IHI Trigger Tools: History
Current Literature and New Validation Results

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David C Classen, MD MS
Patient Safety

• **Definition:** *freedom from accidental injury*
  IOM *To Err is Human* (1999)

• **Measurement**
  – Voluntary reports
  – Safety indicators based on coding (AHRQ)
  – Complications
  – *What is missed?*
Why Use Trigger Tools?

• Traditional reporting of errors, incidents or events does not reliably occur in the best of cultures in healthcare
• Voluntary methods underestimate events and concentrate on what is interpreted as being preventable
• Easily identifies events without complex technology
• Can be integrated into a good sampling methodology
Background

- Computerized triggers for ADE identification and concurrent intervention (LDS Hospital 1988 Classen JAMA 1990)
- Adverse drug event trigger tool developed for the IHI Idealized Design of the Medication System 1999 (Resar QSHC 2003 (2))
- ICU Adverse event trigger tool IHI Idealized design ICU (Resar Jt Comm J Q/S 2006)
- NICU Trigger (Sharek Pediatrics 2006) PICU 2009
- Surgical, Perinatal, Ambulatory Trigger Studies
- Global Trigger Tool testing and spread to US and International hospitals (2004-)
What is a Trigger?

“Triggers are defined as occurrences, prompts, signals, or flags found on review of the medical record that “trigger” further investigation to determine the presence or absence of an adverse drug event.”

“The use of these triggers led to a 60 fold higher detection of Adverse Drug Events at LDS Hospital”

Triggers and Harm Defined

- World Health Organization (WHO) definition of adverse drug event as follows:
  
  "Noxious and unintended and occurs at doses used in man for prophylaxis, diagnosis, therapy, or modification of physiologic functions."

- IHI Trigger Tools:

HARM = an adverse event where there is an injury or harm (any unintended consequence) related to the delivery of care

Currently includes events of commission only, not omission

Error vs. Adverse Event

- “Error” implies preventability, i.e., process-focused
- “Adverse event” describes harm experienced by patient, i.e., outcome focused
Trigger Review Process for Adverse Events

Random Records → Triggers Reviewed → Pos triggers ID → Portion of record reviewed → AE Identified → Harm Category Assigned

- No: End Review
- Yes: AE’s/1000 days (doses for ADE)
Categories of Harm
(from NCC MERP Index)

- E  Temporary harm, intervention required
- F  Temporary harm, initial or prolonged hospitalization
- G  Permanent patient harm
- H  Life sustaining intervention required
- I  Contributing to death
First Triggers: Medication Events (ADEs)

- Diphenhydramine
- Vitamin K
- Romazicon
- Antiemetics
- Naloxone
- Antidiarrheals
- Serum glucose <50
- WBC <3,000
- Platelet <50,000

- Digoxin level > 2
- Rising serum creatinine
- Oversedation / fall / lethargy / hypotension
- Rash
- Abrupt medication stop
- Transfer to higher level of care
- C. difficile positive
- PTT > 100 seconds
- INR >6
Multi-center ADE Data

- 2837 charts reviewed using trigger tool
- 86 institutions
- 720 ADE’s found
- 268,796 medications doses administered
- ADE’s/1000 doses = 2.67
- Admissions with ADE’s = 24.9%

Methods, Tools, and Strategies

A Trigger Tool to Identify Adverse Events in the Intensive Care Unit

Roger K. Resar, M.D.
John D. Rozich, M.D., Ph.D., M.B.A.
Terri Simmonds, R.N.
Carol R. Haraden, R.N., Ph.D.
1294 patient records reviewed

- 1450 events detected in 55% of patients
  - 28% > 1 event
  - 18% medication related
  - 11% in E-codes

- LOS
  - 8.9 days with events
  - 4.3 day without events

ICU Trigger Tool Data

E: 70.00%
F: 25.00%
G: 5.00%
H: 10.00%
I: 3.00%
Detection of adverse events in surgical patients using the Trigger Tool approach

F A Griffin,¹ D C Classen²

ABSTRACT
Background: Most studies of healthcare complications identify surgery as a major contributor to the overall burden of complicated care that leads to injury or death. Indeed, surgical adverse events account for one-half to three-quarters of all adverse events in these studies. Despite the intensive current focus on improving medical quality and safety, only a minority of quality improvement efforts are focused on surgery. This study reports on the development and testing of a Trigger Tool to detect adverse events among patients undergoing inpatient surgery.

Methods: Rather than relying on traditional voluntary reporting for safety outcome measures such as incident reports, surgical peer review, or morbidity and mortality conferences, the Institute for Healthcare Improvement (IHI) has employed a new method for the detection of surgical adverse events (SAEs). This approach, commonly referred to as the “Trigger Tool”, identifies adverse events minority of the active clinical quality improvement initiatives have focused on surgery. Among the few programmes that do address concerns about quality in relation to surgery is the Surgical Care Improvement Project (SCIP), which was launched 3 years ago by the Centers for Medicare and Medicaid Services (CMS) in conjunction with other national partners. A major focus of SCIP has been to enhance the effective adoption of commonly accepted best practices such as antibiotic prophylaxis before surgery.

Although SCIP is firmly based in quality improvement theory and uses widely recognised process measures, only a few surgical quality improvement initiatives such as the National Surgical Quality Improvement Project (NSQIP), for example, have emphasised safety outcome measures. Since 2002, the Institute for Healthcare Improvement (IHI) has organised several surgical
Surgical Trigger Tool
Data from IHI Collaborative

• 11 hospitals
  – Time period – over 1 year
  – Data submitted – 1-8 months (avg 4)
  – 854 charts reviewed

• 139 Adverse Events in 125 Patients
  – 14.6% of patients
  – 8% of events were G, H or I

Perioperative Adverse Events: Harm Categories

Adverse Events in the Neonatal Intensive Care Unit: Development, Testing, and Findings of an NICU-Focused Trigger Tool to Identify Harm in North American NICUs

Paul J. Sharek, Jeffrey D. Horbar, Wilbert Mason, Hema Bisarya, Cary W. Thurm, Gautham Suresh, James E. Gray, William H. Edwards, Donald Goldmann and David Classen

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http://www.pediatrics.org/cgi/content/full/118/4/1332
Collaborative Partners

Child Health Corporation of America (CHCA)
- Paul Sharek, MD, MPH
- Bill Mason, MD, MPH
- April Walker, BA
- Donna Payne, MSN
- Hema Bisarya, MHSA

Vermont Oxford Network (VON)
- Jeffrey Horbar, MD

Center for Patient Safety in Neonatal Intensive Care
- Jeffrey Horbar, MD
- Jim Gray, MD
- Gautham Suresh, MD
- William Edwards, MD
- Donald Goldman, MD

David Classen, MD, MS; First Consulting Group
- National expert in patient safety with the use of trigger tools
- Liaison to the Institute for Healthcare Improvement (IHI)
## Participating Hospitals

### NIC/Q2005 (YIN and YANG) Hospitals (9)
- Providence Alaska Medical Center
- Woman’s Hospital of Baton Rouge
- Vermont Fletcher Allen
- Baylor University Medical Center
- Jackson Madison County General Hospital
- Fairview-University Medical Center, Minneapolis
- Sunnybrook and Women’s College Health Sciences Center
- Wesley Medical Center
- Yakima Valley Memorial Hospital

### CHCA Hospitals (6)
- Children’s Hospital and Medical Center of Akron
- Cincinnati Children’s Hospital Medical Center
- Columbus Children’s Hospital
- Arkansas Children’s Hospital
- Children’s Hospital of Los Angeles
- Lucile Packard Children’s Hospital at Stanford
### Trigger List for Study

<table>
<thead>
<tr>
<th>Trigger</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁</td>
<td>Nosocomial infection</td>
</tr>
<tr>
<td>T₂</td>
<td>Antibiotic use</td>
</tr>
<tr>
<td>T₃</td>
<td>Accidental extubations</td>
</tr>
<tr>
<td>T₄</td>
<td>Hypotension</td>
</tr>
<tr>
<td>T₅</td>
<td>Respiratory arrest</td>
</tr>
<tr>
<td>T₆</td>
<td>Death</td>
</tr>
<tr>
<td>T₇</td>
<td>Catheter infiltration/burn</td>
</tr>
<tr>
<td>T₈</td>
<td>Naloxone (Narcan)</td>
</tr>
<tr>
<td>T₉</td>
<td>Anticoagulant (Lovenox, warfarin, heparin drip)</td>
</tr>
<tr>
<td>T₁₀</td>
<td>Rising serum creatinine</td>
</tr>
<tr>
<td>T₁₁</td>
<td>NEC</td>
</tr>
<tr>
<td>T₁₂</td>
<td>Seizures</td>
</tr>
<tr>
<td>T₁₃</td>
<td>Phenobarbital</td>
</tr>
<tr>
<td>T₁₄</td>
<td>Electrolyte abnormality</td>
</tr>
<tr>
<td>T₁₅</td>
<td>Abnormal cranial imaging</td>
</tr>
<tr>
<td>T₁₆</td>
<td>Hyperglycemia</td>
</tr>
<tr>
<td>T₁₇</td>
<td>Unplanned return to surgery</td>
</tr>
</tbody>
</table>
Aggregate Data

- Total Unique AEs = 554
- Total AEs Associated with ANY Trigger = 841
- Total Triggers = 2,218
- Total NICU Days = 17,106
- Total Patient Count = 749

- Average Triggers per Patient = 2.96
- Average unique AEs per Patient = 0.74
- Average unique AEs per 1000 Patient Days = 32.39
- Average AEs per Trigger (Positive Predictive Value of any given trigger) = 0.38
- Mean Time for Chart Reviews = 20.5 minutes
- Average LOS = 23 days
Adverse Events in the Neonatal Intensive Care Unit: Development, Testing, and Findings of an NICU-Focused Trigger Tool to Identify Harm in North American NICUs

74 Adverse Events per 100 admissions
56% of all Adverse Events “Preventable”

Adverse Events in the NICU setting are substantially higher than previously described. Many events resulted in permanent harm, and the majority were classified as preventable...
Global Trigger Tool

- Extension from the topic & location focused trigger tools
- Uses multiple modules of triggers
  - Cares, Medication, Critical Care, L/D, ED
- Gathers events from the whole hospital
- Establishes a global harm measure for the hospital
- Resource friendly and no dependency on high tech
New Review Process for GTT Study

- Random selection of records (minimum 1 day LOS; > 18 years age)
- Determine harm from patient’s viewpoint without regard for preventability
- Assign level of harm to each individual event
- Deep Dive > 225 records
- Review using trigger tool process by 1 independent mid-level reviewers
- Consensus reviewed by 2 physicians
- All reviewers go through extensive training
  1. Review GTT white Paper
  2. Review 15 Training Charts and Debrief
  3. Review 50 Testing Charts
Results of Reviewer Training

**FIGURE 1.** Percent agreement with consensus by reviewer: 15 training records compared with 50 testing records.
Results of Reviewer Training

FIGURE 6. Kappa statistics for detecting an event by reviewer pairs: 15 training records compared with 50 testing records.
Scatter Diagram on the Relationship Between Percent Agreement on Events and the Kappa Statistic

Kappa Statistic vs Percent Agree (training charts)

% Agreement vs Kappa (Events on Test Set)
Conclusions based on this Analysis

- A common set of reviewers can achieve a high degree of agreement
- Agreement was detected on presence of events, absence of events and severity of the events
- Training improves agreement
Questions

Comments