



**Post-trauma emergent
Interventional Radiology: A
failure modes and effects
analysis**

Todd Nickoles, MBA, BSN, RN, TCRN
Teresa Capriotti, MHA-SM, BSN, RN, CVRN, NEA-BC
Jill Jensen, MSN, RN, HACP, CPPS
Sudhen B Desai, MD, FSIR

1

2

Disclosures

Consultant for Arcos, Inc.

There was no external funding

2



Phoenix Children's
Center for Trauma Care

LET US NEVER SPEAK OF THIS AGAIN

3

Background

- Some patients may benefit from IR embolization
- Infrequent event, high mortality potential
- Many process steps
- ACS (old) requirement for 30 min to needle



Aim

- Identify and refine process steps
- Improve patient care through timely intervention
- Meet ACS requirement without onerous requirements for call

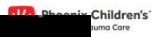
4

How it all began...

- 9y M, MVC, rear restrained lap belt passenger, 30 inches of intrusion and all airbags deployed, death of 10yo brother.
- EMS unbuckled patient, no known LOC, combative and anxious en route, Level 2 activation, arrived at trauma bay screaming
- HR 110-130, BP 110/60, RR 30
- CT Head – R orbit, maxillary fractures; middle cranial fossa hematoma; retroclival hematoma
- New bloody emesis
- CT A/P...



5



6



7

Related challenges

- Initially a Level 2 activation, not upgraded
- Anesthesia busy with Level 1
- Delay of >60 min to intervention
- Patient to IR without support

8

Failure Modes and Effects Analysis (FMEA)

- Endorsed by ASQ, IHI, HRO, etc.
- 1940s US Military
- Processes, products, design
- Essential components:
 - Steps in the process
 - Failure modes (What could go wrong?)
 - Failure causes (Why would the failure happen?)
 - Failure effects (What would be the consequences of each failure?)

Step	Failure mode	Failure effects	Severity	Occurrence	Detectability	RPN	Control	Responsible	Priority	Responsible	Priority
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											

DFT = Defects
FMEA = Failure Mode and Effects Analysis
RPN = Risk Priority Number

9

FMEA Steps

1. Identified key stakeholders
2. "Current state" process map was developed
3. Failure modes for each step
4. Scoring
 - Severity
 - Frequency
 - Likelihood
5. Risk Priority Number (RPN) calculated
6. RPN >100 prioritized for intervention
7. Validation- simulation, live scenario

Frequency/Occurrence Scale

Likelihood	Probability
• Remote (1)	1 in 10,000
• Low (2,3,4)	1 in 5,000
• Moderate (5,6)	1 in 200
• High (7,8)	1 in 100
• Very High (9, 10)	1 in 20

Detection Scale

Likelihood	Probability
• Very high (1)	9 out of 10
• High (2,3)	7 out of 10
• Moderate (4,5,6)	5 out of 10
• Low (7,8)	2 out of 10
• Remote (9, 10)	0 out of 10

Severity Scale

Outcome possibilities	Probability Score
• Slight annoyance	(1)
• May affect system	(2,3)
• Moderate system problem	(4,5)
• May affect the patient	(6)
• Major system problem	(7,8)
• May affect the patient	(9,10)
• Minor injury	(1)
• Major injury	(7)
• Terminal injury or death	(8,9)

10

Failure Mode	Description	Current system	Det	Occ	Sev	RPN	% Fail	Actions/Recommendations
1.1.1.1.1	Failure to identify key stakeholders	Failure to identify key stakeholders	1	1	1	1	1%	
1.1.1.1.2	Failure to develop "current state" process map	Failure to develop "current state" process map	1	1	1	1	1%	
1.1.1.1.3	Failure to identify failure modes for each step	Failure to identify failure modes for each step	1	1	1	1	1%	
1.1.1.1.4	Failure to score severity, frequency, and likelihood	Failure to score severity, frequency, and likelihood	1	1	1	1	1%	
1.1.1.1.5	Failure to calculate Risk Priority Number (RPN)	Failure to calculate Risk Priority Number (RPN)	1	1	1	1	1%	
1.1.1.1.6	Failure to prioritize for intervention	Failure to prioritize for intervention	1	1	1	1	1%	
1.1.1.1.7	Failure to validate simulation, live scenario	Failure to validate simulation, live scenario	1	1	1	1	1%	

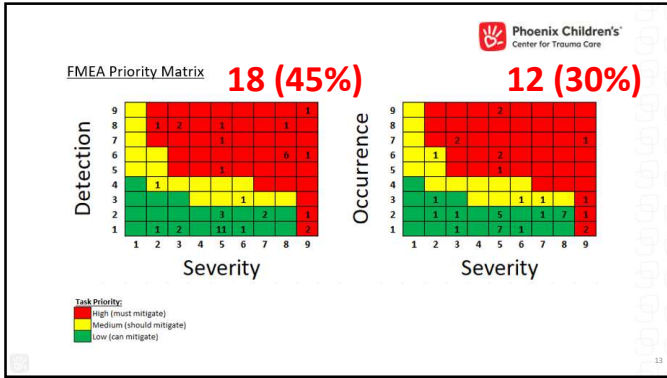
11

Measures

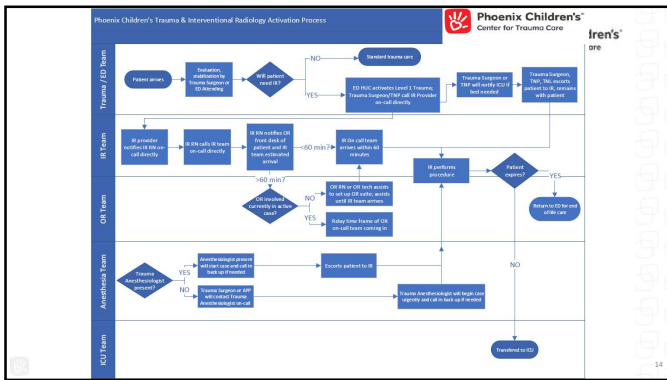
- 10 primary process steps
- 40 failure modes
- Factors:
 - Staff (28)
 - Communication (24)
 - Environment (13)
 - Patient (4)
 - Task (3)
 - Education/training (3)
 - Equipment (3)
- RPN range 3-240
- 6/40 (15%) met threshold of 100
- 35 (87.5%) resulted in mitigation strategies

Phoenix Children's Center for Trauma Core

12



13



14


Results & Validation

Phoenix Children's Center for Trauma Care

- Planned multidisciplinary simulation of emergent IR scenario
- Real patient with need for emergent IR for Grade V splenic injury

APPROVED

15



Phoenix Children's
Center for Trauma Care

Our 9 yo...

- Grade 5 shattered spleen
- Grade 3 liver laceration
- Grade 2 lung contusion
 - right middle lobe with tiny pneumothorax
- Right inferior orbital blowout fracture
- Right posterior maxillary fracture
- Extra axial hematoma in anterior right middle cranial fossa
- Retroclival hematoma
- ISS 45
- Discharged HD#9


16



Phoenix Children's

Thank you!

17



A standardized and integrated protected case review process at one year: What have we learned?

Todd Nickoles, MBA, BSN, RN, TCRN
Ben Padilla, MD, FACS
Dan Ostlie, MD, FACS

18

Background

- Division-level Protected Case Review (PCR) is critical component of hospital performance improvement (PI)
- Need to capture physician-reported events
- Facilitate expert review by division quality leads
- Identify and document Opportunities for Improvement (OFI), action plans, documentation
- Previous efforts have not met this requirement

Are you lonely?
Tired of working on your own?
Do you hate making decisions?
HOLD A MEETING!


You can –

- See people
- Show charts
- Feel important
- Point with a stick
- Eat donuts
- Impress your colleagues

All on company time!

MEETINGS


— THE PRACTICAL ALTERNATIVE TO WORK —



19

Specific Aim

- Develop a novel PCR event review system...
 - Maintains patient and provider confidentiality
 - Facilitates reliable PCR conference discussion, capture action plans
 - Includes stakeholders
 - Electronic with easy user interface
 - Cost effective
 - Improves capture of events and all subsequent PI activities



20



Intervention

Phase 1:

- Development and validation of system
- Single surgical division

Phase 2:

- One year (CY2022)
- Five additional surgical divisions
- Confidential
- Specific criteria
- Event review details
- Automated referral to additional division PCRs
- Provider comments on case

21

General Surgery PCR Case Presentation Form

Use this form to prepare a case for PCR presentation PRIOR to IDENTIFY CASE

Customers purchased by 42 U.S.C. § 20022 and A.S. § 36-401 and 36-402, et seq.

Submit presentation preparation form

Drop and drag files here or [browse files](#)

MIM-3*

Priority Event - Select one or two text*

Other events - Select one or two text*

Date of event*

Primary diagnosis*

Procedure performed*

Identifying hospital*

Case summary*

Other-Other Class

Date Submitted for PCR*

This submission entered by*

Send to PCR Quality Champion for review?

Send me a copy of my records

Submit

22

[EXTERNAL] General Surgery PCR Case Review Form - for quality lead review

This Message is From an External Source

Hi Todd,

The form is updated to be complete. Click to open the case review form for 12/2022

Open Response

Details

Site: OSDF

Relationship: General Surgery

Priority Event: Case of Critical-Issue requiring QIR

Other events: General Surgery

Date of event: 07/2022

Primary diagnosis: Trauma

Procedure performed: Cholecystomy

Region: North

Case summary: Case summary provided

Other-Other Class

Submitted by: todd.nichols@phoenixchildrens.com

Date Submitted for PCR: 08/2022

23

General Surgery PCR Case Review Form - for quality lead review

Click to open the case review form for 12/2022

MIM-3*

Identifying Hospital*

Priority Event*

Other events

Date of event*

Primary diagnosis*

Procedure performed*

Region*

Case summary*

Other-Other Class

Identifying Hospital*

Priority Event*

Other events*

Date of event*

Primary diagnosis*

Procedure performed*

Region*

Case summary*

Other-Other Class*

Submit

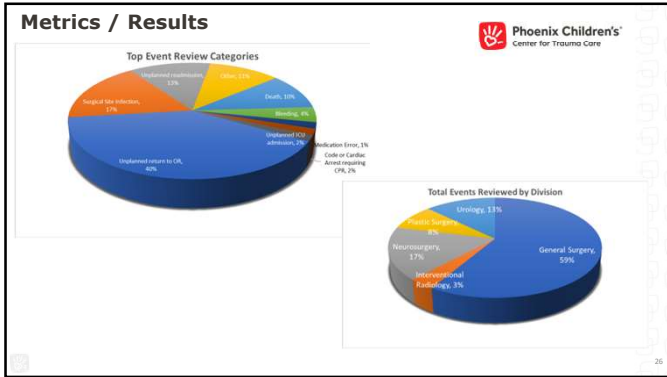
24

Phoenix Children's Center for Trauma Care

Global Surgery PDR Case Review Form

ID	Organization	Reviewer	Case ID	Case Title	Case Type	Review Date	Status	Case Summary	Case Details	Case Status
1	Phoenix Children's	Phonetic	100001	Brain Injury	Brain Injury	10/21/23	Open	Brain Injury	10/21/23	Open
2	Phoenix Children's	Phonetic	100002	Brain Injury	Brain Injury	10/21/23	Open	Brain Injury	10/21/23	Open

25



26

Results / Impact

- ✔ Effective at meeting key requirements
- 🏠 User satisfaction – ease of use, outcomes of case review
- 👩‍⚕️ Future improvements: Additional divisions, Additional automations, Integration into hospital quality systems

27

27