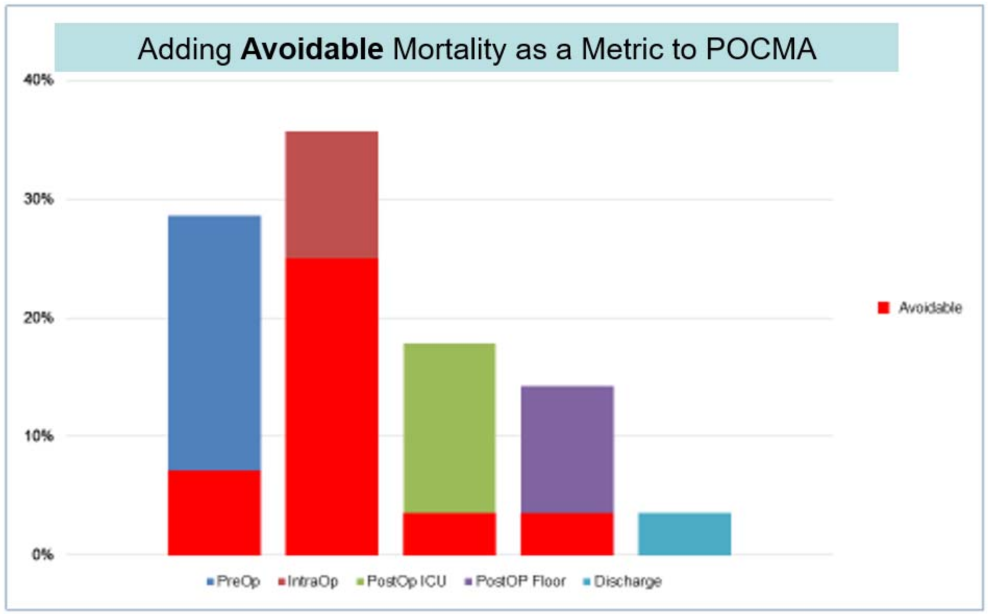
Conclusion

- Distinct differences exist with regard to the phase of care in which seminal events arise that contribute to in-hospital mortality after SAVR or TAVR
  - SAVR mortalities were related to patient selection and postoperative ICU care
  - TAVR mortalities were often the result of intraoperative events
- Knowledge of the timing and location of these events may enable providers to implement strategic interventions that reduce mortality

Conclusion


Deaths by POCA Category and Problem
40
35
30
25
20
15
10
5
0
Total
Risk Benefit
Timing of Surgery
Cardiogenic Shock
Judgment
Catastrophe
Heart Failure
Myocardial Viability
High Risk
Total
Technical
Judgment
Mycardial Protection
Myocardial protection
Recognition
Stroke
Total
Respiratory
Sepsis
Recognition
Catastrophe
Hemodynamic Management
Arrhythmia Management
Cardiac Arrest
Cardiogenic Shock
Risk Benefit
Total
Recognition
Catastrophe
Dysrhythmia
Pharmacological Management
Sepsis
Judgment
Respiratory
Total
Catastrophe
PreOp
IntraOp
PostOp ICU
PostOP Floor
Discharge

Conclusion



Adding **Avoidable** Mortality as a Metric to POCMA
40%
30%
20%
10%
0%
Avoidable
PreOp
IntraOp
PostOp ICU
PostOP Floor
Discharge

Phase of Care Analysis

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Education, and Research
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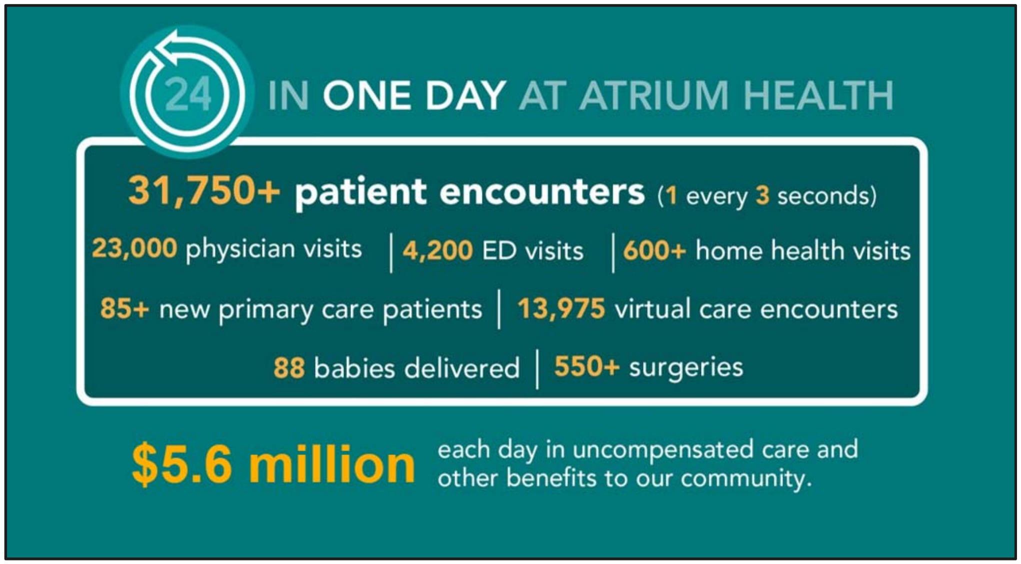
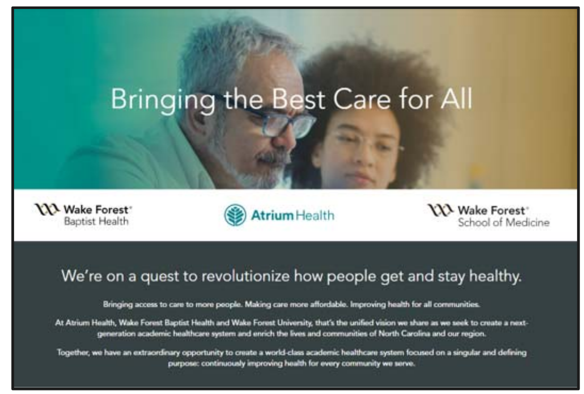
Disclosures

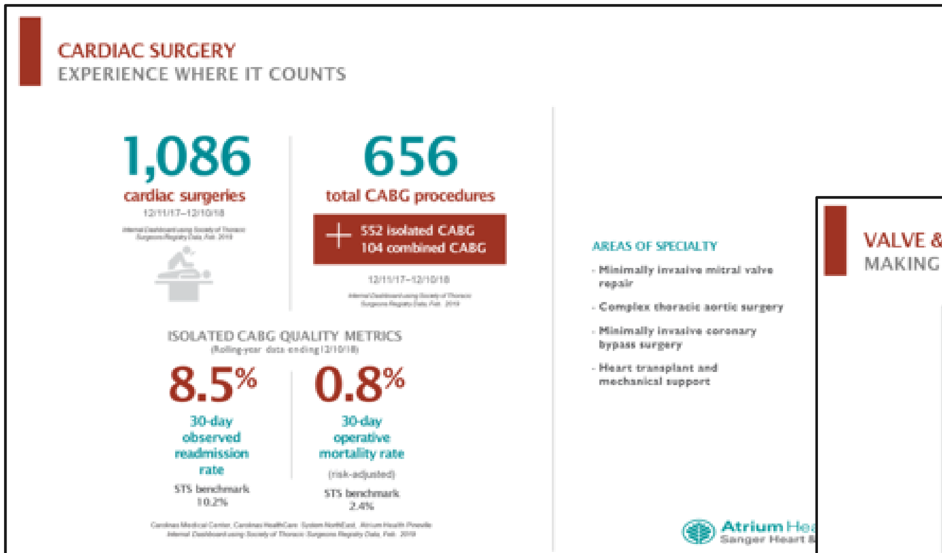
- None

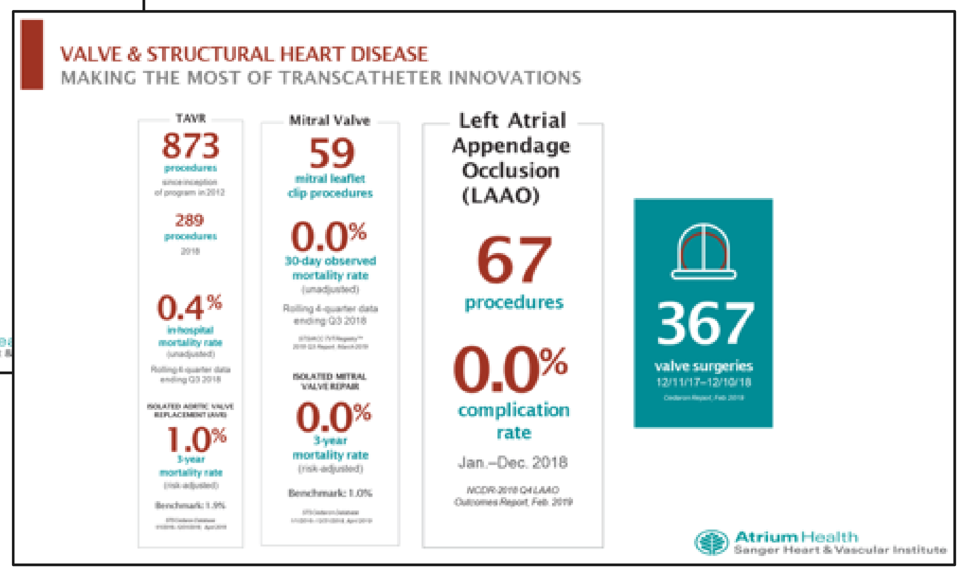
Atrium Health





Atrium Health





Sanger Heart & Vascular Institute

Quality Improvement Program

Quality improvement program decreases mortality after cardiac surgery

Sotiris C. Stamou, MD, PhD, Sara L. Camp, NP, Robert M. Stiegel, MD, Mark K. Reames, MD, Eric Skipper, MD, Larry T. Watts, MD, Marcy Nussbaum, MS, Francis Robicsek, MD, PhD, and Kevin W. Lobdell, MD

Supplemental material is available online.

Objective: This study investigated the effects of a quality improvement program and goal-oriented, multidisciplinary protocols on mortality after cardiac surgery.

Methods: Patients were divided into two groups: those undergoing surgery (coronary artery bypass grafting, isolated valve surgery, or coronary artery bypass grafting and valve surgery) after establishment of the multidisciplinary quality improvement program (January 2005–December 2006, n = 922) and those undergoing surgery before institution of the program (January 2002–December 2003, n = 1289). Logistic regression and propensity score analysis were used to adjust for imbalances in patients' preoperative characteristics.

Results: Operative mortality was lower in the quality improvement group (2.6% vs 5.0%, $P < .01$). Unadjusted odds ratio was 0.5 (95% confidence interval 0.3–0.8, $P < .01$); propensity score–adjusted odds ratio was 0.6 (95% confidence interval 0.4–0.99, $P = .04$). In multivariable analysis, diabetes ($P < .01$), chronic renal insufficiency ($P = .05$), previous cardiovascular operation ($P = .04$), congestive heart failure ($P < .01$), unstable angina ($P < .01$), age older than 75 years ($P < .01$), prolonged pump time ($P < .01$), and prolonged operation ($P = .05$) emerged as independent predictors of higher mortality after cardiac surgery, whereas quality improvement program ($P < .01$) and male sex ($P = .03$) were associated with lower mortality. Mortality decline was less pronounced in patients with than without diabetes ($P = .04$).

Conclusion: Application of goal-directed, multidisciplinary protocols and a quality improvement program were associated with lower mortality after cardiac surgery. This decline was less prominent in patients with diabetes, and focused quality improvement protocols may be required for this subset of patients.

Cardiothoracic surgery has a long history of commitment to improving the quality of patient care. Data collection and critical analysis have established high standards that may effectively decrease the rate of less acceptable outcomes.[1,2] Recently, The Society of Thoracic Surgeons' executive committee created the quality measurement task force, a comprehensive quality measurement program for cardiothoracic surgery.[2] Measurement of existing quality and identification of substantial deviations from best practice are the first steps in any continuous quality improvement program (QIP). Such an examination leads to focused interventions, after which improvements are documented with repeated measurements.[3]

In contrast to the integral role that publication plays in scientific discovery, publication in medical quality improvement has unfortunately had only a limited role to date. This lack of published reports has arguably deprived the health care system of rigorous scholarly evidence on improvement work and thus has slowed advancement of the improvement process.[4,5] There is little evidence evaluating the effects on postoperative mortality after cardiac surgery of implementing QIPs and quality measurement.[4,6-11]

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Continuous Quality Improvement Program and Major Morbidity After Cardiac Surgery

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The aim of this study was to investigate how a continuous quality improvement (CQI) program affected major morbidity and postoperative outcomes after cardiac surgery. Patients were divided into 2 groups: those who underwent surgery (coronary artery bypass grafting, isolated valve surgery, or coronary artery bypass grafting and valve surgery) after the establishment of a CQI program (from January 2005 to December 2006, n = 922) and those who underwent surgery beforehand (from January 2002 to December 2003, n = 1,289). Patients who had surgery in 2004, when the system and processes were reengineered, were not included in the analysis. Outcomes compared between the 2 groups included (1) acute renal failure, (2) stroke, (3) sepsis, (4) hemorrhage-related reexploration, (5) cardiac tamponade, (6) mediastinitis, and (7) prolonged length of stay. Logistic regression analysis and propensity score adjustment were used to adjust for imbalances in the patients' preoperative characteristics. After propensity score adjustment, CQI was found to decrease the rate of sepsis (odds ratio [OR] 0.5, 95% confidence interval [CI] 0.3 to 0.9, p = 0.02) and cardiac tamponade (OR 0.2, 95% CI 0.04 to 0.8, p = 0.02) but to only marginally decrease the rate of acute renal failure (OR 0.7, 95% CI 0.5 to 1.0, p = 0.07). CQI did not emerge as an independent risk factor for hemorrhage-related reexploration, prolonged length of stay, mediastinitis, or stroke in either multivariate logistic regression analysis or propensity score adjustment. In conclusion, the systematic implementation of a CQI program and the application of multidisciplinary protocols decrease sepsis and cardiac tamponade after cardiac surgery. © 2008 Elsevier Inc. All rights reserved. (Am J Cardiol 2008;102:772–777)

Previous studies have evaluated the effects of implementing quality improvement protocols and quality measurement on postoperative morbidity and mortality after cardiac surgery.[1–6] The present study was conducted to systematically evaluate the effect of a continuous quality improvement (CQI) program on major morbidity after cardiac surgery.

Methods

The database of the Division of Cardiothoracic Surgery at the Carolinas Medical Center was queried to identify all patients who underwent coronary artery bypass grafting (CABG), isolated valve surgery, or valve surgery and CABG at our institution from January 2002 to December 2006. Patients were divided into 2 groups: those who underwent surgery after the establishment of a multidisciplinary CQI program (from January 2005 to December 2006, n = 922) and those who underwent surgery beforehand (from January 2002 to December 2003, n = 1,289). Patients who underwent surgery during the transitional year, 2004, were not included in the analysis. The operations were performed by the same group of cardiac surgeons for the period of study. No major changes in surgical techniques took place during the period of study. Baseline demographics, procedural data, and perioperative outcomes were recorded and entered prospectively in a prespecified database by a dedicated data-coordinating center. The Society of Thoracic Surgeons National Cardiac Surgery Database definitions were used for the purposes of the study.

Before data identification and analysis, study approval was sought and obtained from the investigational review board at our institution. Confidentiality of patients' personal information was maintained at all times, consistent with the Health Insurance Portability and Accountability Act of 1996.

The Carolinas Heart and Vascular Institute CQI program began in 2004 and focused on improving cardiac surgery outcomes. Evidenced-based intensive care unit management protocols and guidelines included communication tools (standardized handoff and goal sheets), sedation monitoring, respiratory protocols for early extubation and best pulmonary practices bundles, computerized euglycemia management, blood management, and infection control programs. The Society of Thoracic Surgeons National Cardiac Surgery Database and National Quality Forum metrics and guidelines focused our CQI program.

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hSR proceedings

ORIGINAL ARTICLE

Can timing of tracheal extubation predict improved outcomes after cardiac surgery?

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ABSTRACT

Introduction - Early tracheal extubation is a common goal after cardiac surgery. Our study aims to examine whether timing of tracheal extubation predicts improved postoperative outcomes and late survival after cardiac surgery. We also evaluated the optimal timing of extubation and its association with better postoperative outcomes.

Methods - Between 2002 and 2006, 1164 patients underwent early tracheal extubation (< 6 hours after surgery) and 1571 had conventional extubation (> 6 hours after surgery). Propensity score adjustment and multivariable logistic regression analysis were used to adjust for imbalances in the patients' preoperative characteristics. Receiver operating characteristic curves (ROC) were used to identify the best timing of extubation and improved postoperative outcomes. Cox regression analysis was used to identify whether early extubation is a risk factor for decreased late mortality.

Results - Early extubation was associated with lower propensity score-adjusted rate of operative mortality (Odds Ratio = 0.55, 95% Confidence Intervals = 0.31-0.98, p = 0.043). Extubation within 9 hours emerged as the best predictor of improved postoperative morbidity and mortality (sensitivity = 85.5%, specificity = 52.7%, accuracy = 64.5%). Early extubation also predicted decreased late mortality (Hazard Ratio = 0.45, 95% Confidence Intervals 0.31-0.67, p < 0.001).

Conclusions - Early extubation may predict improved outcomes after cardiac surgery. Extubation within 9 hours after surgery was the best predictor of uncomplicated recovery after cardiac surgery. Those patients intubated longer than 16 hours have a poorer postoperative prognosis. Early extubation predicts prolonged survival up to 16 months after surgery.

Keywords: *early extubation, coronary artery bypass, mortality.*

INTRODUCTION

Early tracheal extubation is a common goal of postoperative recovery after cardiac surgery. It is associated with decreased rates of pulmonary complications and decreased use of hospital resources (1-8). Though many investigations have elucidated the value of early extubation after cardiac surgery, the optimal timing has not been determined.

This propensity-matched study was designed to evaluate optimal timing of early extubation and correlate timing of extubation with early and late outcomes.

METHODS

The Division of Cardiothoracic Surgery at Carolinas Heart and Vascular Institute computerized database was utilized to identify

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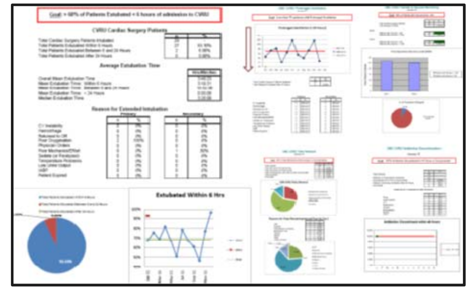
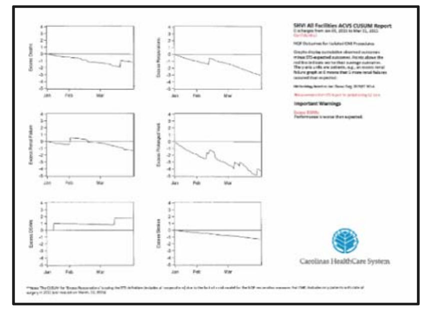
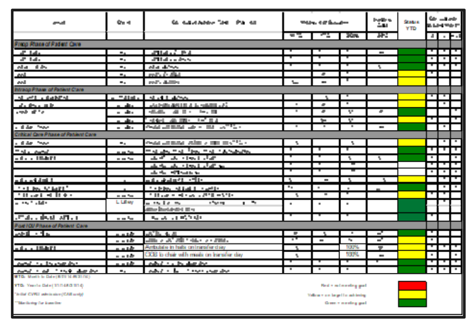
Learning Organization







Risk Assessment

OUTCOMES ANALYSIS, QUALITY IMPROVEMENT, AND PATIENT SAFETY

"What's the Risk?" Assessing and Mitigating Risk in Cardiothoracic Surgery

Kevin W. Lobdell, MD, James I. Fann, MD, and Juan A. Sanchez, MD

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> Not everything that counts can be counted, and not everything that can be counted counts.—William Bruce Cameron, *Informal Sociology*, 1963

To increase awareness and improve safety, quality, and value in cardiothoracic surgery, we provide a synopsis of risk, risk assessment methods, and considerations for mitigating modifiable risks associated in the cardiothoracic surgery patient. Definitions of risk include (1) the possibility or danger of injury or loss; (2) a person or thing that creates a hazard; and (3) the chance of financial loss. One way to quantify risk is to sum the product of consequences and probabilities. A common example of risk, in which the potential outcomes and probability are known, would be the flip of a coin. In surgery, however, quantifying risk becomes much more challenging, and all of the possible outcomes and the exact probabilities of each are difficult to forecast for an individual patient.

Risk management involves assessing and mitigating risk through avoidance, modification of risk (eg, altering timing or procedure type, cancellation, modifications in host, and other factors), as well as the acceptance of risk. An effective surgical risk management strategy requires an objective comparison of risk exposure to the anticipated value of an operation for each patient. Fundamental characteristics of risk models include calibration, namely, the level of agreement between observed and expected outcomes, and discrimination, which is the ability to distinguish between high-risk and low-risk patients [1]. Additionally, surgical risk scoring systems can be static (eg, a snapshot of a patient's risk before operative intervention) or dynamic—which factor in the unique pathophysiologic changes associated with the planned procedure through defined phases of care with variation of risk over time [1, 2].

The Society of Thoracic Surgeons (STS) Adult Cardiac Database, established in 1989 and utilized by approximately 1,100 participants in the United States, leads other clinical disciplines in risk assessment and transparency of methodology [3]. Risk algorithms for adult cardiac surgery have been created, are regularly updated with demographic and clinical data, and are currently available for coronary artery bypass grafting (CABG), cardiac valve surgery, and CABG plus valve surgery. The online STS risk calculator (available at http://riskcalc.sts.org) provides a statistical assessment of the patient's risk of mortality and postoperative morbidities. Surgeons are strongly encouraged to use the calculated risk profile in assessing an individual patient's risks and as a starting point for discussing expectations of surgery and informed consent. It should be noted, however, that despite robust standards, data acquisition methods, and validated statistical models, the coding process may complicate reporting [4].

The reporting of outcomes includes a composite rating system and the opportunity for voluntary public reporting (and soon, reports for individual surgeons). The National Quality Forum has developed national voluntary consensus standards for cardiac surgery to foster quality improvement and transparency to promote the highest quality of care for cardiac surgery patients (available at http://www.qualityforum.org).

Burden of Cardiac and Thoracic Disorders

Acquired heart disease affects 27.6 million adults in the United States, is the leading cause of death (611,106 estimated for 2016), and is projected to result in 3.7 million hospitalizations annually [5]. Approximately 600,000 adult cardiac surgical procedures are expected to be performed in 2016 [6]. In addition, congenital heart disease affects approximately 1% of live births (40,000 per year in the United States), and approximately 25% of those require surgery in their first year of life [7]. Cancer is the second most common cause of death in the United States, and the American Cancer Society estimates 224,390 new cases of lung cancer in the United States for 2016 [8]. Lung cancer causes approximately one in four cancer deaths [9]. The American Cancer Society also estimates 16,910 new cases esophageal cancer in the United States for 2016.

When assessing and categorizing surgical risk, one can utilize a variety of measures such as percentage mortality and relevant statistical information such as standard deviation from the mean, and so forth [10]. Risk assessment may include measuring physiologic determinants such as anaerobic threshold, functional capacity and frailty, and serum biomarkers. In addition, surgical risk and indicators of inferior quality correlate with elevated total costs, as shown by the Virginia Cardiac Surgery Quality

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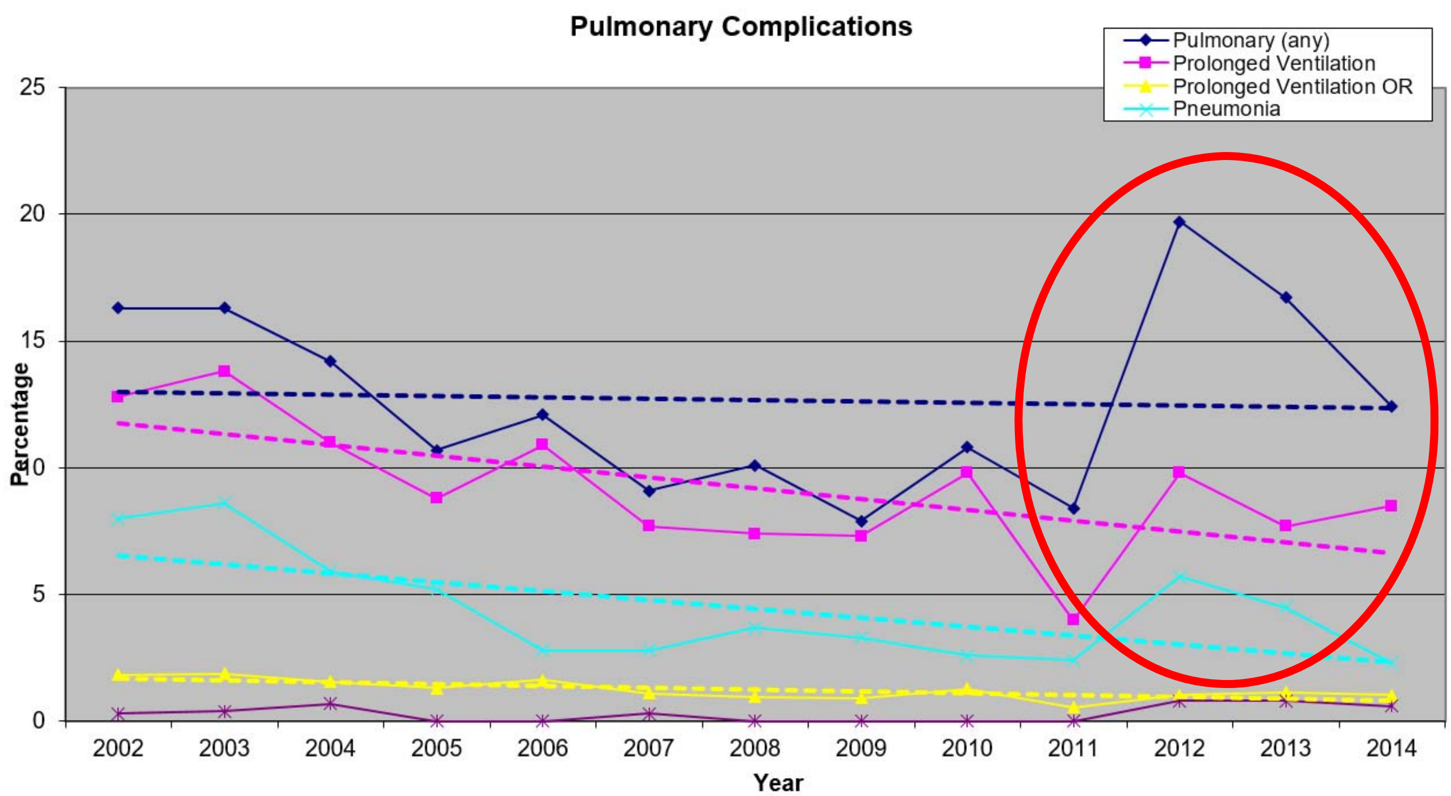
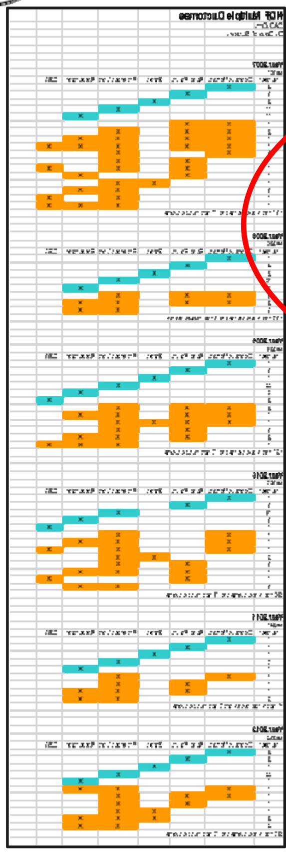
Ventilation Isolated CAB 2002-2014



Phase of Care Analysis

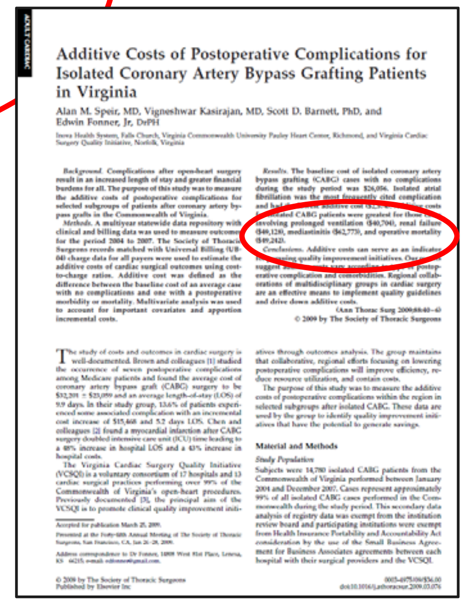
						Complications				Risk			Phase of Care Analysis								
Name	MRN	Mort	CVA	Reop	PV	DSWI	ARF	HAI	Other	STS	ES II	Surgeon	Preop	Op	ICU	Floor	DC	ScanTron	Avoidable	Unavoidable	PI Initiative

2007-2012 Isolated CAB



- 30.5% had multiple complications
- 56% of prolonged ventilation was isolated
- 66% of mortality was associated with prolonged ventilation

Prolonged Ventilation (CAB-Only)	2007	2008	2009	2010	2011	2012	Range	Mean
Multiple Complications (as % of Total)	35.4	18.6	25.6	33.3	36.7	33.3	18.6-35.7%	30.48%
Isolated PV/Multiple Comps	11/15	16/8	14/10	18/12	5/5	14/10		
Ratio	0.77	2.00	1.40	1.50	1.00	1.40	0.77-2.0	
% Total	42%	66%	58%	60%	50%	58%	42-66%	56%
Prolonged Vent Odds Ratio	1.11	0.96	0.92	1.29	0.56	0.68		
Mortality	12	6	5	4	2	4		
Mortality/PV	12/7	6/5	5/4	4/3	2/1	4/2		
% Mortality with PV	58%	83%	80%	75%	50%	50%	50-83%	66%



ADULT CARDIAC

Additive Costs of Postoperative Complications for Isolated Coronary Artery Bypass Grafting Patients in Virginia

Alan M. Speir, MD, Vigneshwar Kasirajan, MD, Scott D. Barnett, PhD, and Edwin Fonner, Jr, DrPH

Inova Health System, Falls Church, Virginia Commonwealth University Pauley Heart Center, Richmond, and Virginia Cardiac Surgery Quality Initiative, Norfolk, Virginia

Prolonged Ventilation after Cardiac Surgery

- Literature review
- Collaboration with pulmonary physicians
- Risk assessment tools
- Standardized approach to assessment & risk mitigation strategies (POCA)
- Pulmonary consultations

Prolonged Ventilation after Cardiac Surgery

Pre Op Phase

Baseline work up for all patients: (1) ABG on room air (2) CXR (3) Spirometry

Hx:
Screen for recent URI/Exacerbation
Recommendation to delay surgery if there was a recent URI
Complete a spirometry and/or PFTs with DLCO for all patients with significant:

- Asthma
- COPD
- Chronic bronchitis
- Emphysema
- Pulmonary fibrosis
- Other respiratory disorder
- ETOH use
- OSA

Pre Op pulmonary consult in the following situations:

- If chronic lung disease is not at baseline judging by symptoms or spirometry or if there is active cough, sputum, wheezing
- If pCO_2>45 or pO_2<65
- If FEV1 less than 60%
- If specific underlying neuromuscular disorder that can affect respiratory system
- CXR abnormality not attributable to cardiac disease
- Untreated sleep apnea
- STS risk > 10% (realizing high risk may not be due to pulmonary factors, but other impairments risk may manifest as pulmonary dysfunction postoperatively

Tool:

- STS PV Risk Calculator-percent risk of prolonged ventilation

0-5% (Low Risk)
6-10% (Mod Risk)
>10% (High Risk)

Handoff

- Teach pulmonary hygiene preoperatively
- Smoking cessation for at least 4 weeks (ideally 6 weeks)
- ETOH cessation for 7+ days if possible

Provide details regarding:
Fx status (Katz Index)
Lack of independence in :

- Bathing , Dressing, Toileting , Transferring , Continence, & feeding

Weakness/frailty: (Grips < 15)

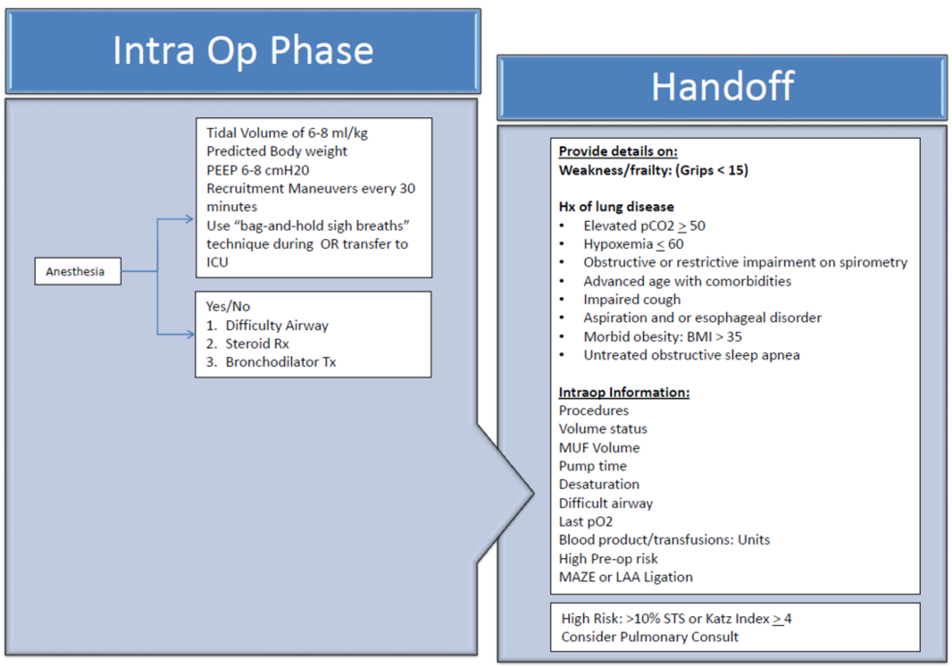
Hx of lung disease

- Elevated $pCO_2 \geq 50$
- Hypoxemia ≤ 60
- Obstructive or restrictive impairment on spirometry
- Advanced age with comorbidities
- Impaired cough
- Aspiration and or esophageal disorder
- Morbid obesity: BMI > 35
- Untreated obstructive sleep apnea

High Risk: >10% STS or Katz Index ≥ 4
Surgical team discussion (i.e. Surgeon, anesthesia, intensivist)

- Phase of Care Risk Mitigation
- Prolonged Ventilation
- Preop

Prolonged Ventilation after Cardiac Surgery



- Phase of Care Risk Mitigation
- Prolonged Ventilation
- Intraop

Prolonged Ventilation after Cardiac Surgery

Post Op Phase

Use tidal volume 6-8 mg/kg IBW while on vent

First 24 Hour Mngt

- Continue preoperative respiratory medications
- Strict adherence to low tidal volume ventilation, keep plateau pressure <30
- Careful monitoring of volume status
- Use early extubation protocol < 6 hours

Prolonged Ventilation

- Continue preoperative respiratory medications
- Consider excluding from early extubation protocol if :
  - High Pre-op risk
  - Intraop complications
  - Prolonged CPB
  - MAZE or LAA Ligation
  - Hemodynamic instability
  - Acute kidney injury
  - New neurological deficit
- Ventilator Bundle/weaning protocol

MD Pulmonary review & assessment prior to extubation if any of the above criteria met

Post Extubation Mngt

Oxygen Therapy

- O2 as needed to keep SaO2 >93%

Incentive Spirometer

- Perform Q1 x 12 hours until ambulation
- Perform Q4 w/a after 12 hours
- If IS < 10 ml/kg IBW, then add EZPAP or IPPB

Home CPAP for OSA

NIPPV for increased risk due to decreased LVEF or lung disease

Early mobilization

Continue pre-op respiratory medications post-extubation unless contraindicated

** some may need to be changed to nebulized therapy using RT driven protocols and In-check device

Respiratory Therapist:

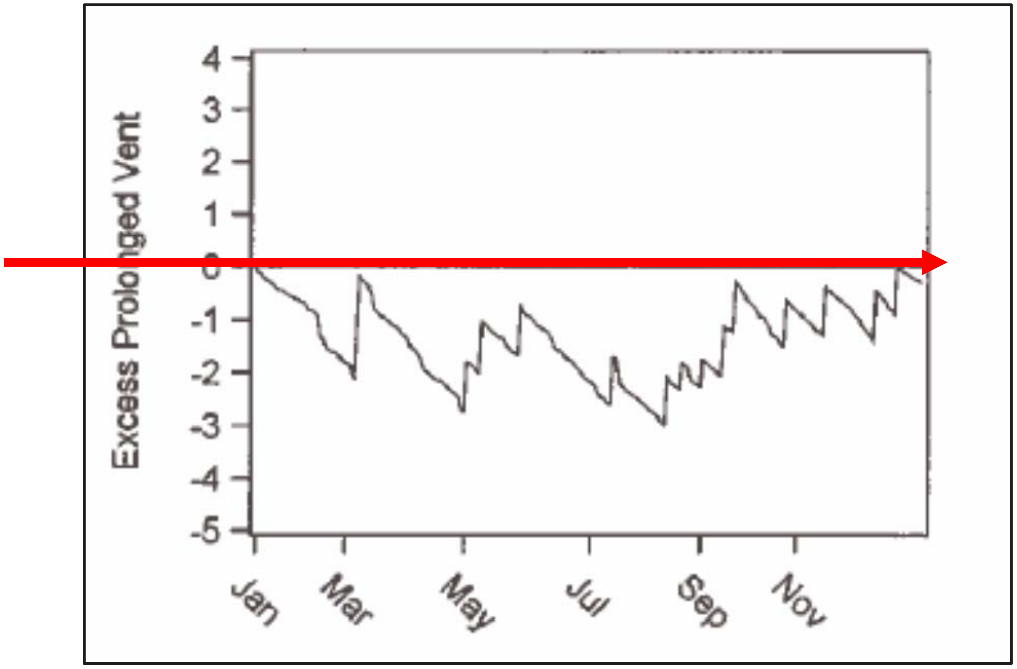
Perform patient assessment 2 – 4 hours post extubation to determine need for and frequency of treatments.

Therapep
CPT
HHN/MDI

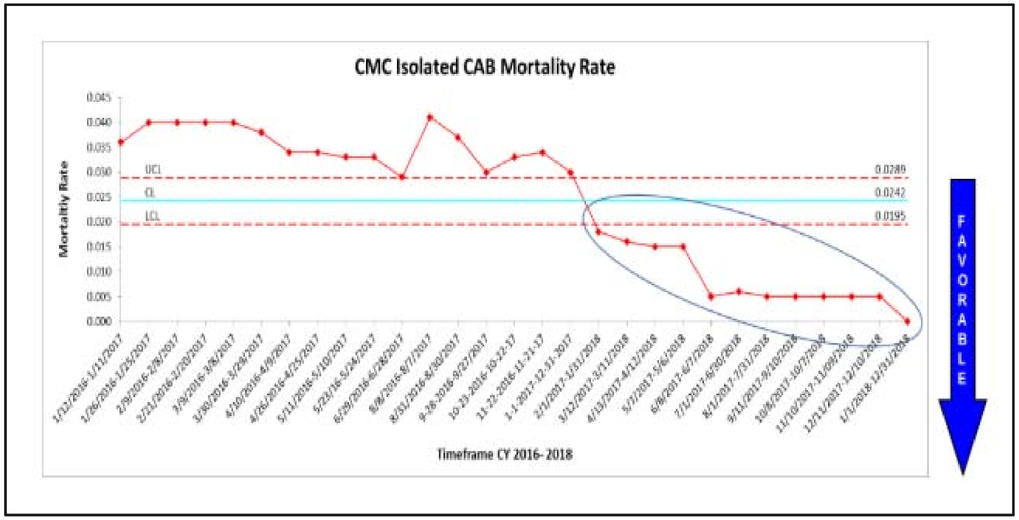
- Phase of Care Risk Mitigation
- Prolonged Ventilation
- ICU

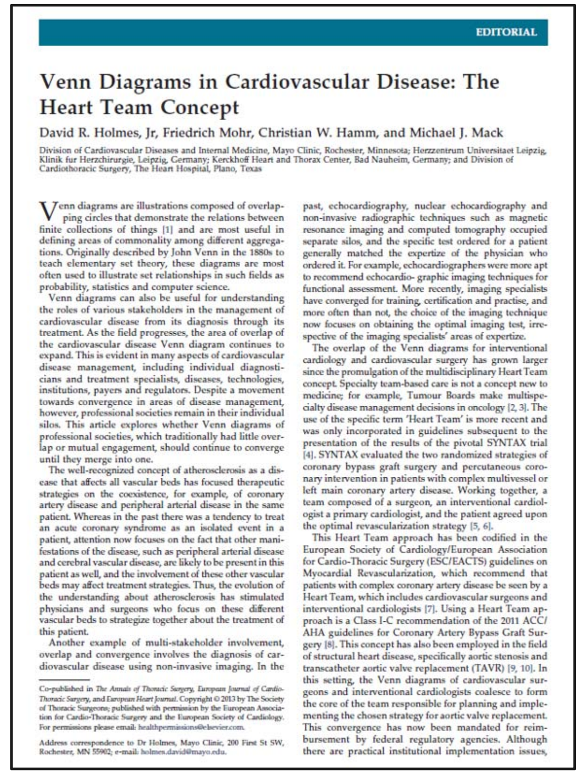
Prolonged Ventilation after Cardiac Surgery

- CUSUM 2015



Heart Team





EDITORIAL

Venn Diagrams in Cardiovascular Disease: The Heart Team Concept

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Division of Cardiovascular Diseases and Internal Medicine, Mayo Clinic, Rochester, Minnesota; Herzzentrum Universitaet Leipzig, Klinik fur Herzchirurgie, Leipzig, Germany; Kerckhoff Heart and Thorax Center, Bad Nauheim, Germany; and Division of Cardiothoracic Surgery, The Heart Hospital, Plano, Texas

Venn diagrams are illustrations composed of overlapping circles that demonstrate the relations between finite collections of things [1] and are most useful in defining areas of commonality among different aggregations. Originally described by John Venn in the 1880s to teach elementary set theory, these diagrams are most often used to illustrate set relationships in such fields as probability, statistics and computer science.

Venn diagrams can also be useful for understanding the roles of various stakeholders in the management of cardiovascular disease from its diagnosis through its treatment. As the field progresses, the area of overlap of the cardiovascular disease Venn diagram continues to expand. This is evident in many aspects of cardiovascular disease management, including individual diagnosticians and treatment specialists, diseases, technologies, institutions, payers and regulators. Despite a movement towards convergence in areas of disease management, however, professional societies remain in their individual silos. This article explores whether Venn diagrams of professional societies, which traditionally had little overlap or mutual engagement, should continue to converge until they merge into one.

The well-recognized concept of atherosclerosis as a disease that affects all vascular beds has focused therapeutic strategies on the coexistence, for example, of coronary artery disease and peripheral arterial disease in the same patient. Whereas in the past there was a tendency to treat an acute coronary syndrome as an isolated event in a patient, attention now focuses on the fact that other manifestations of the disease, such as peripheral arterial disease and cerebral vascular disease, are likely to be present in this patient as well, and the involvement of these other vascular beds may affect treatment strategies. Thus, the evolution of the understanding about atherosclerosis has stimulated physicians and surgeons who focus on these different vascular beds to strategize together about the treatment of this patient.

Another example of multi-stakeholder involvement, overlap and convergence involves the diagnosis of cardiovascular disease using non-invasive imaging. In the past, echocardiography, nuclear echocardiography and non-invasive radiographic techniques such as magnetic resonance imaging and computed tomography occupied separate silos, and the specific test ordered for a patient generally matched the expertize of the physician who ordered it. For example, echocardiographers were more apt to recommend echocardio- graphic imaging techniques for functional assessment. More recently, imaging specialists have converged for training, certification and practise, and more often than not, the choice of the imaging technique now focuses on obtaining the optimal imaging test, irrespective of the imaging specialists' areas of expertize.

The overlap of the Venn diagrams for interventional cardiology and cardiovascular surgery has grown larger since the promulgation of the multidisciplinary Heart Team concept. Specialty team-based care is not a concept new to medicine; for example, Tumour Boards make multispecialty disease management decisions in oncology [2, 3]. The use of the specific term 'Heart Team' is more recent and was only incorporated in guidelines subsequent to the presentation of the results of the pivotal SYNTAX trial [4]. SYNTAX evaluated the two randomized strategies of coronary bypass graft surgery and percutaneous coronary intervention in patients with complex multivessel or left main coronary artery disease. Working together, a team composed of a surgeon, an interventional cardiologist a primary cardiologist, and the patient agreed upon the optimal revascularization strategy [5, 6].

This Heart Team approach has been codified in the European Society of Cardiology/European Association for Cardio-Thoracic Surgery (ESC/EACTS) guidelines on Myocardial Revascularization, which recommend that patients with complex coronary artery disease be seen by a Heart Team, which includes cardiovascular surgeons and interventional cardiologists [7]. Using a Heart Team approach is a Class I-C recommendation of the 2011 ACC/AHA guidelines for Coronary Artery Bypass Graft Surgery [8]. This concept has also been employed in the field of structural heart disease, specifically aortic stenosis and transcatheter aortic valve replacement (TAVR) [9, 10]. In this setting, the Venn diagrams of cardiovascular surgeons and interventional cardiologists coalesce to form the core of the team responsible for planning and implementing the chosen strategy for aortic valve replacement. This convergence has now been mandated for reimbursement by federal regulatory agencies. Although there are practical institutional implementation issues,

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Heart Team


OUTCOMES ANALYSIS, QUALITY IMPROVEMENT, AND PATIENT SAFETY

Investigating the Causes of Adverse Events

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> If I had an hour to solve a problem and my life depended on the solution, I would spend the first 55 minutes determining the proper question to ask, for once I know the proper question, I could solve the problem in less than five minutes.—attributed to Albert Einstein

Despite remarkable advances in surgical care, unintentional harm and suboptimal outcomes persist in the health care environment [1–7]. Many serious events are not attributable to the natural course of the patient's underlying condition or illness but, rather, to system and process failures, many of which share common characteristics. Organizational learning and continuous improvements resulting from the thoughtful and systematic analysis of such events are of vital importance in preventing their recurrence and keeping in patients safe.

Organizations and their cardiothoracic surgical teams must determine the causes of errors and develop solutions that address the inherent systems problems that lie at the root of these events. When they occur, however, the causes are not readily apparent to front-line staff because of the affective and cognitive distortions these failures engender as well as the complexity of the environment. Several analytic tools and methods are available for this purpose that have been widely used in other industries to learn from mistakes and mitigate identifiable hazards [8]. Many health care systems and regulatory agencies have embraced these methods to complement other strategies aimed at reducing events that can be "reasonably prevented" [9]. The Joint Commission (TJC), for example, maintains that meaningful improvements in patient safety are dependent on each organization's ability to identify errors and analyze their contributing factors to prevent similar errors from occurring again at the same institution [10]. Furthermore, the information learned about error frequency, type, and root causes support continuous improvement efforts as organizations redesign systems of care to improve outcomes and enhance patient safety. The purpose of this paper is to highlight the utility of event investigation and analysis to identify the causes and prevent the occurrence of adverse events.

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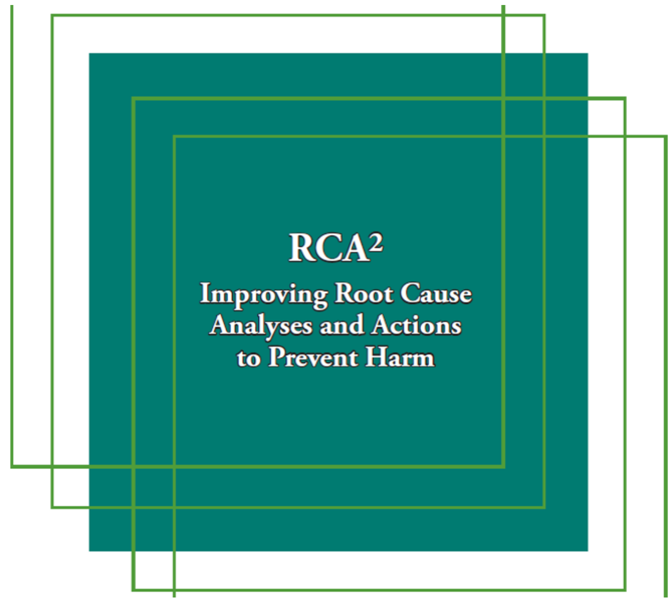
Identifying Causal Factors

The conceptual model for evaluating the quality of medical care, proposed by Donabedian in 1966, contains three components of medical care from which to derive information regarding quality: structure, process, and outcomes [11]. The structure of care involves the settings and context of medical care delivery. Individual processes of care—the actions and activities of delivering medical care—can be examined and compared with best known standards of practice. The processes that can readily be examined, however, are not always those that have the most direct impact on outcomes. For example, the timing of preoperative antibiotic administration can more easily be measured than the performance of a surgeon. Although many other factors (antecedent conditions), such as a patient's comorbidities, influence the result of health care, it is ultimately the outcomes that are the most important indicators of quality [9]. In this framework, undesirable outcomes are a consequence of defects in either the structure (ie, system design) or the incorrect application of processes. The root causes of poor quality can be found by exploring the gap between optimal and suboptimal results. This gap is the object of root cause analysis (RCA) methods.

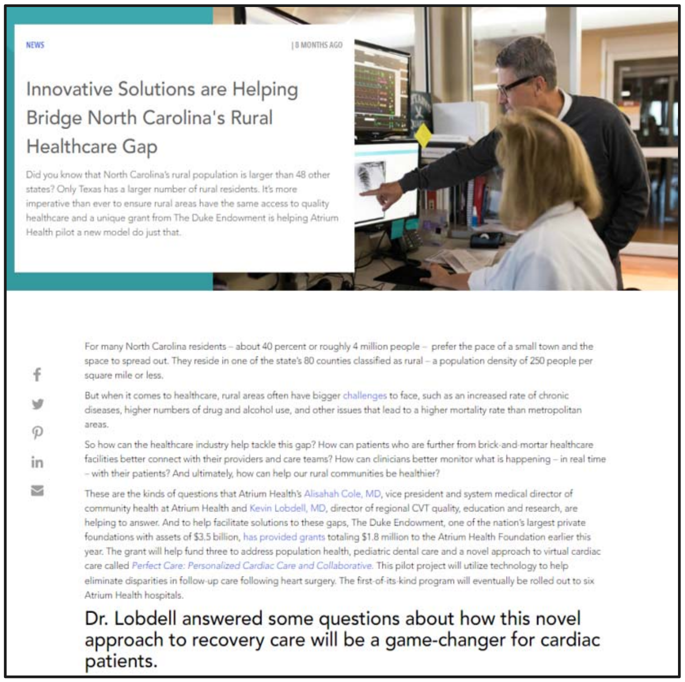
Individual behavior is influenced by an organization's structure, set of processes, and values [12]. Understanding human performance is critical to identifying causal factors. Error-prone conditions are usually predictable and preventable. Errors, accidents, and adverse events can only be avoided by understanding the reasons they occur and by applying lessons learned from similar past events. Unfortunately and too often, human error is the conclusion of a poorly performed accident investigation. Errors are usually a symptom of deeper (systemic or "latent") conditions. To understand the basic, root causes of events, human error must be the starting point rather than the end of an investigation to truly understand causation, systemic hazards, and gaps in organizational performance.

Organizational learning in health care is a necessary characteristic for teams to improve [13]. An organization must be skilled at extracting "learning," not only from major errors, but from all available growth opportunities such as minor events, real or perceived safety risks, near misses, and precursor events. For learning to occur, however, organizations must also be able to systematically aggregate and widely disseminate the results of all its problem-solving activities. Because most adverse



*RCA2 is a trademark of the Institute for Healthcare Improvement

Perfect Care



NEWS | 8 MONTHS AGO

Innovative Solutions are Helping Bridge North Carolina's Rural Healthcare Gap

Did you know that North Carolina's rural population is larger than 48 other states? Only Texas has a larger number of rural residents. It's more imperative than ever to ensure rural areas have the same access to quality healthcare and a unique grant from The Duke Endowment is helping Atrium Health pilot a new model do just that.

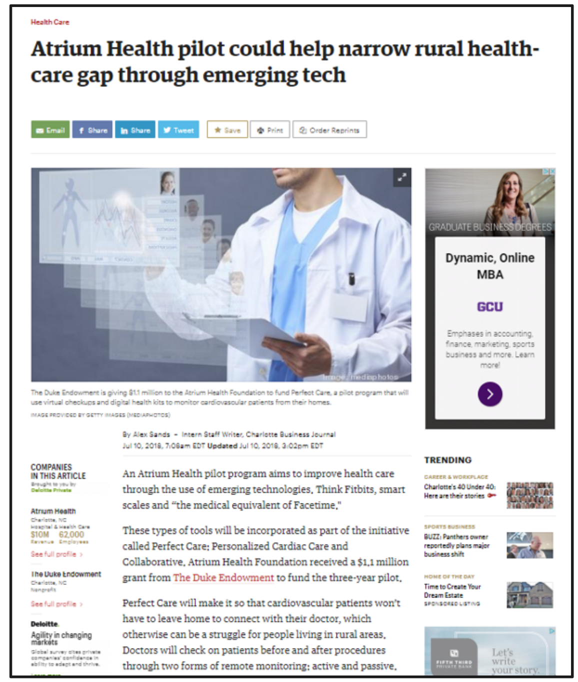
For many North Carolina residents – about 40 percent or roughly 4 million people – prefer the pace of a small town and the space to spread out. They reside in one of the state's 80 counties classified as rural – a population density of 250 people per square mile or less.

But when it comes to healthcare, rural areas often have bigger challenges to face, such as an increased rate of chronic diseases, higher numbers of drug and alcohol use, and other issues that lead to a higher mortality rate than metropolitan areas.

So how can the healthcare industry help tackle this gap? How can patients who are further from brick-and-mortar healthcare facilities better connect with their providers and care teams? How can clinicians better monitor what is happening – in real time – with their patients? And ultimately, how can help our rural communities be healthier?

These are the kinds of questions that Atrium Health's Alisahah Cole, MD, vice president and system medical director of community health at Atrium Health and Kevin Lobdell, MD, director of regional CVT quality, education and research, are helping to answer. And to help facilitate solutions to these gaps, The Duke Endowment, one of the nation's largest private foundations with assets of $3.5 billion, has provided grants totaling $1.8 million to the Atrium Health Foundation earlier this year. The grant will help fund three to address population health, pediatric dental care and a novel approach to virtual cardiac care called *Perfect Care: Personalized Cardiac Care and Collaborative*. This pilot project will utilize technology to help eliminate disparities in follow-up care following heart surgery. The first-of-its-kind program will eventually be rolled out to six Atrium Health hospitals.

Dr. Lobdell answered some questions about how this novel approach to recovery care will be a game-changer for cardiac patients.



Health Care

Atrium Health pilot could help narrow rural health-care gap through emerging tech

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The Duke Endowment is giving $1.1 million to the Atrium Health Foundation to fund Perfect Care, a pilot program that will use virtual checkups and digital health kits to monitor cardiovascular patients from their homes.

IMAGE PROVIDED BY GETTY IMAGES (MEDIAPHOTOS)

By Alex Sands – Intern Staff Writer, Charlotte Business Journal
Jul 10, 2018, 7:08am EDT **Updated** Jul 10, 2018, 3:02pm EDT

An Atrium Health pilot program aims to improve health care through the use of emerging technologies. Think Fitbits, smart scales and "the medical equivalent of Facetime."

These types of tools will be incorporated as part of the initiative called Perfect Care: Personalized Cardiac Care and Collaborative. Atrium Health Foundation received a $1.1 million grant from The Duke Endowment to fund the three-year pilot.

Perfect Care will make it so that cardiovascular patients won't have to leave home to connect with their doctor, which otherwise can be a struggle for people living in rural areas. Doctors will check on patients before and after procedures through two forms of remote monitoring: active and passive.

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Atrium Health
Charlotte, NC
Hospital & Health Care
$10M Revenue | 62,000 Employees
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The Duke Endowment
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TRENDING

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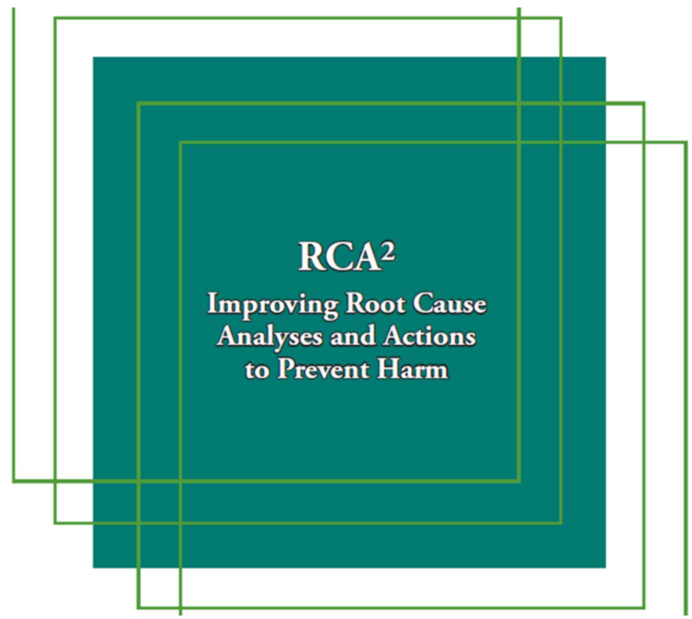
POCA Summary

- Proactive - learning system
- Interactive - heart team
- Precise - quantify risk & mitigate risk
- Expert - all phases of care
- Continuity – 24/7/365
- Scalable - system
- Synergy - multiplicative



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Summary

POCMA Summary – Part 1

- POCMA is a reproducible and intuitive template for determining the root cause of adverse clinical outcomes
- As a template, POCMA is efficient in identifying common causes of surgical mortality and encourages collaborative quality improvement projects among all levels of the CV surgery system
- Seminal events (death triggers) can be modified as evidence-based treatments and our understanding of proper sequences of care evolve

POCMA Summary – Part 2

- The determination of avoidable mortalities or complications is a collaborative analytic process that is best conducted within the context of care
- POCMA concept has been cited and used in large scale quality improvement programs with good results
- Comparison of TAVR vs SAVR POCMA profiles gives insight into the system requirements and challenges of each procedure

Questions

Please direct questions, comments and feedback to Sydney Clinton, Senior Coordinator, STS Quality Metrics & Initiatives, at sclinton@sts.org

Thank you for viewing the STS Quality Webinar on

Phase of Care Mortality Analysis (POCMA)

Please note that webinar slides and other materials are posted on the STS website