Resilience Engineering
Where does it fit in?

Ohio Association for Healthcare Quality
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Resilience Defined

Engineering – structure returning to baseline
Emergency response – speed that systems are restored
Business – back-up systems to operate through disaster
Ecology – ability to avoid irrevocable degradation
Psychology – capacity of individual to deal with trauma

The capacity of a system ... or person to maintain core purpose and integrity in the face of dramatically changed circumstance. Andrew Zolli

Bounces Back

re·sil·ience
n zil·i·ens:
noun
noun: resilience; plural noun: resilient
1 the ability of a substance or object to spring back into shape; elasticity.
"nylon is excellent in wearability and resilience"
2 the capacity to recover quickly from difficulties; toughness.
"the often remarkable resilience of so many British institutions"
Safety: Descriptive Theory

Rules & devices
Behavior-based safety
Safety Science
High Reliability Organizations

Railcar Couplers

Crew members had to go between moving cars during coupling – many were injured and some killed.
Links and pins were continually stolen and sold for scrap. Losses were high. White suggests that the railroads considered the losses to be more important than safety.

Triangle Shirtwaist Factory Fire

25 March 1911
- 146 garment worker deaths
- Management locked the doors
- Life safety codes
Steamboat Boilers

Act of 1838
Boiler explosions
Inspections of boilers
Testing of boilers
Steam safety valves
ASME B&PV Code

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Behavior-Based Safety

7 basic principles of BBS:
1. Intervention
2. Identification of internal factors
3. Motivation to behave in the desired manner
4. Focus on the positive consequences of appropriate behavior
5. Application of the scientific method
6. Integration of information
7. Planned interventions

Behavior-based Safety (BBS) was named by Dr Scott Geller of Safety Performance Solutions (SPS) in 1979.
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New Thinking

- Systems Thinking
  - All people are fallible and experience errors
  - System factors are the majority cause of error
  - Reliable outcomes can be obtained using the right mix of people and process.

- Bad Apple Theory
  - People who make mistakes are poor performers
  - System performance is assured by removing poor performers

The Swiss-Cheese Effect

**Multiple Barriers** - technology, processes, and people - designed to stop active errors (our “defense in depth”)

**Active Errors** by individuals result in initiating action(s)

**EVENTS of HARM**

**Latent Weaknesses** in barriers

**PREVENT** The Errors

**DETECT & CORRECT** The System Weaknesses

Adapted from: James Reason, “Managing the Risks of Organizational Accidents” (1997)
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**High Reliability Organizations**

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**High reliability organizations (HROs)**

“operate under very trying conditions all the time and yet manage to have fewer than their fair share of accidents.”

*Managing the Unexpected* (Weick & Sutcliffe)

- **Risk** is a function of probability and consequence.
- By decreasing the probability of an accident, HRO’s recast a high-risk enterprise as merely a high-consequence enterprise.
- HROs operate as to make systems ultra-safe.

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**Resilience Engineering**
\[ F = \frac{G m_1 m_2}{d^2} \]
\[ F = m a \]
Gravity: Descriptive Theory

Safety: Descriptive Theory

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Resilience Engineering
For your consideration…

- Has the increasing use of extenders made systems more brittle?
- Have electronic healthcare records (EHR) made systems more brittle?
- Has the reduction of slack resources made systems more brittle?

Safety: Descriptive Theory

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Behavior-based safety

Safety I

Safety Science

High Reliability Organizations

Resilience Engineering

Safety II
Hollnagel Model

- Learning (factual)
- Responding (actual)
- Monitoring (critical)
- Anticipating (potential)

retrospective

prospective

system

unit

cause analysis
learning teams
metrics

daily check-in
EMS
safety huddle
watch standers

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WAI v. WAD

Work as Imagined

Work as Done
Future Shock

- Work as Imagine versus Work as Done makes every event analysis into a common cause analysis
- Study the way we thought work was being performed.
- Study the ways work is actually done.
- Study indicates a newer, safer, more reliable, and more resilient way.
- Closing the gap indicated by the study then becomes our proxy for root causes and actions to prevent recurrence.

Collegial Interactive Team

**What**
- Tools – as non-technical skills
- Tones – to minimize power distance
- Scalable – to build on safety tools
- Resilient:
  - Anticipatory thinking
  - Cross monitoring
  - Thinking as a team
  - Inquiry advocacy insertion

**How**
- Focus & Simplify™ the protocol
- Train as a natural work team
- Train using in-situ simulation

Early Warning Systems

**Watch standers**
- Monitor patient condition – and adapts care provider response

**Real-time surveillance using automated GTT**
- Monitors patient condition – and adapts care provider response

**Harm Early Warning System (HEWS)**
- Monitors provider condition mismatches – and adapts unit /service line response
Harm Early Warning Systems (HEWS)

A Harm Early Warning System provides **timely and meaningful information** to appropriate individuals when an **increased level of risk is present** due to one or more factors.

**An effective Harm Early Warning System** suggests potential mitigating actions or risk reduction strategies to reduce the probability or consequence of harm.

A Harm Early Warning System includes four key elements:

1. **Monitoring**: Periodic and PRN evaluation of factors that increase risk
2. **Quantification**: Analysis and quantification of factors that increase risk
3. **Dissemination**: Communication of alerts and warnings to appropriate individuals
4. **Mitigation**: Prescribed actions in response to minimize the risk

Comprehensive Four-Level HEWS

Hospital HEWS

Unit HEWS

Team HEWS

Individual HEWS

Summary

**Why it’s important:**
1) Resilience = Robust + Reliable + adaptive Response
2) Resilient systems bend and bounce back
3) Safety I and EHR have made systems brittle

**What we could do / should do:**
1) Avoid **Robust But Fragile** under **Faster Better Cheaper**
2) Care for our people
3) Think and Think Together as Teams
4) Operational Leadership
5) Build new “systems” around people with adaptive response
6) The theory indicates the combinations of tactics