



Aim

To identify patterns of errors contributing to inpatient trauma deaths

- Comprehensive case identification
- Classification to facilitate understanding & intervention
- Effectiveness of directed policies

Setting & Population



Harborview Medical Center,
Seattle, WA

- a mature Level 1 trauma center
- 6000 trauma admissions per year

All inpatient trauma deaths
1996-2004

Data Sources

- Trauma registry chart abstraction (daily)
- Morbidity & mortality reports (weekly)
- Hospital quality assurance reports
- Trauma registry analyses of risk of death (annually)

Error Survey

- Deaths with quality of care concerns
- Deaths with low to medium probability of mortality at admission
 - TRISS < 0.5 (probability of survival)
 - HARM > 0.5 (probability of mortality)

Case Review

- Detailed review for errors contributing to death
- Peer review
 - Departmental M&M meetings
 - Hospital Trauma Council
 - Regional Trauma QA Committee

Error Classification

Clinical features

JCAHO Patient Safety Net Taxonomy

- *Impact*
- *Type* - diagnosis / treatment / prevention
- *Domain* - management phase
- *Cause* - input / intention / execution
- *Prevention*

Chang et al, Int J Qual Healthcare 2005

Interpretation of Error Patterns

- Longitudinal synthesis for nine-year period
- Relation to institutional & regional trauma system policies

Results

| | Admissions | Deaths |
|---|------------|---------|
| Cases | 44,401 | 2594 |
| Male:Female (%) | 72:28 | 69:31 |
| Age (median) | 34 | 46 |
| Mechanism (%) Blunt:Penetrating:Other | 80:11:9 | 74:17:9 |
| ISS (median) | 9 | 25 |
| Days to discharge/death (median) | 3 | 1 |

2,594 Deaths

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graph TD; A[2,594 Deaths] --> B[53 (2.0%)  
M&M conference  
identified error]; A --> C[601 (23.2%)  
<50% probability  
of mortality]; B --> D[Critical review & peer review]; C --> D; D --> E[64 (2.4%)  
Errors contributing to death];
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53 (2.0%)

M&M conference
identified error

601 (23.2%)

<50% probability
of mortality

Critical review & peer review

64 (2.4%)

Errors contributing to death

Patterns of errors

28% Hemorrhage control

16% abdo/pelvic, 9% thoracic, 3% coagulopathy

16% Airway management

8% delayed surgical airway, 8% unsecured airway

14% Management of unstable patients

8% Damage control, 3% transfer, 3% CT scanner

13% Complications of procedures

6% lines & tubes, 5% feeding tubes, 2% retained FB

11% Prophylaxis

6% VTE, 3% GI, 2% restraint

19% Other

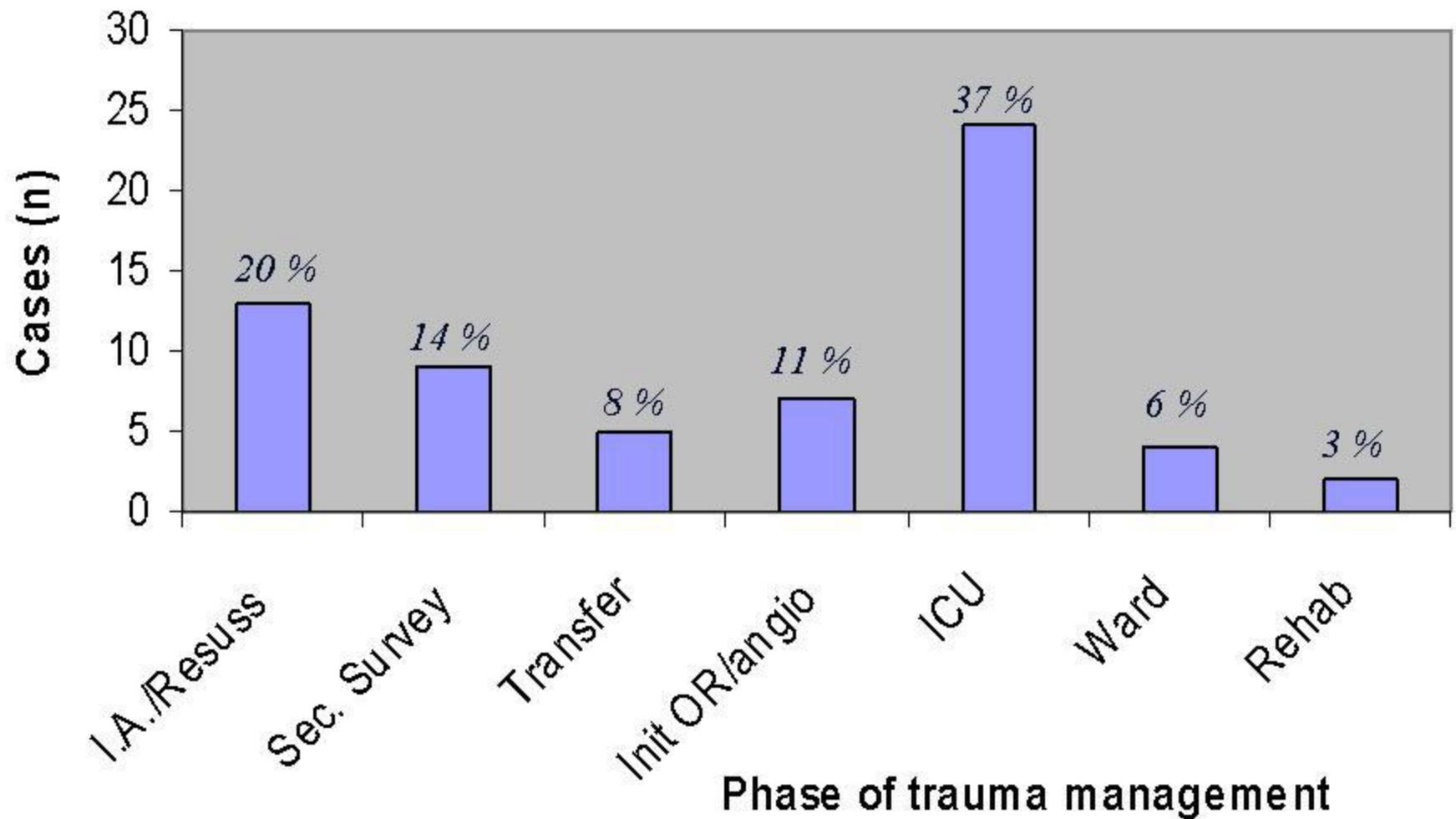
10% missed diagnoses, 5% overresuscitation



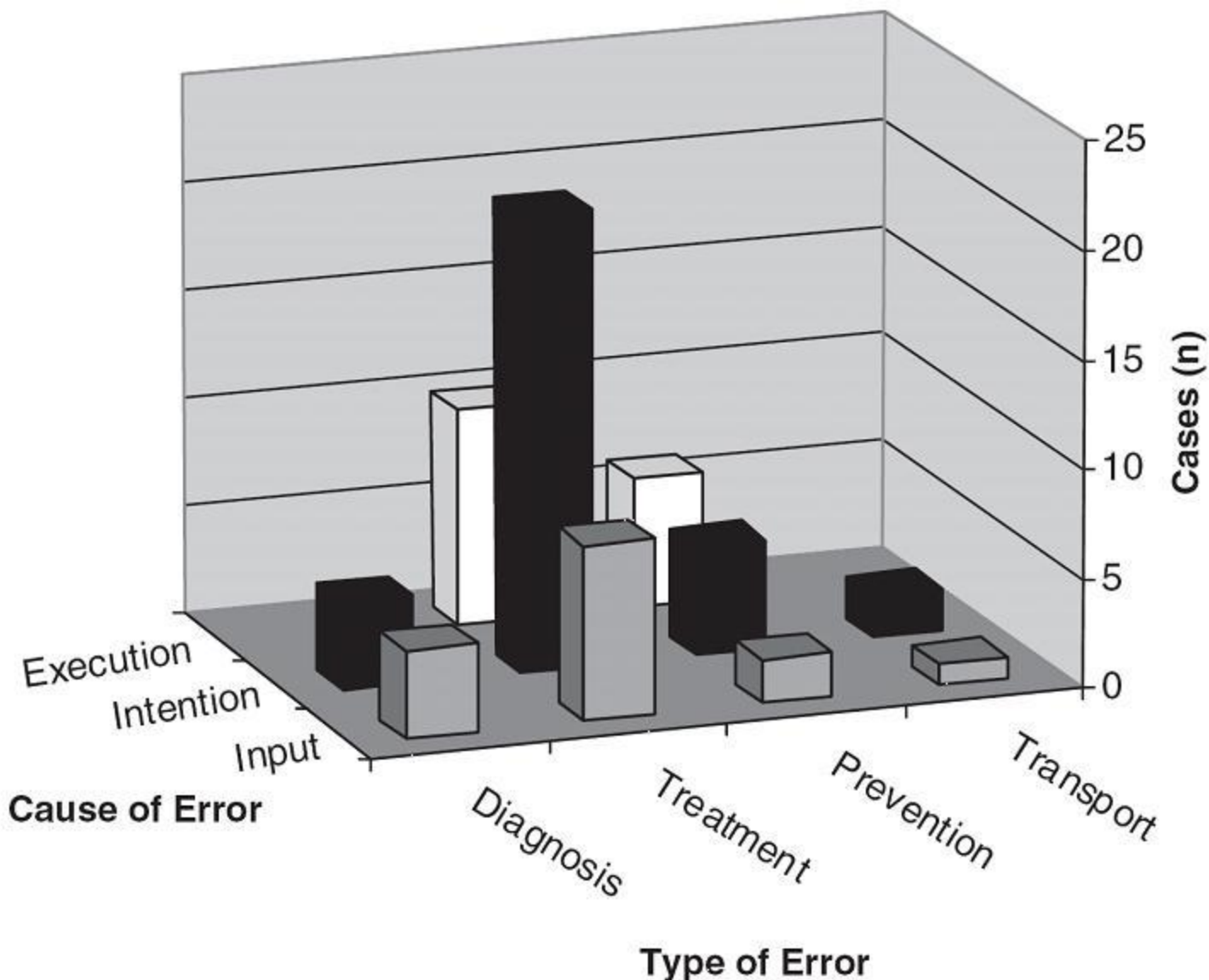
Minimising Errors in Trauma Care *The Crucial Role of Audit & Review*

Russell L. Gruen
University of Melbourne
Royal Melbourne Hospital.

Phase of trauma management



Errors by psychological cause & type



Impact of error reduction policies

1. 2nd chest tube if >10ml/kg blood from 1st tube
2. Transfer center to coordinate all transfers
3. PEG & jejunostomy tube policies
4. Mandatory AXR at end of every laparotomy

| Error group | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---------------------------------------|------|------|------|------|------|------|------|------|------|
| Uncontrolled thoracic hemorrhage | ● | ●●● | ● | | | ● | | | |
| Interhospital transfer of unstable pt | ●● | | | | | | | | |
| Complications of feeding tubes | | ● | ● | | | | | | ● |
| Retained foreign body in OR | | | | ● | | | | | |

 Relevant policy

[illegible]

Conclusions

- Preventable deaths occur even in mature trauma systems
- Patterns of errors are recognizable
- Intention-based errors of treatment predominate
- Institutional protocols can effectively reduce error incidence
- A thorough, transparent & goal-directed institutional process is valuable



What we do in General Surgery

1. Weekly Friday 0700-0800 audit meeting for all general surgery & trauma
2. 2-monthly trauma audit
3. Annual unit by unit Saturday 0830-0930 audit review of all cases selected by Audit Case Selection Committee



Weekly Audit Meeting

Attended by all units, resident staff and consultants, & SSI coordinator

Review of all elective & emergency cases and referrals via patients entered by registrar onto purpose-built general surgery database.

Audit discussion focuses on:

- Patients with LOS > 10 days

- All deaths

- Interesting cases from surgical perspective

Strengths of current process

- Established & regular process driven by surgeons themselves
- Commitment from senior leaders in the surgical units
- Multidisciplinary attendance

Challenges for institutional audits

1. Clarifying audit purpose
2. Concentrating on cases where learning & improvement is most likely
3. Regular multi-level peer review with authority to implement changes more than annually
4. Documentation, loop closure & evaluation of effects of changes

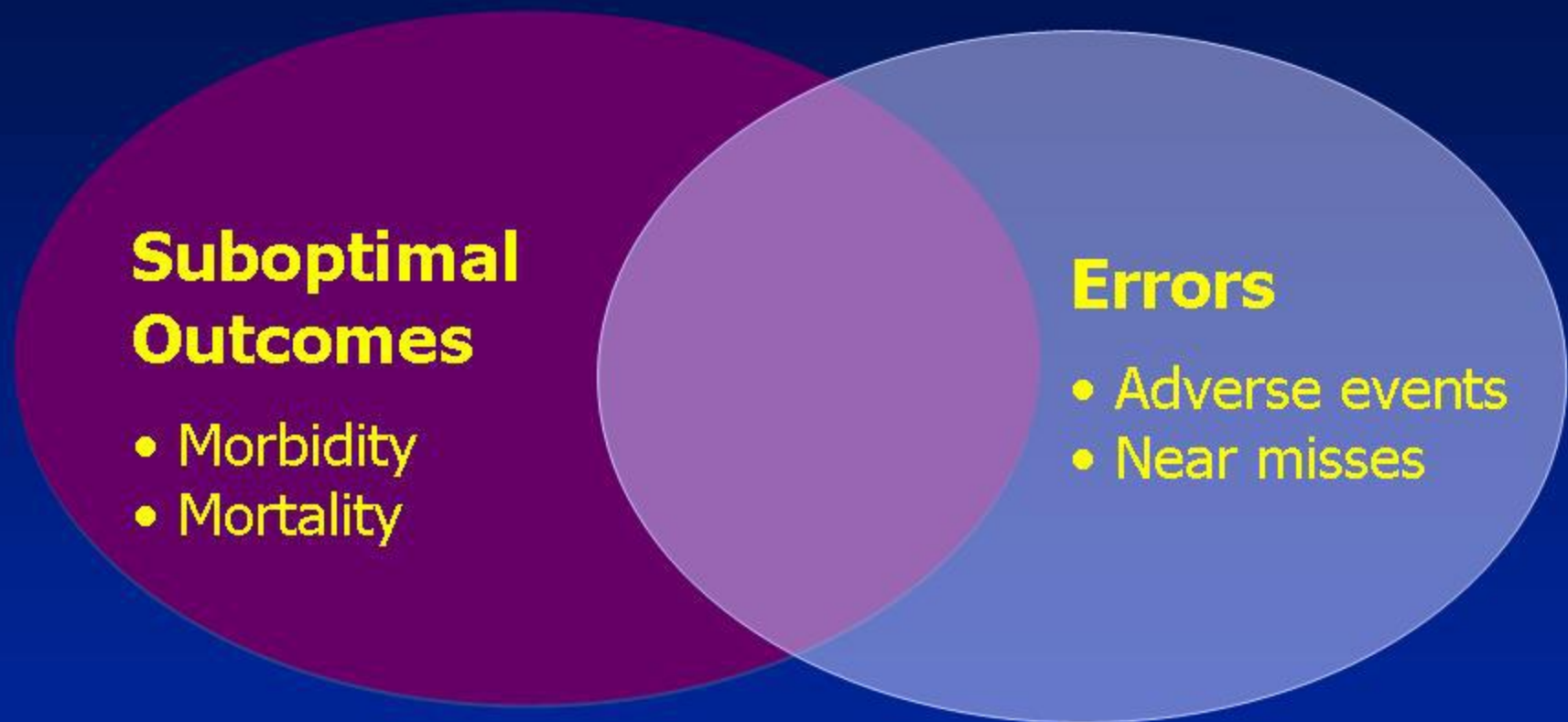
“Preventable Trauma Deaths”

- Surgical investigations for > 50 years
- Clinical review & autopsy studies
- Research contributed to regionalized trauma care
- Causes include:
 - Failure to evaluate abdomen
 - Delays to treatment
 - Critical care errors
- Estimated rates 2 to 50%

Targets of surgical audit

- ‘Complications’ (a confusing term)
 - Suboptimal outcomes (with or without errors)
 - Errors (with or without effect on outcome)
- Descriptive audit
 - Case load
 - Morbidity & Mortality

Beyond auditing 'complications'



A simple & practical classification of the nature/cause of errors

- Input/Diagnosis
- Intention
- Execution

(Gruen (2006) based on the work of James Reason & Sir
Alfred Cuschieri)

Identifying cases for detailed review

| Question | Categories |
|---|---|
| Was there a suboptimal outcome for the patient? | None Insignificant Minor Major |
| If the outcome was suboptimal, what was the likelihood of this outcome? | Very likely Moderately Likely Unlikely Rare |
| Was an error involved? | No Yes |

Towards A Robust Audit Process

- Daily identification & recording of suboptimal outcomes & errors by residents
- Weekly peer review & identification & referral of important cases (+/- initial recommendations)
- Less frequent higher order committee evaluation with authority to make change
- Forum for 'lessons learned'
- Paper trail

Contemporary Approaches

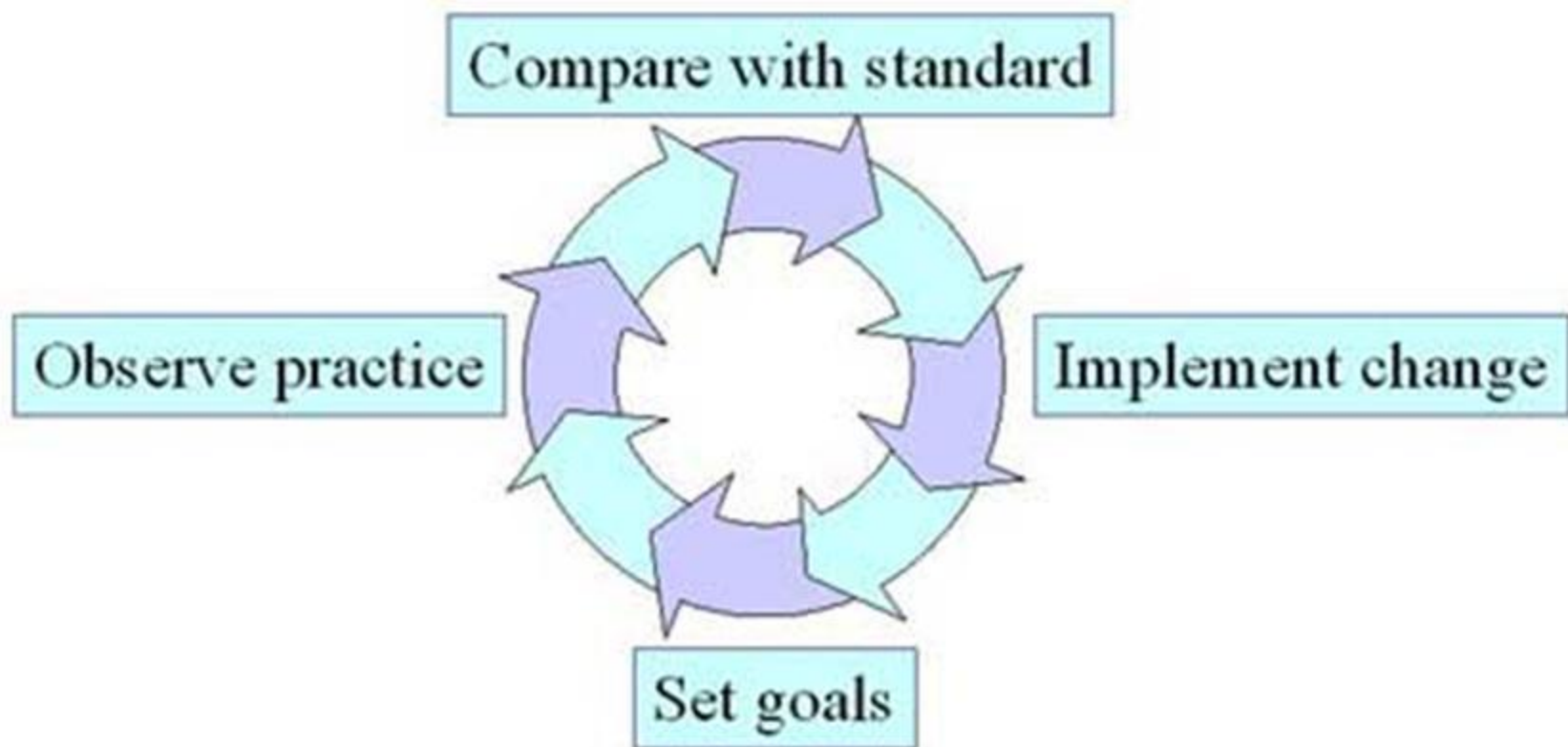
- Improving recognition & reporting
- Standardizing classification
- Understanding predisposing factors
 - Structural & systemic factors
 - Defective information processing
- Pursuing patient safety & error reduction

A definition of audit

The systematic critical analysis of the quality of care,
including the procedures used for diagnosis and treatment, the use of resources, and the resulting outcome and the quality of life for the patient,
carried out by those personally engaged in the activity concerned.

RCSE

THE AUDIT CYCLE



CQI & Surgical Audit

- serial experimentation applied to everyday work to meet the needs of those we serve and improve the services we offer.
- Most problems are found in processes, not in people. CQI does not seek to blame, but rather to improve processes.
- Unintended variation in processes can lead to unwanted variation in outcomes, and therefore we seek to reduce or eliminate unwanted variation.
- It is possible to achieve continual improvement through small, incremental changes using the scientific method.
- Continuous improvement is most effective when it becomes a natural part of the way everyday work is done.

Components of audit

1. Case identification
2. Appropriate forum for appraisal
3. Documentation of discussions and recommendations
4. Process for follow-up of recommendations & review of action taken.
5. Ideally, link to organisational wide reporting systems

Patterns of Errors Contributing to Trauma Mortality

Lessons Learned From 2594 Deaths

Russell L. Gruen, MD, PhD, Gregory J. Jurkovich, MD, Lisa K. McIntyre, MD, Hugh M. Foy, MD,
and Ronald V. Maier, MD

Objective: To identify patterns of errors contributing to inpatient trauma deaths.

Methods: All inpatient trauma deaths at a high-volume level I trauma center from 1996 to 2004 inclusive were audited. Data were collected with daily trauma registry chart abstraction, weekly morbidity and mortality reports, hospital quality assurance reports, and annual trauma registry analyses of risk of death using TRISS and HARM methodology. Deaths that met criteria for low to medium probability of mortality or those with quality of care concerns were analyzed for errors and then subjected to 3-stage peer review at weekly departmental, monthly hospital, and annual regional forums. Patterns of errors were constructed from the compiled longitudinal data.

agency departments. Studies in several countries have identified adverse events, including death, that occur in trauma and emergency care.¹⁻⁴

In 1955, Robert M. Zollinger wrote in the *Archives of Surgery* about the "preventability" of deaths following motor vehicle crashes.⁵ In the *Journal of the American Medical Association*, 30 years later, Donald Trunkey reviewed 29 studies of preventable trauma deaths,⁶ and more have been published since.⁷⁻¹¹ These studies supported the development of regionalized trauma care. They also provided insights into the nature of preventable deaths, including the significance of failure to evaluate the abdomen, delays to treatment, and