Quality Improvement: Practical Pointers and Pitfalls

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University of Pittsburgh
Medical Director
City of Pittsburgh, Department of Public Safety
About me....

- EMT in 1977
- Attending Physician UPMC Presby ED
- Medical Director City of Pittsburgh DPS
- Medical Director of Allegheny Co. 911
- APD EMS Fellowship
- Team Physician Pittsburgh Steelers
- EM Consultant for Pittsburgh Penguins
Lecture Summary

- Understand Barriers
- Initiating a QI Program
- Audits / Pt Care Bundles
- Potential Pitfalls
- Begin with the End in Mind
Quality Improvement

QA - Retrospective
QI - Prospective/Retrospective
CQI - Everything, all the time
Quality Improvement

“Many people say that we have the best EMS agency...”
EMS Quality Improvement

Challenges to initiating a Quality Improvement program

Lack of:
- Interest
- Understanding
- Manpower

Fear of the unknown!
Why do QI?

Misplaced Endotracheal Tubes by Paramedics in an Urban Emergency Medical Services System
“Every error is a treasure!”

Every burden is a blessing.
Methods of initiating a QI program

Sell Job  DIY  Sneak it in
Quality Improvement Opportunities

- Training
- Ride-a-longs
- ED Feedback
Quality Improvement Opportunities

Complaints
- Rude behavior
- Questionable care
- Vehicle crash

Audits
- Intubation
- Chest pain
- Refusals

Triggers
- Use of CPAP
- CPR
- BP < 90

Anonymous reporting
Audits

• Audit categories
  – Structure
    • Response times
    • Equipment
    • Deployment
  – Process
    • Protocols
    • Med administration
    • Transport
  – Outcome
    • Pain control
    • Patient satisfaction
    • Survival
• Reviewer
  – Medical Director
  – QI interest group
  – Supervisor

Chest Pain
Age >35
No ASA given

AE = Adverse Event

Patterson PEC 2014
Choosing Audits – Performance Indicators

• Low hanging fruit
  – Cardiac arrest/Intubations
  – Refusals
• Low volume high risk
• High volume difference makers
• Complaints
• Non Clinical

Don’t reinvent the wheel
Cardiac arrest audits

- Do-able
- High risk
- Procedures
- Measureable (ROSC, survival)
- “Recorded”
- Benchmark-able
  - CARES
- “Life Changing”
Where are the holes...?

- Bystander CPR
- Dispatch
- Pauses during CPR
- Policies/Procedures
- Equipment
- Post ROSC Care

Improving survival from cardiac arrest
Where are the holes...?

• Bystander CPR----------->Pulse Point, CPR training
• Dispatch
• Pauses during CPR------->Re-education, feedback
• Policies/Procedures
• Equipment
• Post ROSC Care-----------> New Protocol, Re-ed, feedback
CPR Time – Bad Example
No CPR >1 minute during intubation
Hyperventilation post intubation

Good ventilation ~ 12 / minute

Do not stop CPR. Patient is intubated

Hyperventilation at 36 breaths/ min
Arrest with EMS on scene
Arrest with EMS on scene
78 yo F w/ Hx CHF in severe resp distress

VS P130  R30  BP 90/p O₂ sat 78% RA rales thru out

• Placed on O₂ via FM ->O₂ sat 89%
• Reeves stretcher to ambulance
• Cardiac arrest in ambulance
• Scoop and run mentality
• Poor working conditions
• Comfort working in ambulance
• Scene safety/bystanders
Pittsburgh EMS Crashing Patient Algorithm

General Impression of a Patient in Extremis
Airway Issues
Significant Respiratory Distress
Signs of Shock

Place NPIOP Airway as Indicated/Tolerated

Respiratory Status

OK or Respiratory Distress
- Poor Trial Volumes
- Unable to Speak
- Loss of Muscle Tone
- Unable to Sit Up
- SaO2 < 90% despite O2
- Altered Mental Status
- Pj < 90

High Flow O2 or CPAP +/- Albuterol

Trial of Assisted Ventilation
PPV via BVM

No Improvement
Improves

Circulatory Status
SBP < 90

Endotracheal Intubation
CPAP +/- Albuterol

EKG: Tachycardia or Bradycardia

Electrical Therapy

Immediate IV/IO Access
500cc NSS Pressure Infused
Check Glucose
Check Lactate
Reassess ABCs/Vitals

Access Appropriate Protocol
Maximal Medical Therapy

Consult Command MD

CRASHING PATIENT/PATIENT IN EXTREMIS – ADULT
STATEWIDE ALS PROTOCOL

General Impression of Patient in Extremis
New Order: O2CO2 (as follows commands): motor GCS <5
Airway Issues
Significant Respiratory Distress
Signs of Shock

DO NOT INITIATE MOVEMENT OF PATIENT
Consider Calling for Backup Unit
Place NPIOP Airway as indicated/tolerated
Apply Monitors: ECG, SpO2, BP, & ETCO2 (if available)

OK or Respiratory Distress
Assess Respiratory Status
Intervene ASAP

Respiratory Status

High-flow Oxygen by NRS

CR
CPAP +/- Albuterol

No Improvement
Improves to adequate effort

Secure Airway

BP < 90

Suspected Dysrhythmia

Immediate IV/IO Access
Obtain in < 10 min from patient contact

Shock

BP < 90

NO

YES

Cardiover or Pacing per Tachycardia
Bradycardia Protocols

Immediate 12x12 BVM

Pulse, 2 thumbs up, sit or elevate head of bed, high-flow 100% oxygen
PEEP valve at 15 cm. (if available)

Obtain in < 30 min from patient contact

Secure Airway

BP < 90

YES

Cardiover or Pacing per Tachycardia
Bradycardia Protocols

Immediate 12x12 BVM

Pulse, 2 thumbs up, sit or elevate head of bed, high-flow 100% oxygen
PEEP valve at 15 cm. (if available)

Obtain in < 30 min from patient contact

Secure Airway

BP < 90

NO

OK to Initiate Patient Extrication/Transport (now)

Maximize Therapy per Protocol

Effective 05/01/19
Impact of the Implementation of a Critically Ill Patient Bundle of Care on the Performance of Key Medical Intervention for Respiratory Distress Patients in the Field

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1City of Pittsburgh Bureau of Emergency Medical Services, Pittsburgh, PA
2University of Pittsburgh School of Medicine, Department of Emergency Medicine, Pittsburgh, PA

INTRODUCTION
- Bundles of care have been advocated as a process-based system to improve patient care and outcomes using evidence-based guidelines.
- In hospital care bundles have been developed for critical care conditions such as Sepsis.
- Prehospital data shows better patient outcomes when critical ALS interventions are accomplished in the field (1).

Objective: To assess the effectiveness of the implementation of a Prehospital "Crashing Patient" Critical intervention Bundle of Care on the performance of key prehospital interventions for patients presenting with respiratory distress.

Hypothesis: The implementation of a Prehospital "Crashing Patient" Critical Care Bundle would improve execution of core ALS interventions for patients presenting with respiratory distress and decrease the incidence of post EMS contact cardiac arrest for these patients.

METHODS
- Urban all ALS municipal (third service) EMS system.
- 63,000+ responses per year
- Crashing Patients Program fully implemented in 2014 with a variety of ongoing educational methods.
- Retrospective review of electronic PRs (EMS Charts *) coded as "Respiratory Distress" from July 2014 – June 2017.
- Core interventions measured for all cases. For patients receiving an Albuterol* or Atrovent*, administration of Solu-Medrol*, Magnesium & 1:1000 Epinephrine were measured.

Disclosures
None

TABLES & RESULTS

Graph 1: Core interventions for Bronchospasm
3rd Quarter 2014 – 2nd Quarter 2017

Graph 2: Percentage of Respiratory Distress Patients Treated with CPAP

Graph 3: Post EMS Contact Cardiac Arrest Cases (% of Total Arrests)

Significant increases in all core performance measures for bronchospasm
- Significant increase in the use of CPAP over time; from every 22nd patient to every 9th.
- Decrease in the overall incidence of post EMS Contact Cardiac Arrest over time and compared to the incidence reported in CARES, however this was not statistically significant (2).

REFERENCES

CONCLUSIONS
- Implementation of a Prehospital Critical Care “Crashing Patient” Care Bundle resulted in:
  - Significant increases in application of EKG & ETCO2 monitoring.
  - Significant increase in obtaining IV access.
  - Significant increase in use of CPAP.
  - Significant increases in is administration of Solu-Medrol*, Magnesium & 1:1000 to patients in bronchospasm.
  - A reduction in the incidence of post EMS contact cardiac arrest; however this was non-significant.

Critical Care Patient Care Bundles may have significant utility to improve patient care and safety in the prehospital setting.

LIMITATIONS
- Retrospective data review that did not take into account the initial severity of patient presentation.
- No data on impact on patient outcome outside of incidence of post-EMS contact cardiac arrest.

FUTURE DIRECTIONS
- Data analysis based on severity of initial patient presentation.
- Effects of interventions on specific patient outcome parameters.
Peer review

• Oncoming crew reviews previous shift
• QI interest group

“That dude never documents 2 sets of vital signs on his trip sheets!”
Peer Review-Identifying Adverse Events

AE identified
- Sr MDS 13
- MC MDs 18
- RN/Medic 36
I ♥ Hawthorne Effect!

• Alteration of behavior by the subjects of a study due to their awareness of being observed.
• For EMS- May require a perceived demand for performance.

QI built into protocols

Performance Parameters:

A. All patients should either receive aspirin or the PCR should include documentation of why aspirin was contraindicated.

B. Review for appropriate transmission of 12-lead ECG when possible. Review for appropriate diversion to facility capable of PCI and/or for appropriate notification of receiving facility when STEMI is identified.

C. Cardiac rhythm monitored and 12-lead ECGs done (when available) and rhythm strips/12-lead ECGs documented with graphs included in PCR.

D. Possible benchmark for on scene time of ≤ 20 minutes.

E. Vital signs documented after each use of vasoactive medication (e.g., nitroglycerin or narcotic analgesics).
Bundles of Joy

Pittsburgh EMS Post Cardiac Arrest Bundle Audit

Key Post Arrest Interventions:

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Performed</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airway Secured</td>
<td>YES</td>
<td>ETI SX1</td>
</tr>
<tr>
<td>2 EtCO2 readings</td>
<td>YES</td>
<td>60 &amp; 60 mm/hg</td>
</tr>
<tr>
<td>documented</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Blood Pressures</td>
<td>YES</td>
<td>190 &amp; 180/5YS</td>
</tr>
<tr>
<td>documented</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluid Bolus</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Epinephrine Drip</td>
<td>N/A</td>
<td>Lowest SBP 180</td>
</tr>
<tr>
<td>Glucose</td>
<td>YES</td>
<td>99 mg/dl</td>
</tr>
</tbody>
</table>

Patient outcome: Pulsing from Mercy

Comments: 31 y/o male possible OD, arrested on you 4 minutes after arrival with a PEA rhythm. Great job with the resuscitation of this patient. Post arrest good job with screening the 12 Lead EKG & checking the glucose. Epinephrine Drip was not required at these SBP’s. Remember to give & document a 500cc NSS bolus fluid given during the arrest counts towards this. Also check a blood glucose. Thanks!

Our new metric this year is goal of 80% of post arrest patients getting a Epinephrine Drip administered and a 12 Lead EKG screened.

==CONFIDENTIAL PEER REVIEW DOCUMENT==

Pittsburgh EMS “Crashing Patient” Audit

Date: 2016

Unit: M-1

Patient contact to arrest: 23 minutes
Moved prior to arrest: YES

Interventions prior to arrest:

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Performed</th>
<th>Comment</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Monitoring</td>
<td>YES</td>
<td>SBP</td>
<td>0 (5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P02</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>POG</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ECO2</td>
<td>9 (5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ECO2</td>
<td>Yes - malfunction 11 (5)</td>
</tr>
<tr>
<td>Airway Managed</td>
<td>YES</td>
<td>No Airway</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N/ A</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>King</td>
<td>N/ A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ETI</td>
<td>5x1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18 (20)</td>
<td></td>
</tr>
<tr>
<td>Respiratory Managed</td>
<td>YES</td>
<td>O2</td>
<td>6 (5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CPAP</td>
<td>N/ A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PPV/BVM</td>
<td>N/ A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Meds</td>
<td>N/ A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pacing</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 (20)</td>
<td></td>
</tr>
<tr>
<td>Arrhythmia Managed</td>
<td>YES</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>N/ A</td>
<td></td>
</tr>
<tr>
<td>Vascular Access</td>
<td>YES</td>
<td>IV</td>
<td>No</td>
</tr>
<tr>
<td>Shock Management</td>
<td></td>
<td>IO</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fluids</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14 (10)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pressors</td>
<td>No</td>
</tr>
<tr>
<td>Medical Therapy</td>
<td>N/A</td>
<td>No Glucose check documented</td>
<td></td>
</tr>
</tbody>
</table>

Thanks
Patient Care Coordinator Pinchak
Procedures

<table>
<thead>
<tr>
<th>IV Attempt/ Patients</th>
<th>Total 12 LD Cases</th>
<th>12-Lead/ Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>18%</td>
<td>56</td>
<td>8%</td>
</tr>
<tr>
<td>13%</td>
<td>23</td>
<td>5%</td>
</tr>
<tr>
<td>17%</td>
<td>85</td>
<td>9%</td>
</tr>
<tr>
<td>2%</td>
<td>7</td>
<td>1%</td>
</tr>
</tbody>
</table>
Find a champion

COMPARISON OF TIMES TO INTUBATE A SIMULATED TRAUMA PATIENT IN TWO POSITIONS

Mark Pinchalk, BS, EMT-P, Ronald N. Roth, MD, Paul M. Paris, MD,
David Hostler, PhD, NREMT-P
Initiative Objectives

- Develop a core list of measures with specific definitions for EMS to improve quality.
- Use evidence-based recommendations and best practice data as the foundation of the development process.
- Engage local, state and national stakeholders throughout the development and testing process.
- Design a system to support continuous updating and expanding the performance measures dictionary going forward.
- Utilize data elements from the National Emergency Medical Services Information System (NEMSIS) whenever possible.
NEMSQA will develop and endorse evidence-based quality measures for EMS and healthcare partners that improve the experience and outcomes of patients and care.
### Table 2: Comparison of EMS clinical performance indicators.

<table>
<thead>
<tr>
<th>Clinical condition</th>
<th>ST Elevation Myocardial infarction (STEMI)</th>
<th>Pulmonary Edema</th>
<th>Asthma</th>
<th>Seizure</th>
<th>Trauma</th>
<th>Cardiac arrest</th>
</tr>
</thead>
</table>
| Indicators or bundle elements | (1) Aspirin  
(2) 12 lead Electrocardiograph (ECG)  
(3) Direct transport to percutaneous cardiac intervention (PCI) interval from ECG to balloon <90 minutes | (1) Nitroglycerin  
(2) Noninvasive positive pressure ventilation | (1) β₂ agonist administration  
(2) Administration of a benzodiazepine | (1) Blood Sugar measurement  
(2) Direct transport to trauma for patients meeting criteria | (1) Entrapment time <10 minutes  
(2) Direct transport to trauma for patients meeting criteria | (1) Response interval <5 min for basic CPR and Automated external defibrillators (AEDs) |
| Outcome | NNT = 15  
Harm avoided: A stroke, 2nd myocardial infarction, or death | NNT = 6  
Harm avoided: need for an endotracheal intubation | Not Specified | NNT = 4  
Harm avoided: persistent seizure activity | NNT = 3 or 11  
depending on criteria used | Harm avoided: one death | NNT = 8  
Harm avoided: one death |

- Sayed M. Emergency Medicine International 2012,
Based on my clinical experience......

“Without data you’re just another person with an opinion.”

- W. Edwards Deming, Data Scientist
Potential Pitfalls
EMS patient care records....

The classic major genres of PCR are:

- Fiction.
- Comedy.
- Drama.
- Horror.
- Non-fiction.
- Realistic fiction.
- Romance novel.
- Satire.

We responded on a cold, dark, and stormy night....
Chasing blips on the radar

- Variation
  – Common cause vs special cause
- Effect Size/Sample size
- Negative feedback
- Human factors
- Irrelevant measures

Placement of cappuccino machine in Medic Room
ACME EMS QI Committee

Acme EMS Intubation Success

- 30% improvement after training
- Therefore we should be allowed to do RSI!
- We are the best in the region...
ACME EMS QI Committee

Acme EMS Intubation Success Rates

<table>
<thead>
<tr>
<th>Intubation Success</th>
<th>1 of 2</th>
<th>0 of 2</th>
<th>4 of 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Pass Success</td>
<td>1 of 5</td>
<td>0 of 2</td>
<td>4 of 5</td>
</tr>
</tbody>
</table>

July | August
“Improved intubation success rate with RSI”

“After initiating RSI our intubation success rate is nearly 100%”

It may take us 6 or 7 tries but we get the tube in!”
Human Error

How to remove human error

- Focusing solely on human error makes errors go underground
- Slips and laps will occur and systems must be able to mitigate these

Get rid of humans
Begin with the end in mind

- Covey

• We get ROSC 50% of the time........
Hi Dr. Roth,
I am the guy that died at last year’s Great Race!

9/28/2019
Missing pieces

Pre-Hospital

Hospital
Crew administers Bicarb instead of D50

Look for system issues, policies procedures
WTF Moments in QI

Crew administers Bicarb instead of D50

Look for system issues, policies procedures

Crew administers 12mg of naloxone to an unresponsive patient with pinpoint pupils

Re-education
WTF Moments in QI

Crew administers Bicarb instead of D50

Look for system issues, policies procedures

Crew administers 12mg naloxone to an unresponsive patient with pinpoint pupils

Re-education

Crew fails to take stretcher/equipment into a high-rise because most of the calls are BS.

Discipline
Just Culture

• Shared responsibility
  – Systems are accountable
  – Individuals are accountable

Human Error
• Memory lapse
• Mistake

At-risk-behavior
• Behavioral choice
• Failure to recognize risk

Reckless behavior
• Conscious disregard
• Unjustifiable risk
You are being audited!

Requests

• Response times
• Overtime expenses

How might you re-direct his audit?
“If you know one EMS agency... you know one EMS agency”
-Roth 1985
One last thing...

- If it’s good enough to change your practice you should publish it!
Summary

• **Limited resources QI program**
  – Understand barriers
  – 3 ways to initiate QI program
  – Leverage “Peer review”
  – Performance Measures
  – Patient care bundles
  – EMS Compass /NEMSQA

• **Sophisticated program**
  – Accuracy of PCRs
  – Begin with the end in mind
  – Lack of hospital data
  – Reviewers may vary
Thank You

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