Use of Medical Education to Improve Patient Care Quality

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Vice Dean for Education
Northwestern University Feinberg School of Medicine
Conflict of Interest

Partnership Between Northwestern University and Simulab

• MERCI Educational Grant to Northwestern University
• Inventor Royalties
Preparing Residents to Provide High Quality Care

- ABC’s
- Monitor
- AED
- ACLS algorithms
Objectives

• Review how medical education rates as a quality improvement tool

• Explain the advantages of mastery learning with deliberate practice over traditional educational strategies

• List translational science studies that use education to improve patient outcomes
How Medical Education Rates as Quality Improvement Tool
Ranking the Effectiveness of Error-Reduction Strategies

Most Effective

- Forcing function and constraints
- Automation and computerization
- Standardization and protocols
- Checklists and double-check systems
- Rules and policies
- Education and information
- Exhortation: “Be careful”

Least Effective

Joint Commission Resources 2005
Recommended Hierarchy of Actions

**Stronger actions**
- Architectural/physical plant changes
- New device with usability testing before purchasing
- Engineering control or interlock (forcing functions)
- Standardize equipment or process or caremaps
- Tangible involvement and actions by leadership

**Intermediate actions**
- Increase staffing/decrease in workload
- Software enhancements/modifications
- Eliminate/reduce distractions
- Checklist/cognitive aid
- Eliminate look and sound alikes
- Read back
- Enhanced documentation/communication
- Redundancy

**Weak actions**
- Double checks
- Warnings and labels
- New procedures/memorandum/policy
- **Training**
- Additional study/analysis

http://www.patientsafety.gov
All Education Is Not the Same

• 3 hours of traditional lecture - experienced instructor
• 3 hours of instruction using DP - inexperienced instructor
• Deliberate practice – challenging questions and tasks requiring students to practice reasoning and problem solving with frequent feedback
• Increased student attendance, higher engagement and more than twice the learning using research-based instruction

Deslauriers L, Improved learning in a large-enrollment physics class. *Science* 2011
Freeman S. Active learning increases student performance in science engineering, and mathematics. *PNAS* 2014
Deliberate Practice

1. Highly **motivated** learners with good concentration;
2. Engagement with a **well-defined learning objectives** or tasks; at an appropriate level of difficulty; with
3. Focused **repetitive practice** that leads to
4. Rigorous, **precise measurements**; that yield
5. Informative feedback from educational sources (e.g., simulators, teachers); and
6. Trainees also monitor their learning experiences and correct errors
7. Evaluation to reach a **mastery** standard; and then
8. Advance to another task or unit

**Goal: Constant Improvement**

Ericsson Acad Med. 2004; McGaghie, Chest 2009
Design and Sequencing of Training Activities

- Performance vs. Amount of Deliberate Practice
  - Gradual improvement in some specific aspect
  - Deliberate practice
  - Expert performance

A. Ericsson 2007
Mastery Learning

1. Baseline, i.e., diagnostic testing;
2. Clear learning objectives, units ordered by difficulty;
3. Educational activities (e.g., deliberate skills practice) focused on objectives;
4. Minimum passing *mastery* standard (MPS) for each unit;
5. Formative testing → *mastery* of each unit;
6. Advancement if performance ≥ MPS; or
7. Continued practice or study until MPS is reached
8. Time varies, outcomes are uniform

**Excellence for all**

McGaghie et al., *Chest* 2009
*Acad Med* Nov 2015
Simulation-Based Mastery Learning (SBML)

Cardiac Auscultation

Paracentesis

Code Status Discussion
Includes:
- Internal Med.
- Neurology
- Anesthesiology
- Gen. Surgery
Explain the Advantages of Mastery Learning with Deliberate Practice over Traditional Educational Strategies
Traditional Training ≠ Competence

![Graph showing the distribution of checklist scores with a mean of 65.4% and a standard deviation of 14.2% compared to an MPS of 85%.]
Typical Educational Outcomes

- MPS = 85%
- M = 65.4%, SD = 14.2%
- M = 93.3%, SD = 8.4%
Mastery Learning Educational Outcomes

Barsuk, et al *Neurology* 2012
List Studies that Use Deliberate Practice and Mastery Learning to Improve Patient Outcomes
Extending the Endpoint: Medical Education as Translational Science

Table 1. Contributions of medical education interventions to T1, T2, and T3 outcomes.

<table>
<thead>
<tr>
<th>Medical education interventions</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased or improved</td>
<td>Knowledge, skill, attitudes, and</td>
<td>Patient care practices</td>
<td>Patient outcomes</td>
</tr>
<tr>
<td></td>
<td>professionalism</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Target</td>
<td>Individuals and teams</td>
<td>Individuals and teams</td>
<td>Individuals and public health</td>
</tr>
<tr>
<td>Setting</td>
<td>Simulation lab</td>
<td>Clinic and bedside</td>
<td>Clinic and community</td>
</tr>
</tbody>
</table>

Kirkpatrick Level

<table>
<thead>
<tr>
<th>Level</th>
<th>1. Reaction</th>
<th>2. Learning</th>
<th>3. Behavior</th>
<th>4. Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kirkpatrick Level</td>
<td>Reaction</td>
<td>Learning</td>
<td>Behavior</td>
<td>Results</td>
</tr>
</tbody>
</table>

McGaghie WC. *Science Translational Medicine.*
Education “Best Practices” Improve Patient Care
A Chain of Evidence
### CVC Insertion Checklist

#### Central Line Insertion (II)

**Skill Key:**
- **A** = Done Correctly
- **B** = Done Incorrectly/Not Done

<table>
<thead>
<tr>
<th>Task</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informed consent obtained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benefits (medicines, fluids; 1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risks (infection, bleeding; 2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consent given (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Call “time out” and site mark if appropriate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wash hands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Place the patient in slight Trendelenburg position</td>
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<td></td>
</tr>
<tr>
<td>Test each port and flush the lines with sterile saline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clamp each port (ok to keep distal port open)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keep distal port open to accommodate guidewire</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area is cleaned with chlorhexidine (30 seconds if use, ok to use 3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Don sterile gown, gloves, hat and mask</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area is draped in usual sterile fashion (must be full body drape, must remove bottom sticky sheet)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The US probe is properly set up, draped and sonographic gel is used on inside and outside of sheath (sterile sheath)</td>
<td></td>
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</tr>
<tr>
<td>The vein is localized using anatomical landmarks with the ultrasound machine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The skin is anesthetized with 1% lidocaine in a small wheel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The deeper structures are anesthetized</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using the large needle (or catheter) syringe complex cannulate the vein while aspirating</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remove the syringe from the needle or advance the catheter into the vein (must be lubbed) removing both the syringe and needle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using the guidewire advance the guidewire into the vein no more than about 12 cm-15 cm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Make sure to nick the skin to advance the dilator (scalpel)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advance the dilator over the guidewire and dilate the tissue tract</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
T1 Mastery Learning Education Outcomes

T2/T3 Patient Outcomes


Complications

- Pneumothorax: 2% (p=0.757)
- Arterial Puncture: 12% (p<0.005)
- CVC Adjustment: 21% (p=0.002)
- Insertion Failure Rate: 17% (p=0.005)
T3 Outcomes: 85% Reduction in CLABSI

Barsuk et al. Arch Intern Med 2009
The total annual estimated savings were approximately $820,000, 139 patient hospital days, and 120 MICU days.

When compared with the cost of our intervention ($112,000), the net savings was approximately $708,000, which results in a 7:1 ROI.

Cohen et al. *Simul Healthc.* 2010
Some hospitals excel, others perform poorly in protecting patients from dangerous catheter problems, new numbers show:

- The state uses infection ratios to track performance; calculated by dividing the number of infections that occurred in a year by the number that might be expected to occur
- A ratio of 1 means that actual infections equaled expected infections

- Northwestern Memorial Hospital, Chicago: 2009 infection ratio 0.41
- Mercy Hospital and Medical Center, Chicago: 2009 infection ratio 2.27
T3/T4 Outcomes: Mercy Hospital CLABSI Fall by 74%

Infection Rate per 1000 Catheter Days, No.

Simulator-trained residents enter the unit

Barsuk et al. *BMJ Quality and Safety*, 2014
Dissemination to 105 VA Hospitals

Barsuk et al Critical Care Medicine 2016
Paracentesis SBML
T2/T3 Outcomes after Paracentesis SBML

<table>
<thead>
<tr>
<th>Variable</th>
<th>Bedside Procedure n=294 patients</th>
<th>IR Procedure n=208 patients</th>
<th>Odds ratio</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of Stay (SD), days</td>
<td>7.19 (6.91)</td>
<td>8.63 (8.66)</td>
<td>NA</td>
<td>.003</td>
</tr>
<tr>
<td>ICU transfer (%), n</td>
<td>28 (9.5%)</td>
<td>32 (15.4%)</td>
<td>2.21</td>
<td>.02</td>
</tr>
<tr>
<td>Red Blood Cell transfusion (%), n</td>
<td>95 (32.3%)</td>
<td>72 (34.6%)</td>
<td>1.11</td>
<td>.62</td>
</tr>
<tr>
<td>Platelet transfusion (%), n</td>
<td>18 (6.1%)</td>
<td>37 (17.8%)</td>
<td>4.56</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Fresh Frozen Plasma transfusion (%), n</td>
<td>19 (6.5%)</td>
<td>38 (18.3%)</td>
<td>4.07</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Death (%), n</td>
<td>14 (4.8%)</td>
<td>13 (6.2%)</td>
<td>1.39</td>
<td>.47</td>
</tr>
<tr>
<td>30-day readmission (%), n²</td>
<td>123 (43.9%)</td>
<td>84 (43.1%)</td>
<td>1.00</td>
<td>.99</td>
</tr>
<tr>
<td>Emergency department visit within 30 days (%), n²</td>
<td>10 (3.6%)</td>
<td>8 (4.1%)</td>
<td>0.95</td>
<td>.93</td>
</tr>
</tbody>
</table>

Abbreviations: ICU, intensive care unit
²N=475 patients surviving to discharge

5:1 ROI Compared to IR Procedures

**Additional Evidence: Simulation-based Education Improves Patient Care**

<table>
<thead>
<tr>
<th>Study</th>
<th>Skill</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andreatta et al.</td>
<td>Laparoscopic Skills</td>
<td>T1 Skills on porcine model</td>
</tr>
<tr>
<td>Seymour et al.</td>
<td>Lap Cholecystectomy</td>
<td>T2 Skills, burning wrong tissue, faster</td>
</tr>
<tr>
<td>Cohen et al.</td>
<td>Colonoscopy</td>
<td>T2 Ability to reach cecum, identify abnormal</td>
</tr>
<tr>
<td>Sedlack et al.</td>
<td>Colonoscopy</td>
<td>T2 Mucosal visualization, depth inserted</td>
</tr>
<tr>
<td>Mayo et al.</td>
<td>Airway</td>
<td>T2 Checklist performance actual emergency</td>
</tr>
<tr>
<td>Blum et al.</td>
<td>Bronchoscopy</td>
<td>T2 Visual cute and subjective thoroughness</td>
</tr>
<tr>
<td>Draycott et al.</td>
<td>Shoulder dystocia</td>
<td>T2, T3 Neonatal injury</td>
</tr>
<tr>
<td>Zendejas et al.</td>
<td>Lap Hernia Repair</td>
<td>T3 Complications</td>
</tr>
<tr>
<td>Britt et al.</td>
<td>Central Line Insertion</td>
<td>T2, T3 Overall complications</td>
</tr>
<tr>
<td>Kessler et al.</td>
<td>Infant Lumbar Puncture</td>
<td>T2 Procedure success</td>
</tr>
</tbody>
</table>
Communication Skills and Outcomes

Association Between Implementation of a Medical Team Training Program and Surgical Mortality

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Peter D. Mills, PhD, MS
Yinong Young-Xu, ScD, MA, MS
Brian T. Carney, MD
Priscilla West, MPH
David H. Berger, MD, MHCM
Lisa M. Mazzaia, MD
Douglas E. Paull, MD
James P. Bagian, MD, PE

A

DIVERSE EVENTS RELATED TO surgery continue to occur despite the best efforts of clinicians.¹ Teamwork and effective communication are known determinants of surgical safety.² Previous efforts at demonstrating the efficacy of patient safety initiatives have been limited because of the inability to study a control group.³ For example, the use of the World Health Organization Safe Surgery checklist has been evaluated, but its overall efficacy remains uncertain because no control group was studied to clearly demonstrate this instrument's effectiveness.⁴

The Veterans Health Administration (VHA) is the largest national integrated health care system in the United States, with 153 hospitals, 130 of which provide surgical services. The VHA's nationwide training program required briefings and debriefings in the operating room and included checklists as an integral part of this process. The training included 2 months of preparation, a 1-day conference, and 1 year of quarterly coaching interviews.

Main Outcome Measure The rate of change in the mortality rate 1 year after facilities enrolled in the training program compared with the year before and with nontraining sites.

Results The 74 facilities in the training program experienced an 18% reduction in annual mortality (rate ratio [RR], 0.82; 95% confidence interval [CI], 0.76-0.91; P = .01) compared with a 7% decrease among the 34 facilities that had not undergone training (RR, 0.93; 95% CI, 0.80-1.06; P = .59). The risk-adjusted mortality rates at baseline were 17 per 1000 procedures per year for the trained facilities and 15 per 1000 procedures per year for the nontrained facilities. At the end of the study, the rates were 14 per 1000 procedures per year for both groups. Propensity matching of the trained and nontrained groups demonstrated that the decline in the risk-adjusted surgical mortality rate was about 50% greater in the training group (RR, 1.49; 95% CI, 1.10-2.07; P < .01) than in the nontraining group. A dose-response relationship for additional quarters of the training program was also demonstrated: for every quarter of the training program, a reduction of 0.5 deaths per 1000 procedures occurred (95% CI, 0.2-1.0; P = .001).

Conclusion Participation in the VHA Medical Team Training program was associated with lower surgical mortality.

JAMA. 2010;304(15):1693-1700

Facilities in the program experienced an 18% reduction in surgical mortality.
Unpacking “The Michigan Project”: Beliefs, Norms, Culture, Teams and Education

“This study found that peer and public pressure toward hospitals and their MICUs to participate and conform, reframing CVC-BSIs as a social problem, “using several interventions [including strong doses of medical and nursing education] that functioned in different ways to shape a culture of commitment to doing better in practice,” using data on infection rates as a disciplinary focus, and reliance on the ‘hard edges’ of accountability and professional sanction are the reasons why the statewide Michigan intervention produced strong results.”

Education
Motivation
Teamwork
Culture

Dixon-Woods M, Milbank Quarterly 2011
McGaghie WC, Chest 2012
Why Does This Matter? Aren’t We Already Meeting Our QI Goals?

Khullar D et al. Diagnostic errors are clinically and financially more costly today than ever before. NEJM 2015

Shulkin DJ. The aging population of veterans, their changing expectations, infrastructure limitations, and application of emerging therapies and technologies have all contributed to a mismatch of demand and capacity. NEJM 2016

Young RC. But the cost of cancer care has been growing rapidly: though it accounts for a relatively small portion of overall U.S. health care expenditures, it is expected to increase from $125 billion in 2010 to $158 billion in 2020. NEJM 2015

Ginsburg PB et al. To coordinate care effectively, providers need to be able to engage patients actively in their care, especially in chronic disease management, and steer them to other providers on their team. But under Medicare, an ACO may not even be able to identify the patients for whom it's responsible until after the contract year ends. NEJM 2015
Preparing Residents to Provide High Quality Care

- Train to mastery
- Communication skills/team training
- In situ-codes
- Add nurses/pharmacists
- Patient preferences
- Readmission rates
- Cost/case
- Patient satisfaction
Thank You

Funding Sources:
- Excellence in Academic Medicine Act - The Illinois Department of Health and Family Services Administered by Northwestern Memorial Hospital
- Augusta Webster Faculty Development Grant
- Baum Simulation Grant
- AHRQ/ NIH

J. Larry Jameson
Douglas Vaughan
William McGaghie
Jeff Barsuk
Elaine Cohen
Joe Feinglass
Aashish Didwania
Chief Medical Residents