CERTAIN – Checklist for Early Recognition and Treatment of Acute Illness

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Multidisciplinary Epidemiology and Translational Research in Intensive Care (M.E.T.R.I.C.)

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Disclosure

- Research support from NIH, CMS and Mayo Clinic
- Provisional patent application for critical care related software tools has been submitted by Mayo Clinic
- No financial relationships with any commercial companies and no other relevant disclosures
Learning Objectives

- Discuss the need for precompiled responses to acute clinical illness (“the checklist manifesto”)
- Explore how novel informatics technologies can assist dissemination of knowledge to the point of care
- Introduce CERTAIN – Checklist for Early Recognition and Treatment of Acute Illness
- Discuss the challenges and opportunities within international implementation study of point of care checklists
Definition of a Problem: Hospital Ward

45-year old with pneumonia
### In the ICU

<table>
<thead>
<tr>
<th>Heart Rate</th>
<th>125</th>
<th>126</th>
<th>126</th>
<th>121</th>
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<td>Arterial BP-Mean</td>
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<tr>
<td>CVP Pressure</td>
<td>0</td>
<td>4</td>
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<td>9</td>
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<td>4</td>
<td>19</td>
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</tbody>
</table>

#### Colloid in - Volume/Bolus
- **Albumin 5% mL**: 250 350 350 500 250 250
- **RBC Leuko-Reduced 0-10000 mL**: 350

#### Medication Infusions
- **Dobutamine 0-10000 mcg/kg/min**
- **Drotrecogin Alpha 0-10000 mcg/hour**
- **Fentanyl 0-10000 mcg/hour**
- **Midazolam 0-10000 mcg/hour**

#### Crystalloid In
- **0.9 NaCl 1000 mL at 10 mL/hour**: 250 250 250 1000 2000 1000
- **0.9 NaCl - Fluid Bolus 1000 mL**: 1000 1000
- **Intermittent Infusions 250 mL**: 20 20

#### Fluids OUT

#### Urine out

### LAB AG Continuous Columns

<table>
<thead>
<tr>
<th>Sample Site</th>
<th>13:35</th>
<th>11:52</th>
</tr>
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<tbody>
<tr>
<td>CVP</td>
<td>CVP</td>
<td></td>
</tr>
<tr>
<td>pCO2</td>
<td>38 *</td>
<td>@c6</td>
</tr>
<tr>
<td>pH</td>
<td>7.26 *</td>
<td>@c6</td>
</tr>
<tr>
<td>Base Excess</td>
<td>-9 *</td>
<td>@c6</td>
</tr>
<tr>
<td>Hb</td>
<td>9.8</td>
<td>@c6</td>
</tr>
<tr>
<td>SO2</td>
<td>53</td>
<td>@c6</td>
</tr>
</tbody>
</table>

| pCO2        | 27 *  | @c6   |
| pH          | 7.36  | @c6   |
| Base Excess | -9 *  | @c6   |
| HCO3        | 15 *  | @c6   |
| Hb          | 12.8  | @c6   |
| SO2         | 78    | @c6   |
## Monitored Care (ICU and PCU)

**7/8/2007**

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### Colloid in - Volume/Bolus

<p>| | | | | | | | | | | | | |</p>
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<tbody>
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<td>Albumin 5% mL</td>
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<tr>
<td>RBC Leuko-Reduced 0-10000...</td>
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<td>350</td>
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### Medication Infusions

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<tr>
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<tr>
<td>Drotrecogin Alpha 0-10000 mcg</td>
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<td>50</td>
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<td>Fentanyl 0-10000 mcg/hour</td>
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<td>2</td>
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<tr>
<td>Midazolam 0-10000 mg/hour</td>
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</tbody>
</table>

### Fluids IN

- **0.9 NaCl 1000 mL at 10 mL/hour**: 250 → 250 → ↑
- **0.9 NaCl - Fluid Bolus 1000 mL**: 1000 → 1000 → ↑
- **Intermittent Infusions 250 mL**: 1000 → 1000 → ↑
- **LR - Fluid Bolus 1000 mL**: 1000 → 1000 → ↑

### Fluids OUT

<p>| | | | | | | | | | | | | |</p>
<table>
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<td>Catheter; Indwelling</td>
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<td>51</td>
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</table>

### LAB AG Continuous Columns

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<td>* @c6</td>
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<td>Hb</td>
<td>9.8</td>
<td>* @c6</td>
<td>8.4</td>
<td>* @c6</td>
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<tr>
<td>SO2</td>
<td>53</td>
<td>@c6</td>
<td>53</td>
<td>@c6</td>
</tr>
</tbody>
</table>

### LAB AG Continuous Columns

| pCO2        | 27  | * @c6 | 25  | * @c6 |
| pH          | 7.36| @c6   | 7.39| @c6   |
| Base Excess | -9  | * @c6 | -9  | * @c6 |
| HCO3        | 15  | * @c6 | 15  | * @c6 |
| Hb          | 12.8| @c6   | 10.3| @c6   |
| SO2         | 78  | @c6   | 68  | @c6   |
Few days later
Finally...
Chaos Theory of Critical Illness

Good Outcome

Bad Outcome

Window for Early Treatment & Prevention

Daily Rounds

911
Emergency Room
Operating room
Recovery room
Hospital ward
Rapid response team

ICU
“The most sophisticated intensive care becomes unnecessarily expensive terminal care…”

Peter Safar
### Challenges during golden hour

<table>
<thead>
<tr>
<th>Factors which may conspire together to make crises challenging</th>
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<tbody>
<tr>
<td>• They may present with opaque, non-specific signs or symptoms.</td>
</tr>
<tr>
<td>• They may arise from the interaction of many complex factors.</td>
</tr>
<tr>
<td>• The problems may evolve, revealing additional layers of complexity.</td>
</tr>
<tr>
<td>• The particular set of circumstances may never have been encountered before.</td>
</tr>
<tr>
<td>• Recently introduced processes and equipment may bring new unforeseen problems.</td>
</tr>
<tr>
<td>• Skilled assistance may not be available in the necessary time frame.</td>
</tr>
<tr>
<td>• They may have to be resolved very rapidly if disaster is to be averted.</td>
</tr>
</tbody>
</table>

Runciman et al. *Qual Saf Health Care* 2005
Challenges during golden hour

Factors which can affect human performance in a crisis

- The usual cognitive strategy, "frequency gambling", may be counterproductive in a crisis.
- The clinician may run out of rules or apply the wrong rules.
- Working from first principles, although powerful, may be too slow and laborious.
- Anxiety engendered by imminent disaster may degrade performance.
- The workload may be excessive in a crisis.
- A "mind set" may lead to "confirmation bias" (that is, new information is discarded).

Runciman et al. *Qual Saf Health Care* 2005
“The fundamental problem with the quality of medicine is that we’ve failed to view delivery of health care as a science”

• The tasks of medical science fall into three buckets.
  – understanding disease biology
  – finding effective therapies
  – insuring those therapies are delivered effectively

• That third bucket has been almost totally ignored. It’s viewed as the art of medicine.
  – “That’s a mistake, a huge mistake”
Science of Healthcare Delivery

Core Components (tools)

• Epidemiology
  The application of epidemiologic principles to understand the frequency, outcomes and risk factors associated with various healthcare delivery systems and approaches

• Clinical Informatics
  The application of clinical informatics to assist in the management and processing of data, information and knowledge to support the practice and delivery of clinical care

• Systems Engineering
  The application of systems engineering principles to design and implement novel health care systems which can more effectively deliver the highest quality care
## Probability of Performing Perfectly

<table>
<thead>
<tr>
<th>Number of Steps</th>
<th>Probability of Success for Each Step in the Process</th>
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<tbody>
<tr>
<td></td>
<td>0.95</td>
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<td>1</td>
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<tr>
<td>25</td>
<td>0.28</td>
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<tr>
<td>50</td>
<td>0.08</td>
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<tr>
<td>100</td>
<td>0.006</td>
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<table>
<thead>
<tr>
<th></th>
<th>Operating Room Crisis Checklists</th>
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<tbody>
<tr>
<td>1</td>
<td>Air Embolism – Venous</td>
</tr>
<tr>
<td>2</td>
<td>Anaphylaxis</td>
</tr>
<tr>
<td>3</td>
<td>Bradycardia – Unstable</td>
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<tr>
<td>4</td>
<td>Cardiac Arrest – Asystole/PEA</td>
</tr>
<tr>
<td>5</td>
<td>Cardiac Arrest – VF/VT</td>
</tr>
<tr>
<td>6</td>
<td>Failed Airway</td>
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<td>7</td>
<td>Fire</td>
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<tr>
<td>8</td>
<td>Hemorrhage</td>
</tr>
<tr>
<td>9</td>
<td>Hypotension</td>
</tr>
<tr>
<td>10</td>
<td>Hypoxia</td>
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</tbody>
</table>
Hemorrhage

Acute massive bleeding

START

1. Call for help and a code cart
   - Ask: “Who will be the crisis manager?”

2. Open IV fluids and assess for adequate IV access

3. Turn FiO₂ to 100% and turn down volatile anesthetics

4. Call blood bank
   - Activate massive transfusion protocol
   - Assign 1 person as primary contact for blood bank
   - Order blood products (in addition to PRBCs)
     - 1 FFP : 1 PRBC
     - If indicated, 1 platelet apheresis : 6 PRBCs

5. Request rapid infuser (or pressure bags)

6. Discuss management plan between surgical, anesthesiology, and nursing teams

7. Call for vascular surgery consultation

8. Keep patient warm

9. Send labs
   - CBC, PT/PTT/INR, fibrinogen, lactate, arterial blood gas, potassium, and ionized calcium

10. Consider...
    - Electrolyte disturbances (hypocalcemia and hyperkalemia)
    - Uncrossmatched type O blood if crossmatched blood not available
    - Contacting transfusion medicine physician (BB pager 35110 for guidance)
    - Damage control surgery (pack, close, resuscitate)
    - Special patient populations (see considerations below)

DRUG DOSES and treatments

HYPOCALCEMIA treatment
- Give calcium to replace deficit
  - (calcium chloride or calcium gluconate)

HYPERKALEMIA treatment
1. Calcium gluconate
   - 30 mg/kg IV
   - or
   - Calcium chloride
     - 10 units regular IV with 1–2 amps D50W as needed

2. Insulin
   - 10 units regular IV with 1–2 amps D50W as needed

3. Sodium bicarbonate
   - If pH < 7.2
   - 1–2 mEq/kg slow IV push

SPECIAL PATIENT POPULATIONS

OBSTETRIC:
- Empirical administration of 1 pool of cryoprecipitate (10 cryo units)
- Check fibrinogen... (goal is fibrinogen > 100 mg/dL)
  - If first fibrinogen level is:
    - < 100 mg/dL
      - Order 2 more pools of cryoprecipitate
    - 100 – 200 mg/dL
      - Order 1 more pool of cryoprecipitate

TRAUMA:
- Give either...
  - Antifibrinolytic tranexamic acid: 1000 mg IV over 10 minutes followed by 1000 mg over the next 8 hours
  - or
  - Aminocaproic acid: 4–5 g in 250 mL NS/RL IV over first hour followed by a continuing infusion of 1 g in 50 mL NS/RL IV per hour over 8 hours

NON-SURGICAL UNCONTROLLED BLEEDING despite massive transfusion of PRBC, FFP, platelets and cryo:
- Consider giving Recombinant Factor VIIa: 40 mcg/kg IV
- Surgical bleeding must first be controlled
- Use with CAUTION in patients at risk for thrombosis
- DO NOT use when PH is < 7.2
Operating room crises checklists: results

## Table 4. Participants’ Perceptions of Crisis Checklists, with Responses across All Checklist Scenarios.

<table>
<thead>
<tr>
<th>Survey Statement</th>
<th>Response Score</th>
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</thead>
<tbody>
<tr>
<td>The checklist helped me feel better prepared during the emergency scenario</td>
<td>4.4±0.81</td>
</tr>
<tr>
<td>The checklist was easy to use</td>
<td>4.3±0.84</td>
</tr>
<tr>
<td>I would use this checklist if I were presented with this operative emergency in real life</td>
<td>4.5±0.76</td>
</tr>
<tr>
<td>If I were having an operation and experienced this intra-operative emergency, I would want the checklist to be used</td>
<td>4.7±0.60</td>
</tr>
</tbody>
</table>
Key messages

- Even experienced clinicians make basic errors in crisis situations (box 2).
- This exposes clinicians to litigation and adverse publicity even if they are not at fault.
- The use of pre-compiled responses is one strategy clinicians can use to improve their performance and reduce perceived culpability (table 1).
- Crises may be very challenging (box 3).
- Clinicians may have difficulty responding appropriately (box 4).
- The use of pre-compiled responses should be supplemented by regular training, preferably in teams.
- Crisis management algorithms should be regularly reviewed and updated in the light of new information about what may go wrong in health care.
- Other disciplines in clinical medicine would benefit from the use of crisis management algorithms, based on consensus and evidence on what goes wrong in their field of practice.
Checklists in ICU practice

 QUALITY CORNER

 Journal of Critical Care, Vol 18, No 2 (June), 2003: pp 71-75

 Improving Communication in the ICU Using Daily Goals

 Peter Pronovost, Sean Berenholtz, Todd Dorman, Pam A. Lipsett, Terri Simmonds, and Carol Haraden


 An Intervention to Decrease Catheter-Related Bloodstream Infections in the ICU

 Peter Pronovost, M.D., Ph.D., Dale Needham, M.D., Ph.D., Sean Berenholtz, M.D., David Sinopoli, M.P.H., M.B.A., Haitao Chu, M.D., Ph.D., Sara Cosgrove, M.D., Bryan Sexton, Ph.D., Robert Hyzy, M.D., Robert Welsh, M.D., Gary Roth, M.D., Joseph Bander, M.D., John Kepros, M.D., and Christine Goeschel, R.N., M.P.A.

 Pronovost et al. Journal of Critical Care, 2003
 Pronovost et al. NEJM, 2006
Mind the gap

- Focus on specific condition/specialty/setting
  - CPR (too late)
  - Heart attack/stroke
  - Trauma
- ~90% of acute critical illness not covered by a structured approach
- Focus on training and remembering
- Expensive!
Conventional clinical practice

Courtesy Dr Kilickaya
Conventional clinical practice

Has no idea

Courtesy Dr Kilickaya
Conventional clinical practice

Has an idea

It is Wrong

Courtesy Dr Kilickaya
Conventional clinical practice

Knows what to do

Not organized

He delays

Courtesy Dr Kilickaya
CERTAIN practice

Idea?

Knows?

CERTAIN

Courtesy Dr Kilickaya
Need for CPR
(Consider patient preference i.e. DNR)

Primary ABCDE survey (Table 3) to identify problems that need immediate action (i.e. compromised airway, increased work of breathing, poor perfusion, severe dysrhythmia, seizure, external bleeding...)

Evaluation
- Situation
- Background
- Findings
- Problem List

Management
- Main presentation (Table 2)
  - i.e. shortness of breath, altered mental state, hypotension...
- History
  - i.e. COPD, diabetes, cirrhosis...
- Medications
  - i.e. anticoagulation, insulin...
- Allergies
- Vital signs
  - i.e. HR, BP, RR, SpO₂, Temp, UOP
- Physical exam
  - ABCDEs (Table 3)
- Critical labs
  - i.e. ABG, CBC, lactate...
- Bedside ultrasound and ECG
- Advanced diagnostics
  - i.e. X-ray, CT, angiography...

General
- Oxygen
- Vascular access
- Blood sample
- ECG monitor
- Point of care US

Context Specific
- Fluid bolus
- Vasopressors
- Intubation
- Sedation
- Antimicrobials
- Cardioversion
- ...

Critical care syndromes
- Sepsis
- Respiratory failure
- Shock
- Acute coronary syndrome
- Coma
- Gastrointestinal bleeding
- ...

System based evaluation and plan of care
- Neural
- Cardiovascular
- Respiratory
- Nephrology
- Gastrointestinal
- Endocrine
- Hematology
- Infectious disease
- Skin
- Devices
- Patient/family goals
- ICU discharge plan

Kilickaya et al. Yearbook of Intensive Care and Emergency Medicine 2014, in press
Novel Representation of Clinical Information in the ICU

Developing User Interfaces which Reduce Information Overload

B.W. Pickering^1,2; V. Herasevich^1,2; A. Ahmed^2; O. Gajic^2

Patient knowledge

Medical knowledge

Data Cloud

Extract High Value Data

Information Packages Constructed

Holistic Picture Emerges
Methodology

Field observation → Surveys & interviews → Workflow & workshops → Simulated tests
Simulation
CERTAIN description

ELITE
Stabilization Module

Admission

Resuscitation

ROUNDS
Optimization Module

Rounding

http://www.icertain.org/
**Decision support**

### Sepsis

#### Immediate considerations
- **Cultures**
  - Cultures should be taken as soon as possible and before antimicrobial therapy
- **Antibiotics**
  - Antibiotics should be initiated as soon as possible according to likely pathogen, site of infection, immune status, and allergy
- **Source control**
  - Remove dead tissue, pus, or infected device for source control
- **Fluid challenge**
  - Start fluid bolus (~30ml/kg), repeat as needed to achieve adequate tissue perfusion taking into consideration fluid responsiveness
- **Vasopressors**
  - Add vasopressors for shock despite fluid resuscitation
- **Steroids**
  - Add steroids for shock despite vasopressors
- **Limit oxygen consumption**
  - Consider mechanical ventilation, use analgesics, sedatives, and neuromuscular blockers as appropriate to limit oxygen consumption

#### Management after stabilization

#### Cautions
Keeping track of interventions
Checklist with timer for critical procedures

Intubation

Indications
- Continuous monitoring: HR, rhythm, RR, BP, SpO2
- Equipment: Suction, bag and mask, laryngoscope, different sized blades, stylet, different sized ET tubes, preparation for difficult airway, drugs, fixing material
- Preoxygenation (3 minutes), handholding and reassurance
- Medications (Click on the options in the table to select, then issue)

<table>
<thead>
<tr>
<th>Seq.</th>
<th>RSI</th>
<th>Non-RSI</th>
<th>Awake fiberoptic intubation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Midazolam 2 mg</td>
<td>Midazolam 5 mg</td>
<td>Topical anesth. of oropharynx</td>
</tr>
<tr>
<td>2</td>
<td>Ketamine 50 mg</td>
<td>Propofol 70 mg</td>
<td>Midazolam 2 mg</td>
</tr>
<tr>
<td>3</td>
<td>Propofol 50 mg</td>
<td>Fentanyl 100 mcg</td>
<td>Fentanyl 100 mcg</td>
</tr>
<tr>
<td>4</td>
<td>Succinylcholine 100 mg</td>
<td>Rocuronium 50 mg</td>
<td>Incremental doses as needed</td>
</tr>
</tbody>
</table>

Cautions
- Intubation
- Check tube position: Auscultation, EtCO2 monitoring, chest X-ray, etc.
- Fix the tube: Record the depth of ETT at the lip (~24 cm/men, ~22 cm/women)
- Ventilation
  - Mode: AC
  - PEEP: 5-15 cmH2O
  - TV: 450 ml (men), 350 ml (women)
  - Rate: 20-35 /minute

Hypnosedatives
- Midazolam 2 mg
- Ketamine 50 mg
- Propofol 50 mg
- Etomidate 15 mg

Opioids
- Fentanyl 50 mcg

Neuromuscular blockers
- Succinylcholine 100 mg
- Rocuronium 50 mg

Other drugs (as needed)
- Phenylephrine 0.2 mg
- Ephedrine 10 mcg
- Metoprolol 5 mg

BW 64

Drug
Dose
Unit
Route
Order

Start CPR 03:04:06 AM
Hypothesis

The care assisted by decision support tool (CERTAIN) will improve the process and outcome of acute critical illness.
Aim

• Designing point of care decision support (CERTAIN) to facilitate global adoption of systematic and disciplined evaluation and treatment of acutely ill patients

• To Implement CERTAIN into clinical practice of ICUs with variable resources, across the globe and evaluate the impact of this tool on the processes and patient outcomes
Study Sites

- Bosnia
- Serbia
- Turkey
- Mexico
- Panama
- Dominican Republic
- Brazil
- Kenya
- Rwanda
- Uganda
- Mongolia
- China
- India
### Step-wedge cluster implementation

<table>
<thead>
<tr>
<th>Hospital 1 (PILOT)</th>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systematic review of best practice</td>
<td>Identification of local clinical champions</td>
<td>Implementation of CERTAIN</td>
</tr>
<tr>
<td>CERTAIN Customization based on local needs</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Hospital 2 | | |
| Hospital 3 | | Implementation of CERTAIN |
| Refine CERTAIN prototype | Education on best practices | |

| Hospital 4 | | |
| Hospital X | | |

| All Hospitals | | |
| Define, design, implement, validate and maintain key data entry to the cloud environment in support of clinical utilization of CERTAIN | | |

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<td></td>
</tr>
<tr>
<td>Refine CERTAIN prototype</td>
<td>Education on best practices</td>
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<td>Hospital 4</td>
<td></td>
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<tr>
<td>Hospital X</td>
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| All Hospitals | Define, design, implement, validate and maintain key data entry to the cloud environment in support of clinical utilization of CERTAIN | | |
Online data collection

Log In

Please log in with your user name and password. If you are having trouble logging in, please contact REDCap Admin (5-6033).

Username: 
Password: 
Log In
Cloud computing
Remote education of bedside providers

• Transcontinental “screen share” feature (CERTAIN)

  AND

• Cheap audio (+/- video) communication (Skype, Google+...
Online training

– Mission statement explaining the rationale and importance of early resuscitation.
– “Knobology” video: visual guide through software functionality
– Access: opportunity of exploration of CERTAIN software by themselves
– PowerPoint Presentation of Workflow and CERTAIN methodology
– Video of a case management using CERTAIN workflow
Video-assisted coaching and certification

– Refreshing key aspects of online training
– “Knobology” quiz (computer-assisted checklist use)
– Video assisted team training

<table>
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<tr>
<th>Training</th>
<th>Participant 1</th>
<th>Participant 2</th>
<th>Participant 3</th>
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<tr>
<td>Test Case 1A</td>
<td>Team Leader</td>
<td>Prompter</td>
<td>Team Member</td>
</tr>
<tr>
<td>Test Case 2A</td>
<td>Team Member</td>
<td>Team Leader</td>
<td>Prompter</td>
</tr>
<tr>
<td>Test Case 3A</td>
<td>Prompter</td>
<td>Team Member</td>
<td>Team Leader</td>
</tr>
</tbody>
</table>

– Certification (scoring)

<table>
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<th>Participant 1</th>
<th>Participant 2</th>
<th>Participant 3</th>
</tr>
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<tbody>
<tr>
<td>Test Case 1B</td>
<td>Team Leader</td>
<td>Prompter</td>
<td>Team Member</td>
</tr>
<tr>
<td>Test Case 2B</td>
<td>Team Member</td>
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<td>Prompter</td>
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</tbody>
</table>

– Survey
Refining, customizing and updating decision support content

• Systematic review of practice guidelines
  – checklist drafts by investigators from various backgrounds (anesthesiology, emergency and internal medicine)

• International survey of acute care providers

• Iterative review through a structured feedback by expert users from various international settings and backgrounds ("bug reports")
Users’ feedback with screen capture

Contact form

Name
Ognjen Gajic,

E-mail
gajic.ognjen@mayo.edu

Comment

Send
PDSA cycles

- Concept Introduction
- Identification of local champions
- Education and Training
- Data gathering and Quality improvement
- Tool Refinement and Validation
- Patient Betterment
Outcome assessment

- Better care: Adherence to basic critical care processes
- Better health: Hospital and 28 days mortality
- Lower cost: Hospital length of stay
The Survey On Critical Care Practices In Developing Countries

M. Kojicic Vukoja¹, E. Riviello², M. Dunser³, N. Adhikari⁴, R. Fowler⁵, M. Schultz⁶, M.N. Gong⁷, D. Talmor⁸, O. Gajic⁹, O. Kilickaya⁸

¹The Institute for Pulmonary Diseases of Vojvodina – SremskaKamenica, Serbia
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³Salzburg General Hospital – Salzburg, Austria
⁴Sunnybrook Health Sciences Centre – Toronto, Canada
⁵Academic Medical Center, University of Amsterdam – Amsterdam, Netherlands
⁶Montefiore Medical Center – Bronx, USA
⁷Beth Israel Deaconess Medical Center – Boston, USA
⁸Mayo Clinic – Rochester, USA

Rationale
Timely critical care is the key component of care for acutely ill or injured patients, but its effectiveness may be limited in low resource settings. To implement best practices in intensive care units (ICUs) in low and middle income countries, an internationally representative group of clinicians developed a point of care training and decision support tool: CERTAIN (Checklist for Early Recognition and Treatment of Acute Illness). We undertook a critical care needs assessment in middle and low income countries to inform future decision support interventions.

Method
A cross-sectional 22-item web-based survey was conducted in a convenience sample of 15 ICUs in Eastern Europe (4), Africa (4), Asia (4) and Latin America (3) between April and July 2012. Four ICUs were from low income, 7 from low-middle income and 9 from upper-middle income countries according to the World Bank country category. Clinician respondents were asked about the number of beds, patient characteristics, human resources, drugs, equipment, education, and processes of care.

Results
Fifteen clinicians (1 per ICU) responded. Hospitals had median (IQR) 520 (150–1200) beds. The ICUs had on average 10 (6–13) beds and treated 31 (20–60) patients/month. Most (47%) patients were 51–60 years old. The most common perceived cause of death was sepsis (7 ICUs), road traffic trauma (3 ICUs), followed by ischemic heart disease (1 ICU), stroke (1 ICU), conditions leading to emergency operations (1 ICU), nutritional diseases (1 ICU), illness in newborn children (1 ICU) and diseases of the respiratory system (1 ICU). Many ICUs had staff (doctor, clinical officer, nurse) with some formal critical care training (n=9) or who completed Fundamental Critical Care Support (n=7) or Advanced Life Support (n=10). Course. The availability of ICU staff, drugs and equipment are presented in figures 1 and 2. Only two ICUs used checklists. Thirteen ICUs listed lack of trained staff as the most important barrier to improving the care and outcome of critically ill patients.

Conclusion
In a convenience sample of highly motivated ICUs from low and middle income countries, trained staff and processes of care such as checklists are frequently lacking even as access to ICU resources is reasonable. Evaluation of interventions to bring context-appropriate best practices to the bedside of critically ill patients should be a global priority.

Acknowledgement
The authors thank physicians working in the ICUs of participating centers for providing the data.

CERTAIN: Checklist for Early Recognition and Treatment of Acute Illness

http://www.icertain.org/
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Oguz Kilickaya
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Fan Lei
Guangxi Li
John Litell
Jack O'Horo
Hajrunisa Omanic
Sonal Pannu
Pauline Park
Brian Pickering
Beth Rivello
Marcus Schultz
Serkan Senkal
Sanjay Subramanian
Danny Talmor
Venu Velagapudi
Marija Vukoja
AWARE & CERTAIN

http://www.icertain.org/

...to prevent
DEATH
(Diagnostic Errors and Therapeutic Harm)

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