



# **Increasing efficiency in the ED: Evidence based guidelines as a driver for quality**

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Houston, Texas



# Disclosures

- I do not have any relevant financial relationships with the manufacturers of any commercial products and/or provider of commercial services discussed in this presentation

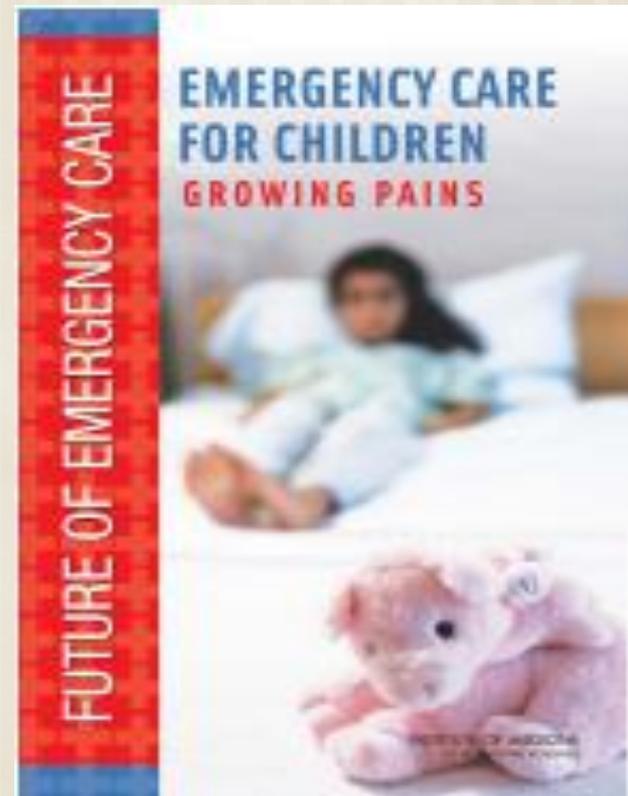
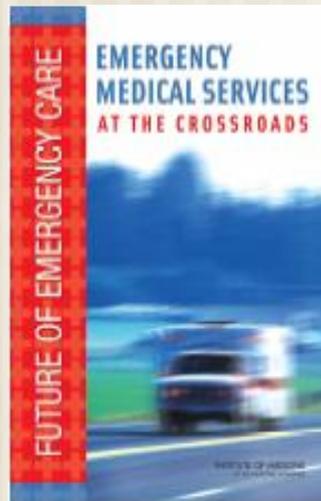
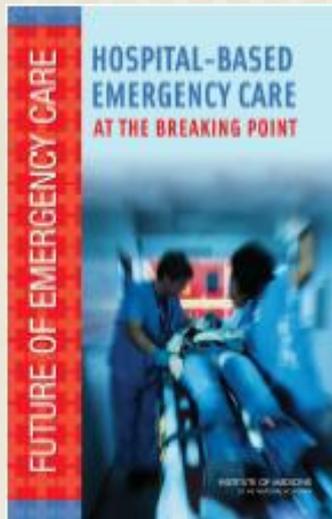


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# Future of Emergency Care



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# The Washington Post

June 15, 2006

Emergency medical care in the United States is on the verge of collapse...

...As a system...it provides care of variable and often unknown **quality**...



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## One definition of *quality*

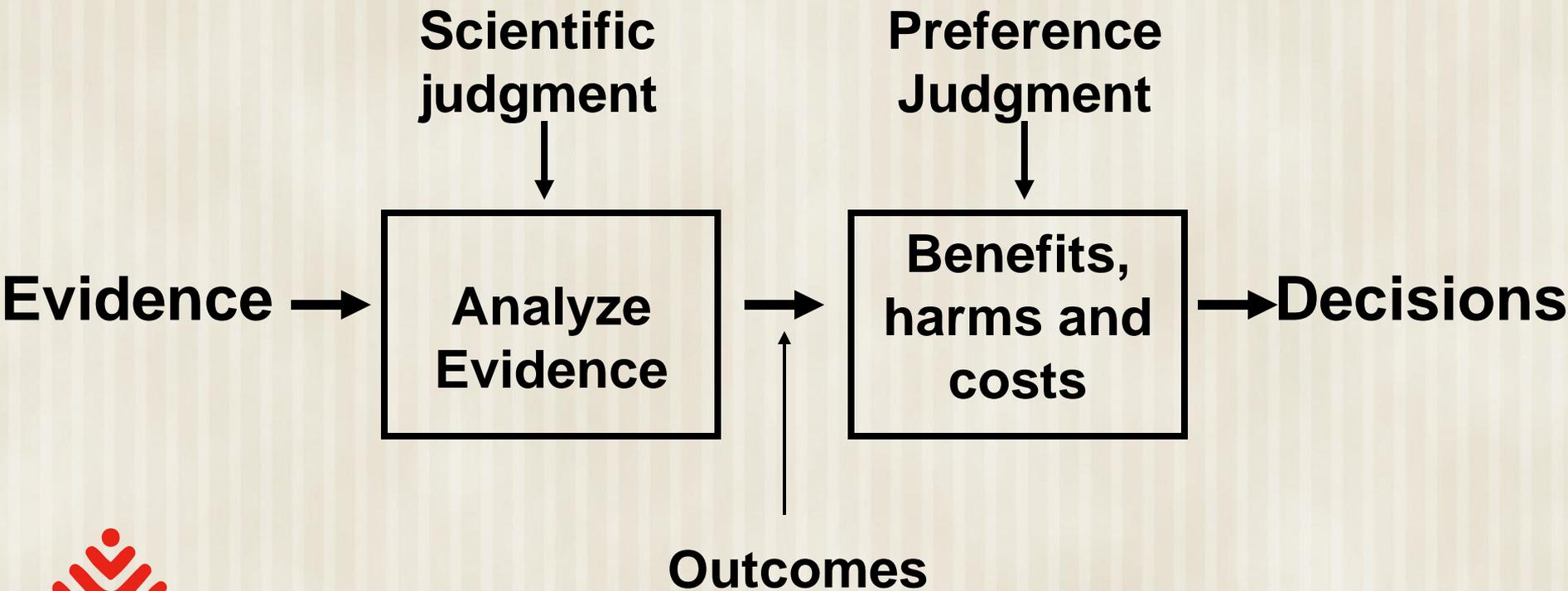
- The degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are **consistent with current professional knowledge**

KN Lohr, N Engl J Med, 1990



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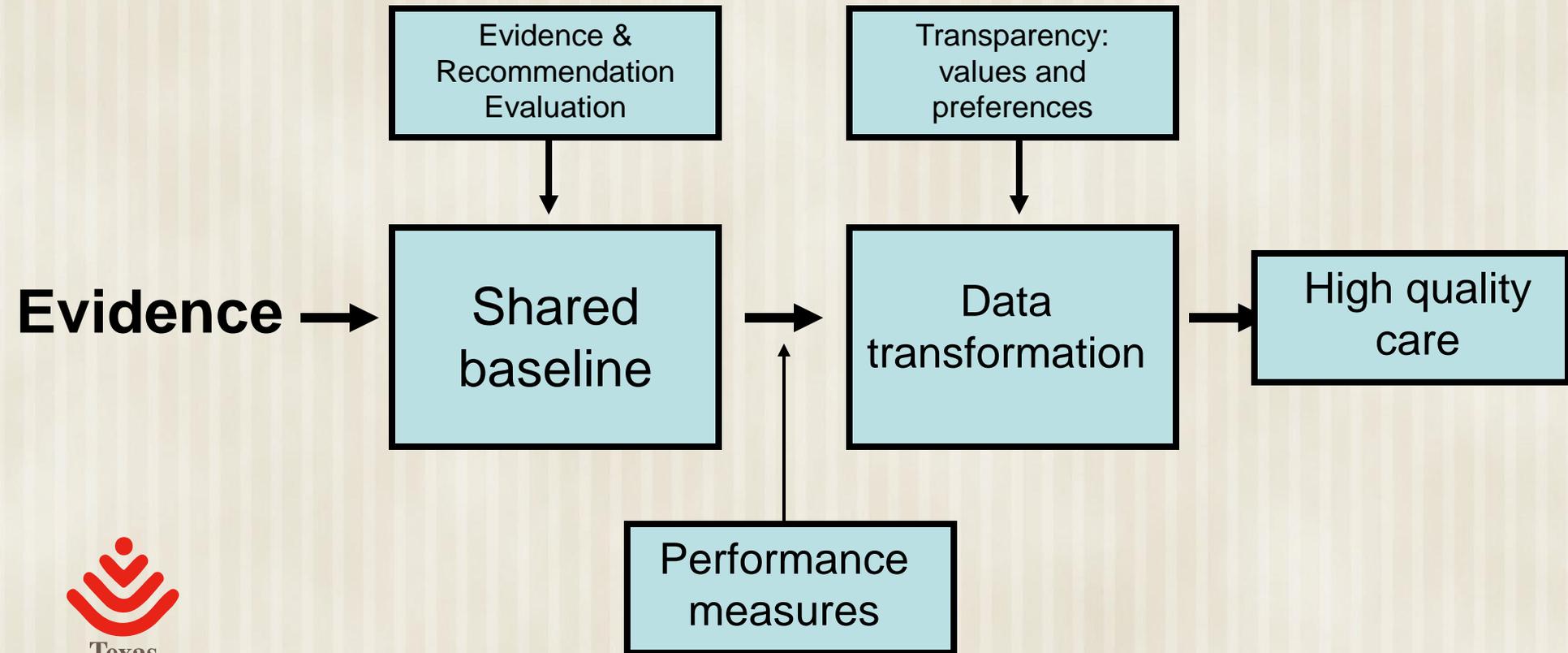


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Adapted from D Eddy MD, PhD

# Decision making and quality



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# Why does it matter? A parallel example

- RCT of treatment of hypertension on the jobsite (a steel mill) versus referral to the PCP
- No difference in compliance between the groups
- Exploration of factors relating to therapy revealed specific determinants of the clinical decision to treat some, but not other, hypertensive patients:
  1. The level of diastolic blood pressure.
  2. The patient's age.
  3. ?????
  4. The amount of target-organ damage.



## A parallel example

- RCT of treatment of hypertension on the jobsite (a steel mill) versus referral to the PCP
- No difference in compliance between the groups
- Exploration of factors relating to therapy revealed specific determinants of the clinical decision to treat some, but not other, hypertensive patients:
  1. The level of diastolic blood pressure.
  2. The patient's age.
  3. **The year the physician graduated from medical school**
  4. The amount of target-organ damage.



# The purpose of EBGs: minimizing variation

- Wide variations in practice are often not related to differences among patients
- Minimizing variations in practice can improve quality of health care delivery
  - Variation in beliefs
  - Variation in interpretation of evidence
  - Variation in response when evidence is lacking
- Does this variation exist in emergency medicine?



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# Variation in ED practice

Entity	Population	Study	Variation
Acute asthma	Eastern Ontario	Lougheed, Chest 2009	Systemic steroids, PEFr, referrals to asthma services
Asthma admissions	Ontario	Lougheed Chest 2006	3 fold variation in hospitalization rates for asthma influenced by variation in % ED pts admitted
Trauma facility utilization	California	Wang Ann Emerg Med 2008	Trauma center hospitalization varied by distance of residence, presence of private insurance
Periorbital cellulitis	Vancouver	Goldman Ped Emerg Care 2008	po vs IV antibiotics Variation in decision for hospitalization
AGE	PHIS	Tieder Pediatrics 2009	Variation in resource use: electrolytes, stool studies, UA/Ucx, antibiotics, antiemetics
Retropharyngeal abscess	KID 2003	Lander Int J Pediatr Oto 2008	Variation in hospitalization; Midwest had decreased total charges and LOS

# Empowering the “*art*” of medicine

- Evidence based guidelines help control complexity
  - Analytic methods to understand outcomes
  - Divide and conquer for different personnel
  - Reductionism to a more efficient functioning
- Pareto principle
  - 80/20 rule
  - 20% of the problems cause 80% of the trouble
  - 80% of the benefit will come from 20% of the opportunities



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“*Art*” is in the eye of the beholder



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# Creating EBGs:

## 1. Identifying the quality gaps

- Targeting areas for quality improvement
  - High prevalence
  - Marked variations in care
  - Resource intensive care
  - High morbidity or mortality



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# Clinical Guidelines and Order Sets

[EB Medicine Course](#) - Click here for information on the Evidence-Based Medicine course.

## EVIDENCE-BASED OUTCOMES CENTER

	<b>Updated</b>
<a href="#">Acute Chest Syndrome - SCD</a>	11/2008
<a href="#">Acute Gastroenteritis</a>	07/2009
<a href="#">Acute Heart Failure</a>	08/2009
<a href="#">Acute Otitis Media</a>	07/2008
<a href="#">Appendicitis/Appendectomy</a>	11/2008
<a href="#">Asthma</a>	10/2008
<a href="#">Bronchiolitis</a>	01/2008
<a href="#">Cancer Center Procedural Management</a>	11/2009
<a href="#">Cardiac Thrombosis</a>	08/2009
<a href="#">Community Acquired Pneumonia</a>	02/2009
<a href="#">Deep Vein Thrombosis</a>	03/2009
<a href="#">DKA</a>	11/2009
<a href="#">Fever and Neutropenia in Children with Cancer</a> Newly Revised	05/2010
<a href="#">Fever Without Localizing Signs 0-60 d</a>	03/2009
<a href="#">Fever Without Localizing Signs 2-36 mo</a>	03/2009
<a href="#">Hyperbilirubinemia</a>	02/2010
<a href="#">Neonatal Thrombosis</a>	10/2009
<a href="#">Nutrition/Feeding in the Infant Post-Cardiac Surgery</a>	02/2010
<a href="#">Rapid Sequence Intubation</a> *	
<a href="#">Skin and Soft Tissue Infection - Cellulitis</a> *	03/2010
<a href="#">Status Epilepticus</a>	06/2009
<a href="#">Stroke</a> *	
<a href="#">Tracheostomy Management</a> *	
<a href="#">Urinary Tract Infection</a>	05/2008

## Nursing Table of Contents

- 06 North
- 10 Tower Neurology  
Neurosurgery
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and Transplant
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- Advanced Practice Registered  
Nurses
- After Hours Call Center
- BMTU 8WT
- Cancer Center Inpatient 9WT
- Cardiac Catheterization  
Laboratory
- Cardiovascular ICU
- Evidence Based Outcomes  
Center
  - Acute Heart Failure
  - Acute OM Guideline
  - ACS Guideline
  - AGE Guideline
  - Appy Clinical Guideline
  - Asthma Guideline
  - Bronchiolitis Guideline
  - CAP Guideline
  - Cardiac Thrombosis
  - Cellulitis Guideline

# Creating EBGs:

## 2. Assembling a team

- Team
    - Community or Subject Area Practitioner Leader
    - Champion of Guideline topic
    - Sub-specialists in the area of focus
    - Nurses
    - Pharmacist
    - Other Allied Healthcare providers (RTs, OT/PT, etc.)
    - Family / patient
  - Clinical Effectiveness and other support
    - Facilitator
    - Methodologist
    - Librarian
    - Data analyst and outcomes coordinator
    - Educator
- “Bottom-up” team building and interdisciplinary care are fundamentals of quality improvement**



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# Creating EBGs:

## 3. Identifying the questions in *PICO* format

- P – population
  - “In **ED patients** with bronchiolitis...”
- I – intervention
  - “...does nebulized hypertonic saline...”
- C – comparison
  - “when compared to standard therapy...”
- O – outcome of interest
  - “**prevent admission, shorten ED stay, etc.**”



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# Creating EBGs: 4. Conducting the search

(bronchiolitis and hypertonic saline) AND systematic[sb] - PubMed result - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.ncbi.nlm.nih.gov/pubmed?term=Clinical=bronchiolitis+and+hypertonic+saline&term=(bronchiolitis+and+hypertonic+saline)+AND+systematic[sb]&p%24a=0p%24l=PubMedStaticPages&p%24el=0p%24st

Search: PubMed

(bronchiolitis and hypertonic saline) AND systematic[sb] Search Clear

Display Settings:  Summary, Sorted by Recently Added Send to:

**Results: 4**

- [Towards evidence based emergency medicine: Best BETs from the Manchester Royal Infirmary. Bet 1. Nebulised hypertonic saline significantly decreases length of hospital stay and reduces symptoms in children with bronchiolitis.](#)  
Horner D.  
Emerg Med J. 2009 Jul;26(7):518-9. Review.  
PMID: 19546275 [PubMed - indexed for MEDLINE]  
[Related articles](#)
- [Bronchiolitis: from empiricism to scientific evidence.](#)  
Carraro S, Zanconato S, Baraldi E.  
Minerva Pediatr. 2009 Apr;61(2):217-25. Review.  
PMID: 19322125 [PubMed - indexed for MEDLINE]  
[Related articles](#)
- [Nebulized hypertonic saline solution for acute bronchiolitis in infants.](#)  
Zhang L, Mendoza-Sassi RA, Wainwright C, Klassen TP.  
Cochrane Database Syst Rev. 2008 Oct 8;(4):CD006458. Review.  
PMID: 18843717 [PubMed - indexed for MEDLINE]  
[Related articles](#)
- [Current treatment for acute viral bronchiolitis in infants.](#)  
Martín-Torres F.  
Expert Opin Pharmacother. 2003 Aug;4(8):1355-71. Review.  
PMID: 12877643 [PubMed - indexed for MEDLINE]  
[Related articles](#)

Display Settings:  Summary, Sorted by Recently Added Send to:

**Filter your results:**

All (4)

[Review \(4\)](#)

Free Full Text (0)

[Manage Filters](#)

**Titles with your search terms**

► Evidence-based emergency medicine/systemat [Ann Emerg Med. 2010]  
» See more...

**Find related data**

Database:

**Search details**

Turn Off

```
(("bronchiolitis"[MeSH Terms] OR "bronchiolitis"[All Fields]) AND ("saline solution, hypertonic"[MeSH Terms] OR ("saline"[All Fields] AND "solution"[All Fields]))
```

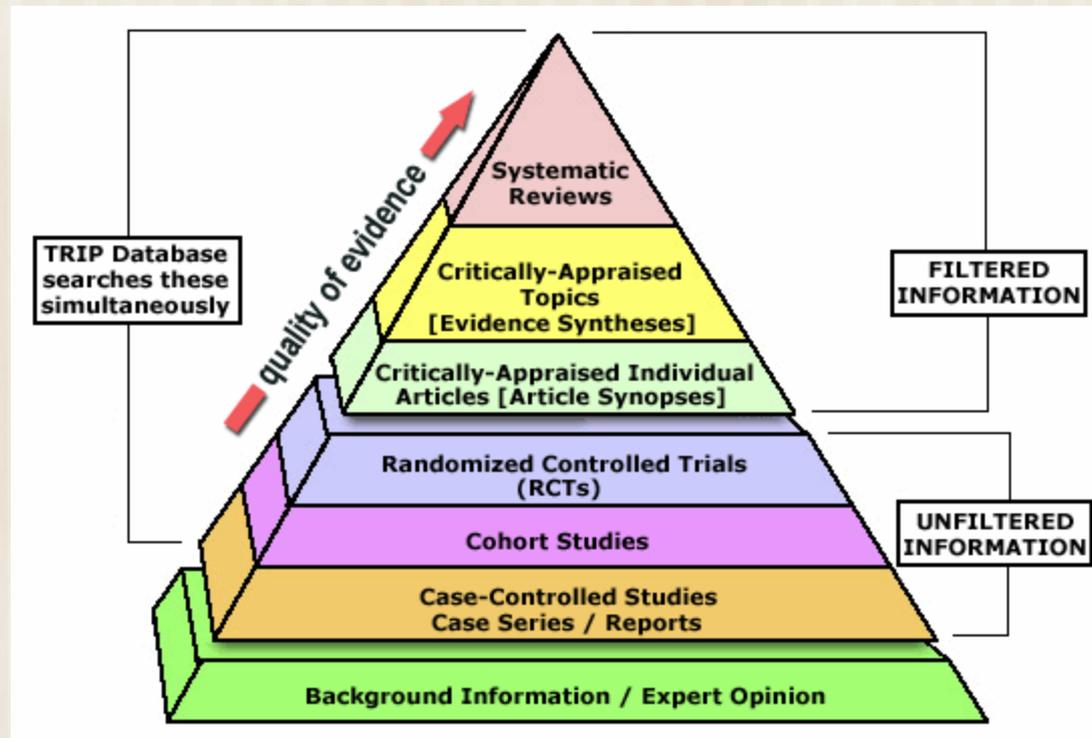
» See more...

**Recent activity**

Turn Off Clear

🔍 (bronchiolitis and hypert... (4) PubMed  
» See more...

# Creating EBGs: 5. Evaluating the Evidence



# Grading of Recommendations, Assessment, Development and Evaluation

- Recommendations
  - Strong
  - Weak
- Evidence quality
  - High
  - Moderate
  - Low
  - Very low



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# Guideline appraisal of existing guidelines

- AGREE (Appraisal of Guidelines Research and Evaluation)
  - Becoming “industry standard”
- 23 item list with six domains
  - scope and purpose
  - stakeholder involvement
  - rigor of development
  - clarity and presentation
  - applicability
  - editorial independence



# When the evidence is lacking

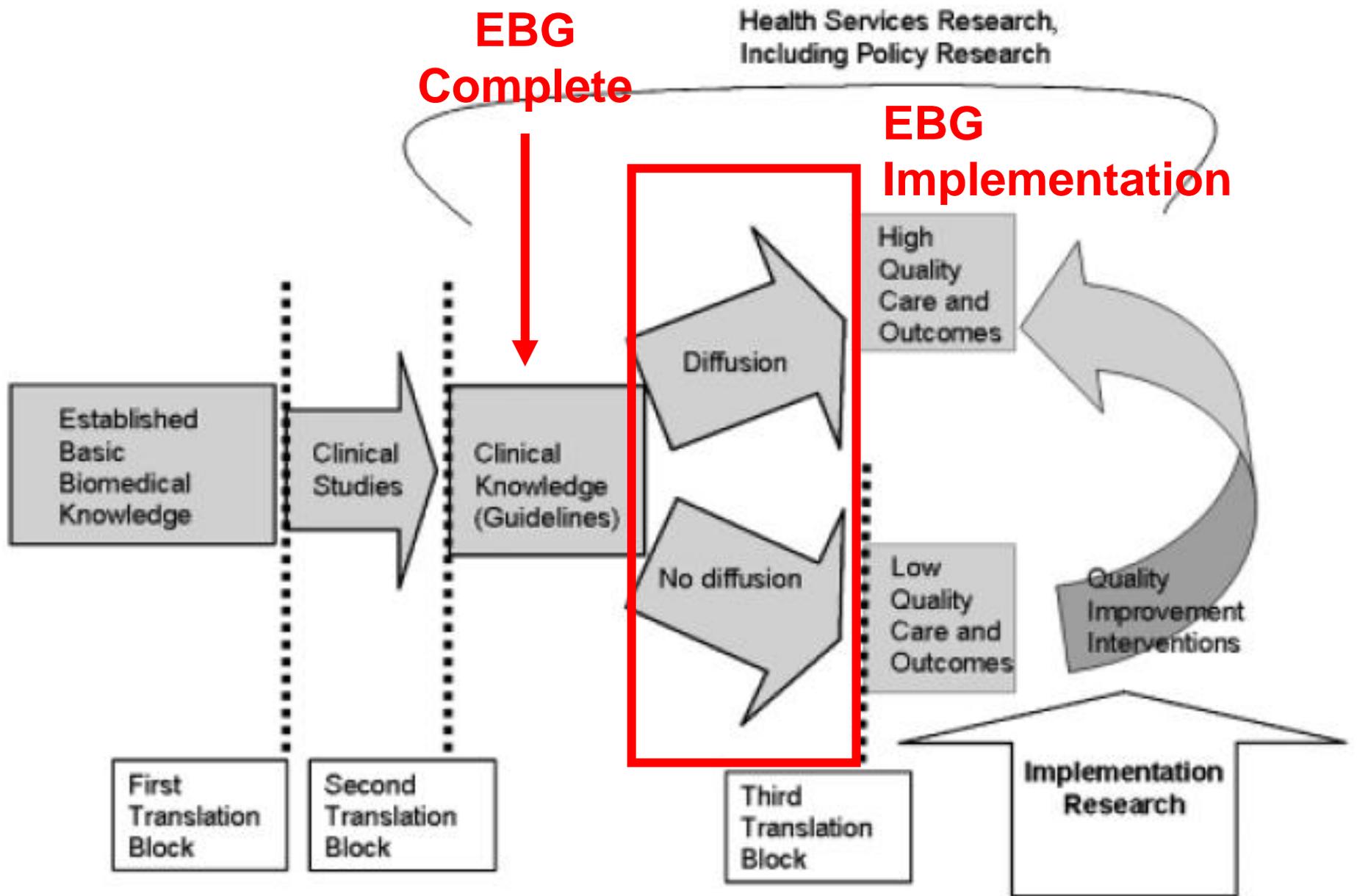
- Standardize (goal of a guideline)
- Revisit evidence frequently and rigorously
- Clinical/outcomes research to increase evidence base



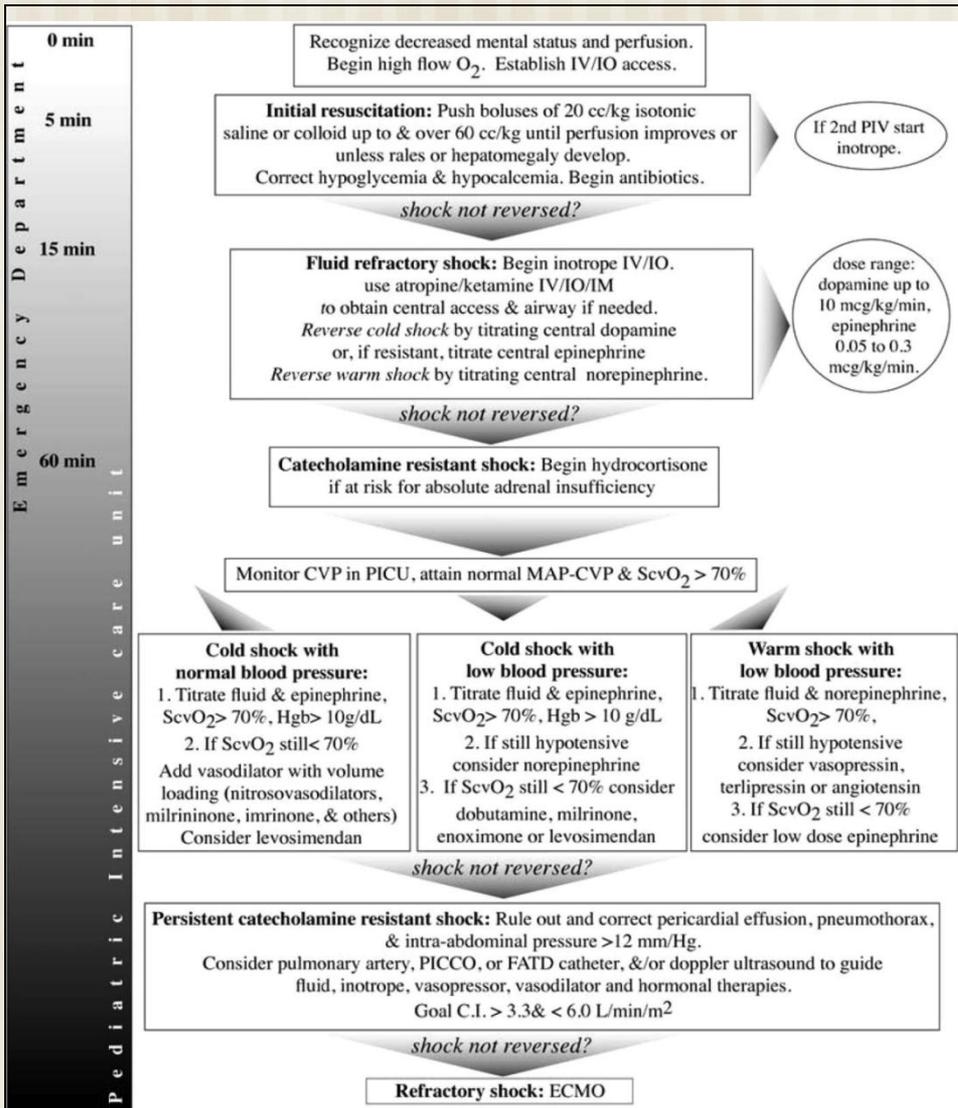
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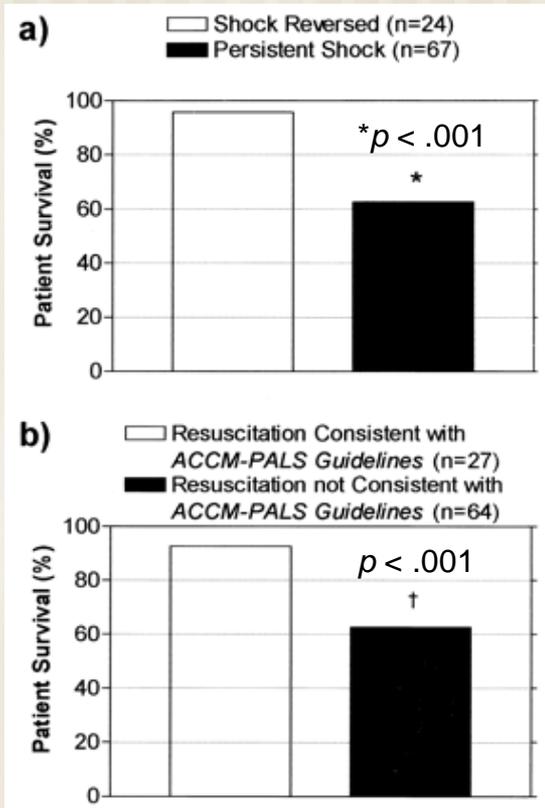


# Age-specific goal directed therapy



- ER: 1<sup>st</sup> hour fluid resuscitation and inotrope therapy
  - Therapeutic endpoints:
    - ▣ Threshold heart rate
    - ▣ Normal blood pressure
- Capillary refill ≤2 sec
  - ▣ Normal pulses
  - ▣ Warm extremities
  - ▣ Normal glucose and ionized calcium
- Monitoring
- Recommendations:
  - ▣ Airway and breathing
  - ▣ Circulation
  - ▣ Fluid resuscitation
  - ▣ Hemodynamic support
  - ▣ Hydrocortisone therapy
- Ongoing ICU hemodynamic support
  - ▣ Central venous oxygen saturation >70%
  - ▣ Cardiac Index 3.3-6.0 L/min/m<sup>2</sup>

# Shock reversal resulted in better survival



Multiple logistic regression analyses revealed time-dependent relationships between persistent shock and delayed ACCM-PALS-directed resuscitation with poor outcome

Variable	Mortality Odds Ratio	95% Confidence Interval
Duration of persistent shock (per 1-hour increment)	2.29	1.19 – 4.44
Delay in resuscitation consistent with ACCM-PALS Guidelines (per 1-hour increment)	1.53	1.08 – 2.16

- Improved mortality by 38%
- Number Needed to Treat = 3.3

## Evidence for *goal directed therapy*

PI	Study	Population	Outcome
Ninis	<i>BMJ</i> 2005	Meningococcal septic shock	22.6 adjusted mortality OR with delay in inotrope resuscitation
de Oliveira	<i>Intensive Care Med</i> 2008	Shock with continuous central venous oxygen sat monitoring	RCT: Goal directed therapy via 2002 guidelines decreased mortality from 39% to 12% (NNT 3.6)
Karapinar	<i>Crit Care Med</i> 2004	Tertiary care center patients in fluid refractory shock	Before/after 28 day mortality of targeted goal: 3% otherwise healthy and 9% chronically ill
Maat	<i>Crit Care</i> 2007	Referral, transport and tertiary care center	Reduction in mortality rate from purpura and severe sepsis to 1% (ARR of 19%)

# Shock management at TCH: 2009

- Time to FIRST bolus: 53 min
- Time to THIRD bolus: 152 min
- Time to first antibiotic: 127 min
- Time to PICU: 260 min



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# The team

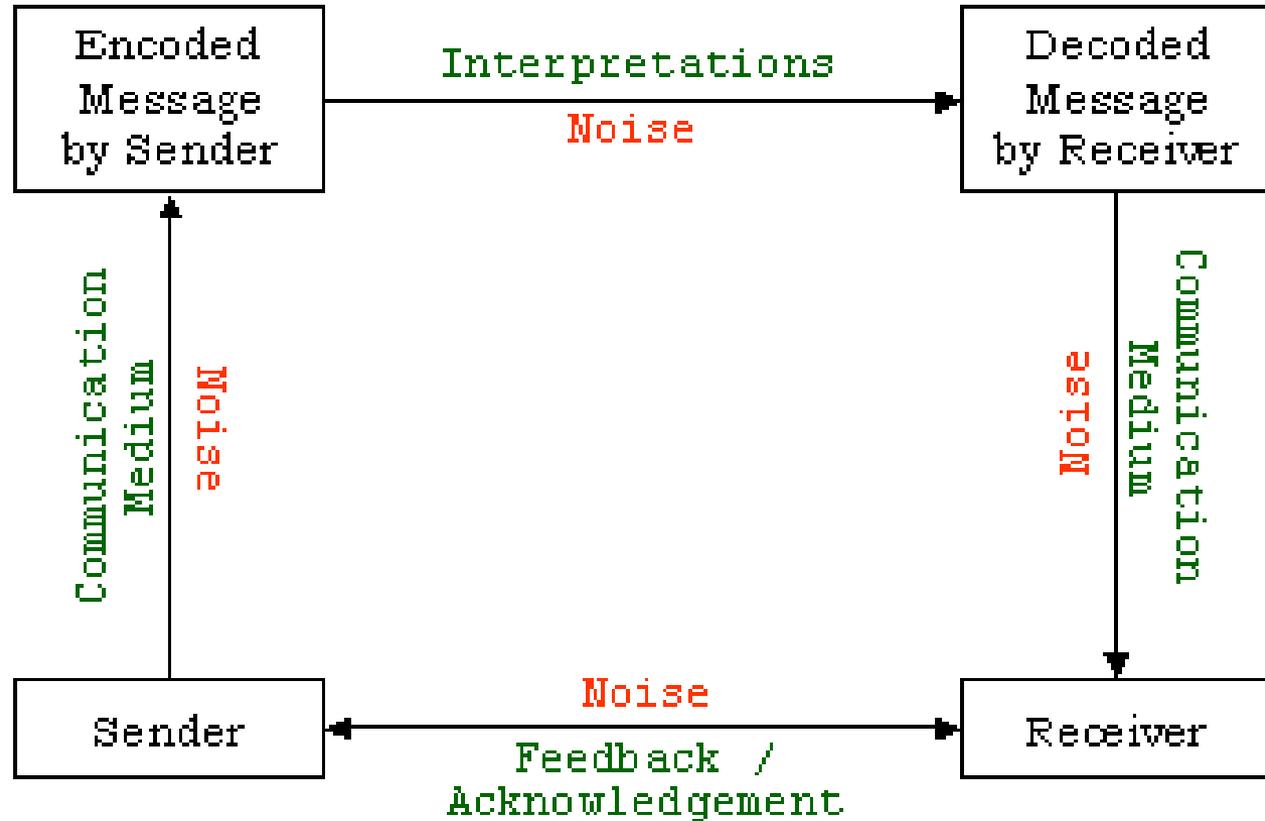
- ED: B Patel MD
- ED: A Perry MD
- ED/ID: A Cruz MD, MPH
- Nursing: E Wuestner RN
- PICU: E Williams MD
- Transport: J Graf MD
- Nursing administration: E Fredeboelling RN



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# Model for communication



A Communication Model



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**I hate you  
more!**



**Intensive  
care unit**



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**Emergency  
center**

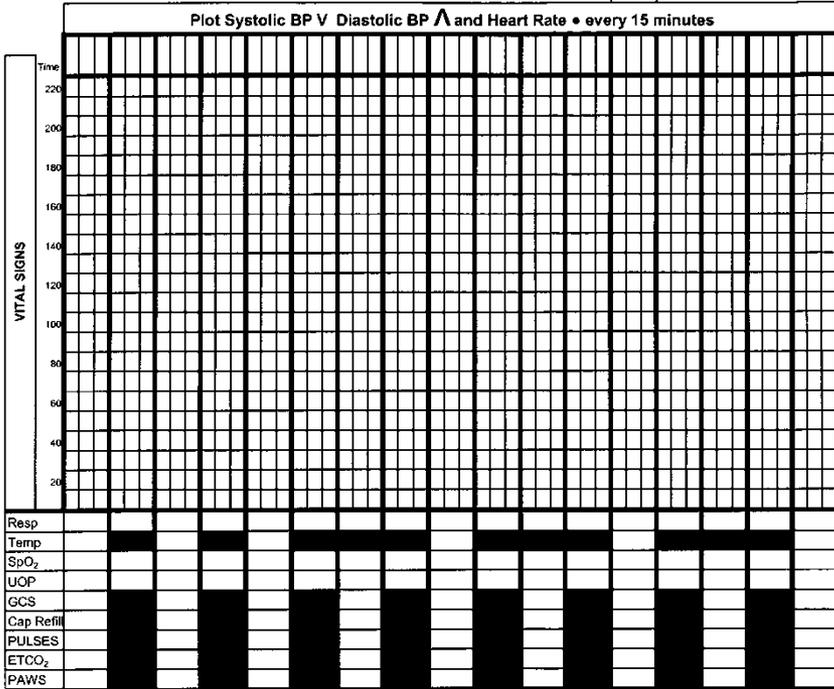
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Courtesy of Eric Williams MD

Date \_\_\_\_\_ Time \_\_\_\_\_ Allergies \_\_\_\_\_  NKDA  
 Weight \_\_\_\_\_ kg  
 O<sub>2</sub> Delivery \_\_\_\_\_ @ \_\_\_\_\_ LPM IV sites: #1 \_\_\_\_\_ #2 \_\_\_\_\_

INITIALS SIGNATURE & TITLE



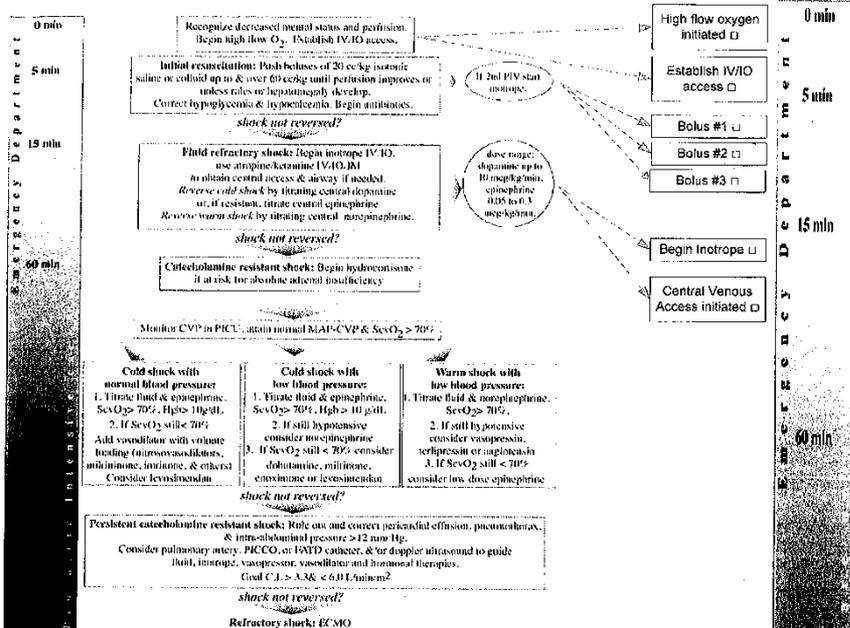
IV Fluids/ Medications	Volume/ Dose	Route	Time	Initials
Bolus # 1				
Bolus # 2				
Bolus # 3				
Bolus # 4				
Zosyn®				
Gentamicin				
Vancomycin				

VBG pH \_\_\_\_\_ CO<sub>2</sub> \_\_\_\_\_ O<sub>2</sub> \_\_\_\_\_ BE \_\_\_\_\_ iCa \_\_\_\_\_  
 ScvO<sub>2</sub> \_\_\_\_\_ Lactate \_\_\_\_\_ Dstck \_\_\_\_\_  
 DIC/PT \_\_\_\_\_ INR \_\_\_\_\_ PTT \_\_\_\_\_ Ddimer \_\_\_\_\_ Fibr \_\_\_\_\_  
 Cultures sent? Blood  Urine  Other \_\_\_\_\_

Ca \_\_\_\_\_  
 Mg \_\_\_\_\_  
 Phos \_\_\_\_\_

MD Summary: \_\_\_\_\_  
 PICU Notified: \_\_\_\_\_  
 Bedside Report given: \_\_\_\_\_  
 Disposition location: \_\_\_\_\_

HANDOFF TOOL



Excerpted from: Brierley J, Carcillo, JA, et al. Clinical practice parameters for hemodynamic support of pediatric and neonatal septic shock: 2007 update from the American College of Critical Care Medicine. Crit Care Med 2008; 37:680

**Pediatric Advanced Warning Score (PAWS)**

Behavior	0	1	2	3
Flap up/ Appropriate	Flap up/ Appropriate	Turbid (Erythematous)	Irritable (Irritability)	Lethargic/ Comatose
Cardiovascular	HR in range, no rales, no JVD, no L2 hyperg.	Pale or Cap. refill > 3 seconds	Pale & Cap. refill > 4 seconds	Grey or Mottled or Cap. refill > 5 seconds or no perfusion > 20
Respiratory	RR < 20 and SpO2 > 95% on baseline or no hyperoxia	RR > 20 and SpO2 > 95% on baseline or no hyperoxia	RR > 20 and SpO2 > 95% on baseline or no hyperoxia	RR > 20 and SpO2 > 95% on baseline or no hyperoxia

Legend: Green = 0-2 Score, Orange = 3 Score, Yellow = 4 Score, Red = 5 or > 5 Score

**Chocov's Clonus Score**

Byes Clonus	Distal Vascular Response	Rect Abdom
Spontaneous	4+ Contract, easy	5+ Normal
To Speech	3+ Contract, Contractible, easy	4+ Localizes to pain
To Pain	2+ Incontractile	3+ Withdraws to pain
None	1+ Moves no pain	2+ Discontinues
	No response	1+ Discontinues
		No response

Shock flow sheet: ERM-XXXX

Optio Label

# Triage best practice alert

Epic Hyperspace - WT EMERGENCY CNTR - POC - ASAP NURSE TEST

Desktop Action Patient Care Tools Help

Back Forward ED Manager Track Board ED Chart Patient Lists My Reports Calculator Pedi-Advisor

Epic Home Shock,Bpa

**Shock, Bpa** DOB: 1/11/2008 Chief Complaint: ISO/INF Pt Location: A  
MRN: 3000001382 CSN: 806148502 2 y.o / F None WTEC P

Patient Summary  
Chart Review  
Results Review  
History  
Demographics  
Allergies  
Order Entry  
Doc Flowsheets  
Patient Events Log

**ED Navigator (Contact Date: 1/11/2010)**

Triage Charting Tx Team Admit Print AVS

Problems (0): **None** Allergies (0): **Not on File** Meds (0): **None**

- Triage
- Arrival Info
- Triage Start
- Chief Complaint
- CC Category
- TX PTA
- Allergies
- History
- Focus Assessmt
- Vitals**
- Dehydration Asses...
- CRS Evaluation
- Protocol
- Triage Plan
- BestPractice

**Vitals - Vitals (SHIFT+F6 to enter comments)**

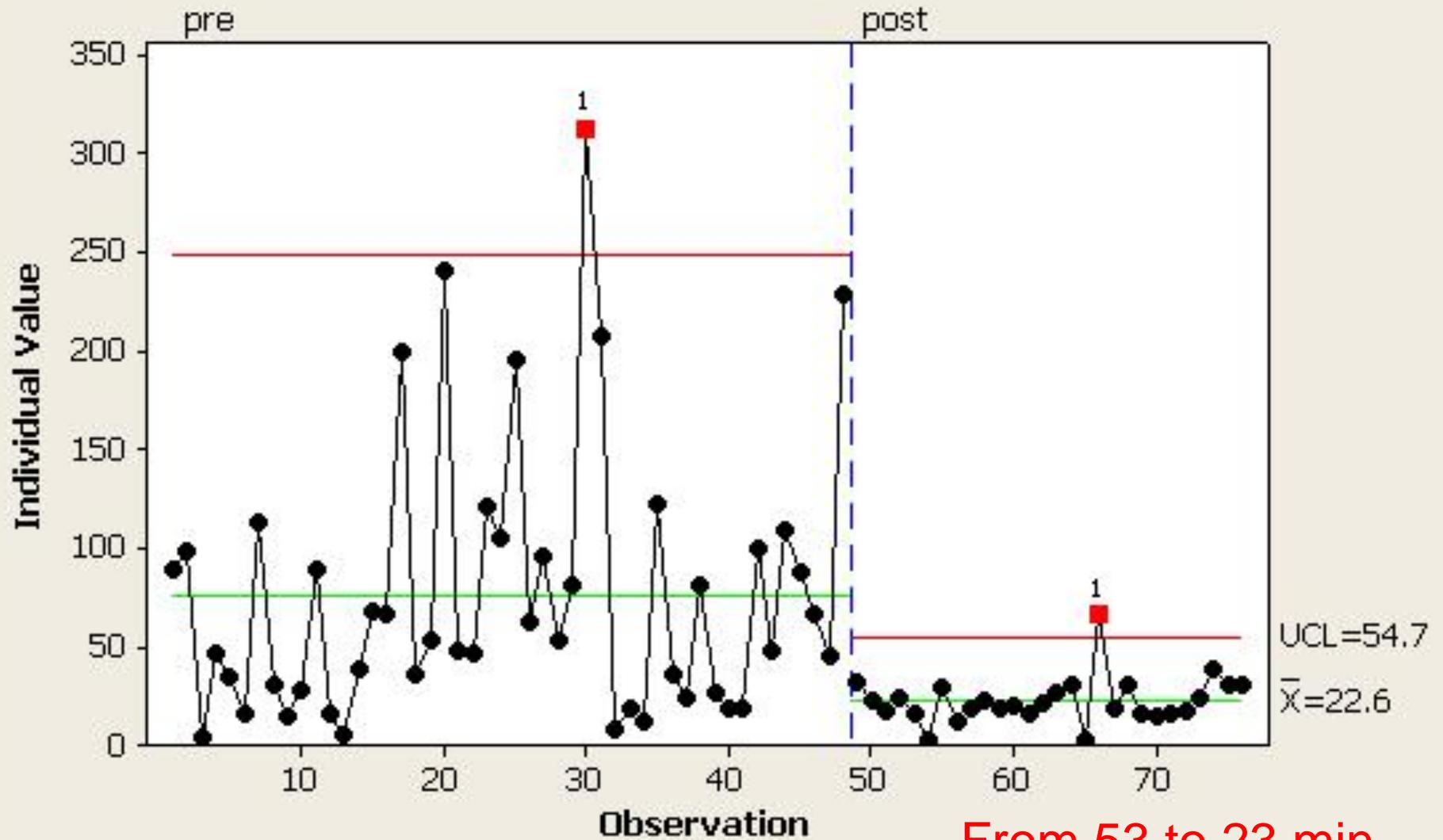
**BestPractice Alert - Shock,Bpa**

**If high risk patient (malignancy, BMT, transplant, asplenia, sickle cell disease, central line, or immunodeficiency), consider SHOCK PROTOCOL**

Accept Cancel

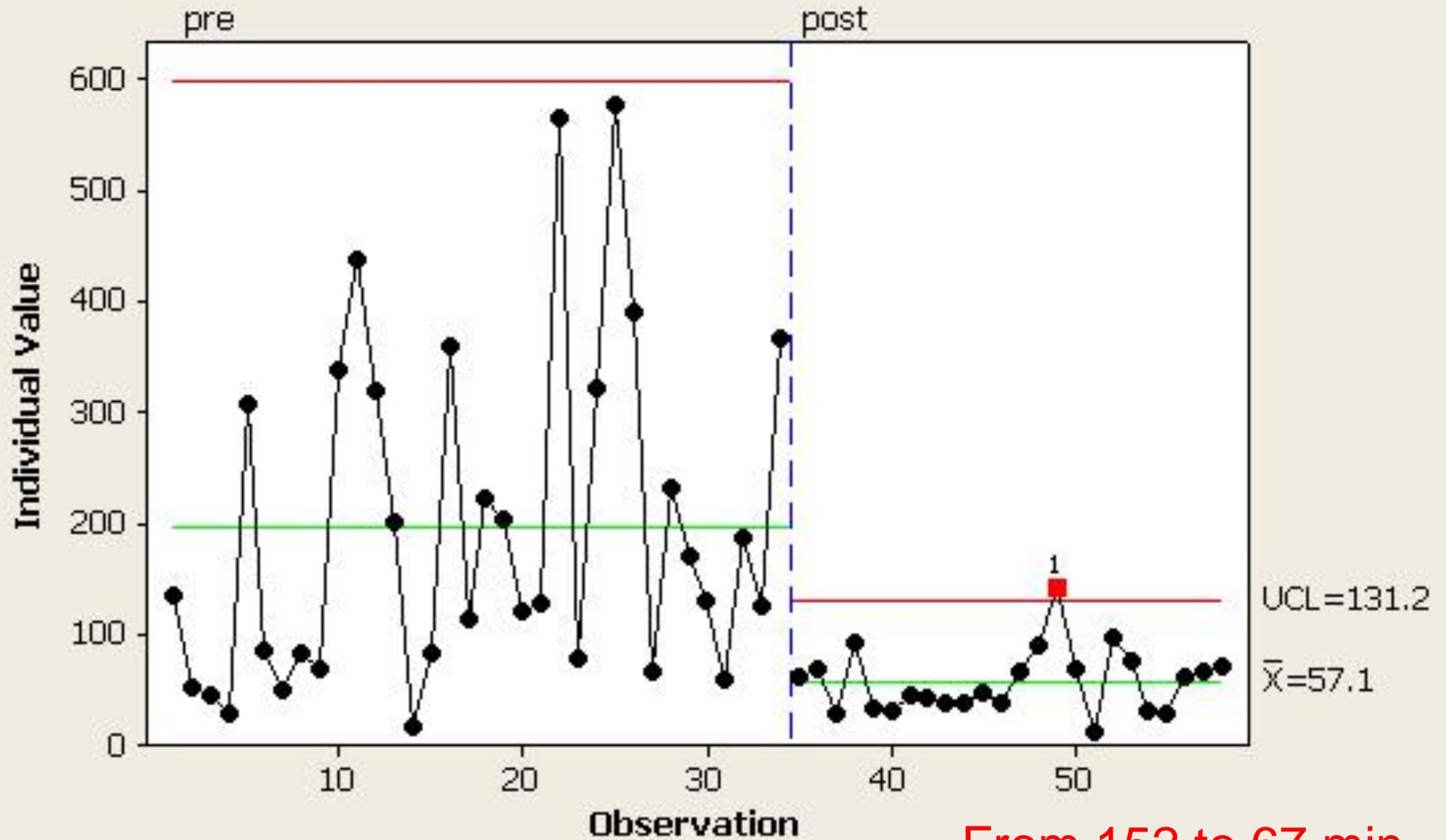
Height Method

# I Chart of Triage to 1st bolus



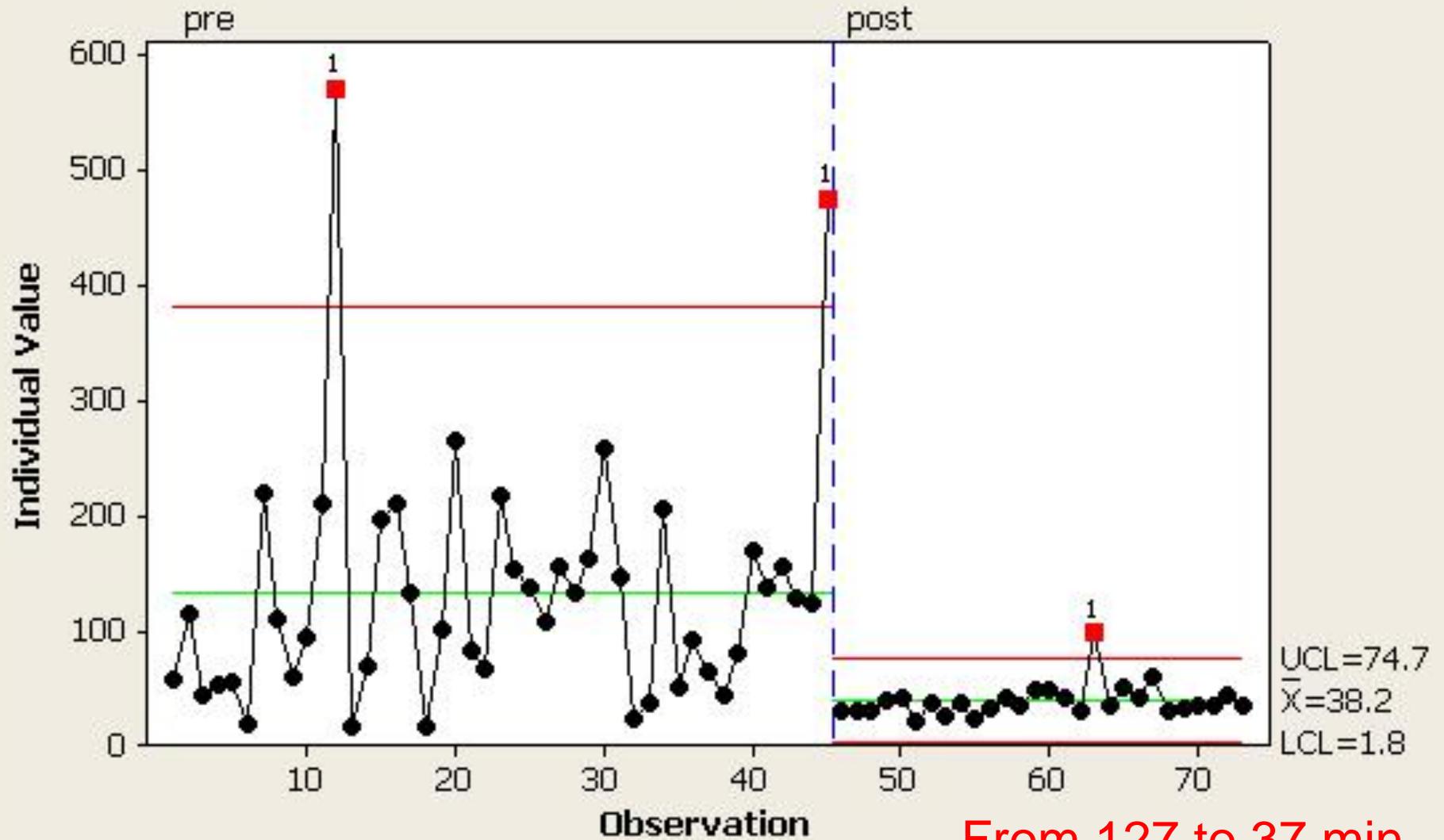
From 53 to 23 min

# I Chart of Triage to 3rd bolus



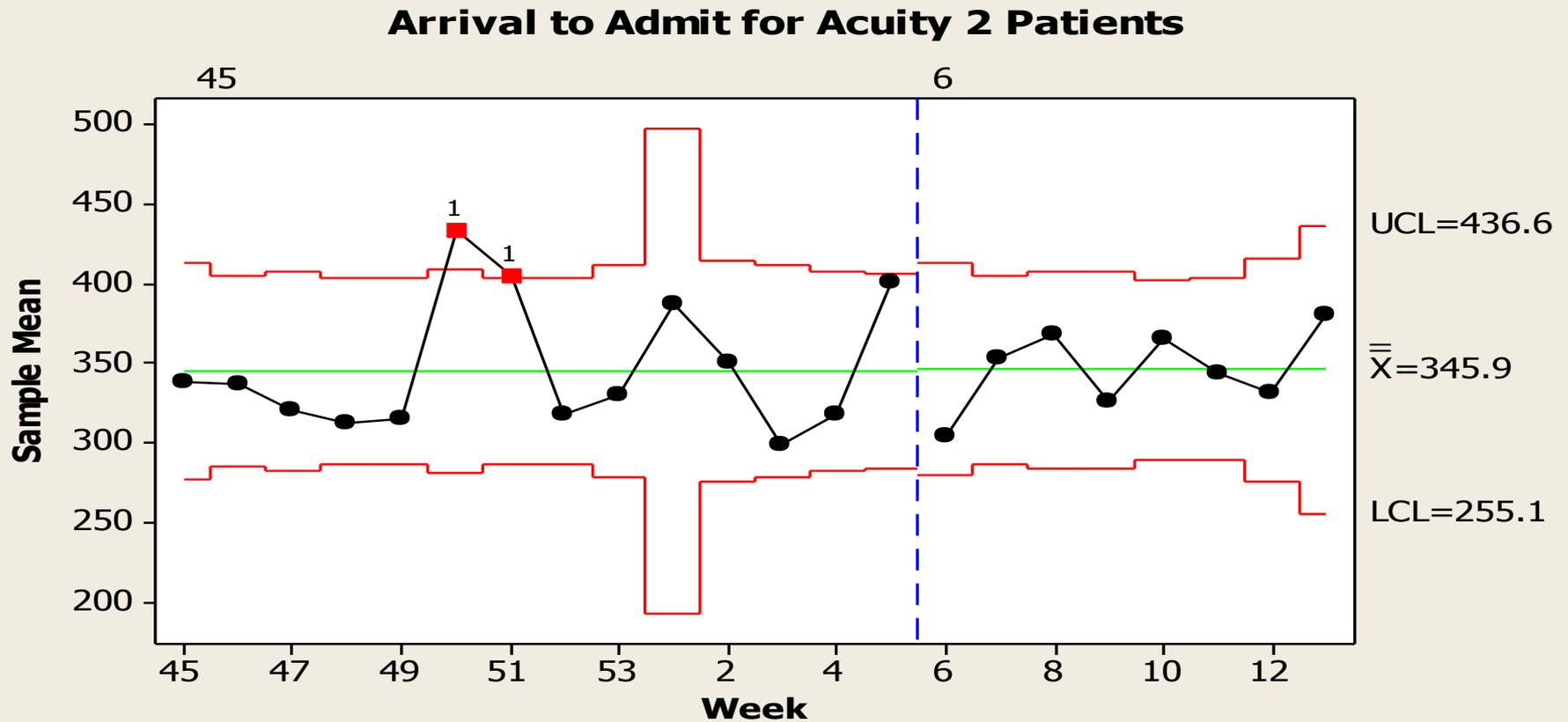
From 152 to 67 min

# I Chart of Triage to 1st abx



From 127 to 37 min

# Balance measures



Tests performed with unequal sample sizes

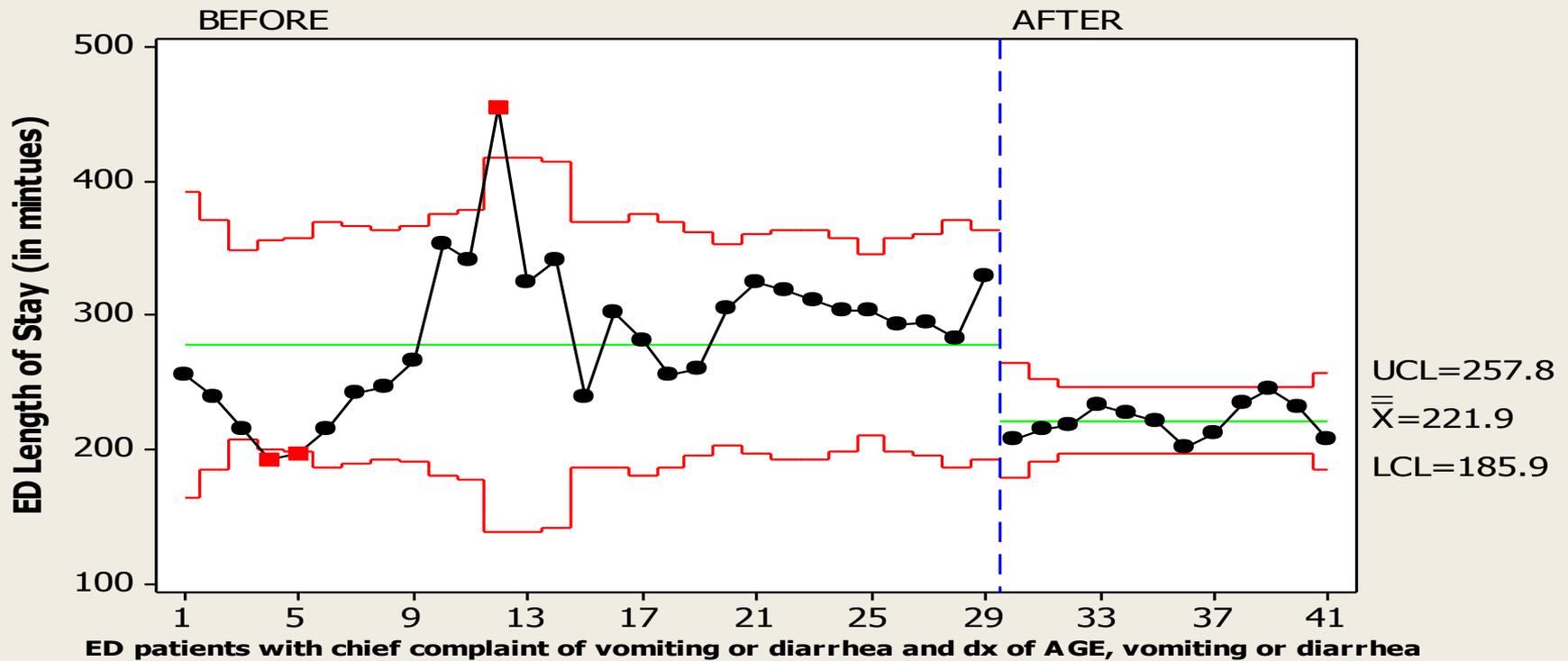
# The outcome

- A reduction in morbidity
- A projected 38% reduction in mortality
- 10 year costs of sepsis related lawsuit settlements:
  - TCH: \$2.5 million (actual costs)
  - BCM: \$1.25 million (estimated costs)
  - Total projected 10 year savings: \$1.4 million



# LOS in ED for AGE

**Moving Average Chart of Length of Stay in ED Before and After Introduction of ORT**



## Gains: capacity measures

<b>Time savings</b>	<b>Total ED hours</b>	<b>Number of patients/year</b>
33 min	3646 hours	691 patients
<b>Goal (d): 58 min</b>	<b>6409 hours</b>	<b>1216 patients</b>
<b>Goal (v): 91 min</b>	<b>10056 hours</b>	<b>1908 patients</b>



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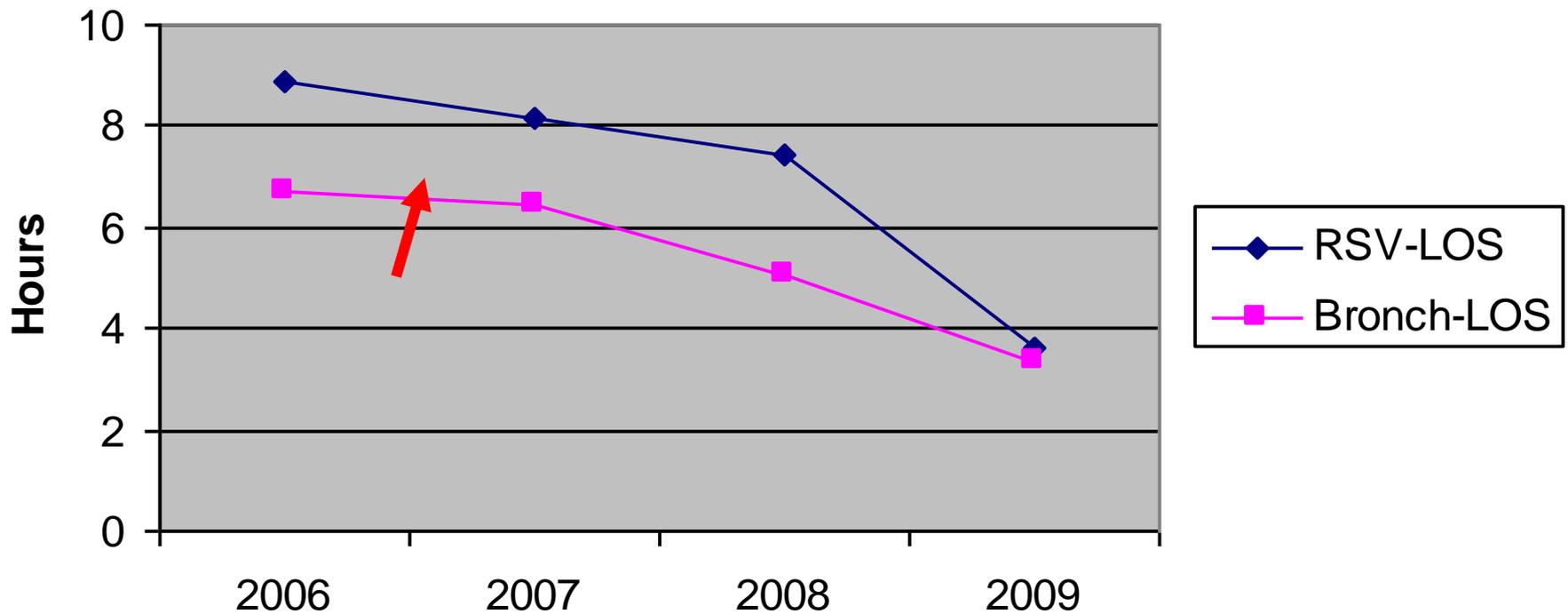
Financial implications:

\$250,000 to 1.3 million contribution to margin

Financial planning and reporting: Alec King and Carolyn Smith

# Bronchiolitis measures

## ED LOS

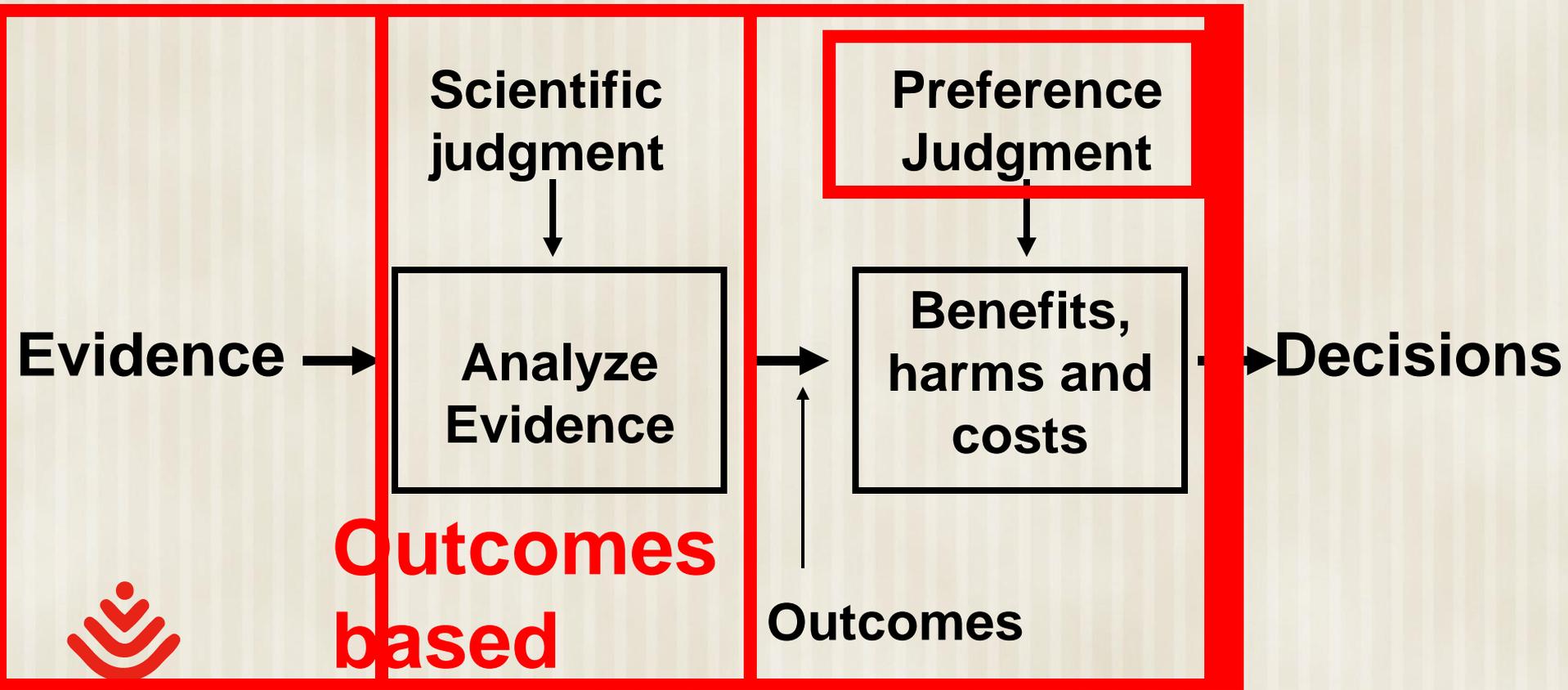


# Cost savings (bronchiolitis)

- Calculating cost savings inpatient
  - Use # of Admits for Bronchiolitis (2009 = 583)
  - Calculate days saved per year based upon ALOS decrease from 2006 pre EBG year
    - ▣ Building capacity
  - Use 2009 data to determine “variable direct cost” per day (\$2011)
  - Calculate savings in 2008 - \$128,965
  - Assumption: filling beds in early days with patients with higher margin per case
- Calculating capacity ED
  - Building ED capacity because of shorter LOS in ED
  - 2006 to 2009: ED LOS decreased 2.91 hours for bronchiolitis
  - x 1430 patients=4161 hours
  - x avg LOS in 2009 (5.27 hrs)= 789 additional patients
  - Could multiple by per patient revenue/margin for financial impact
    - ▣ Contribution margin: 1.57 million
    - ▣ Complex model with multiple caveats



# Not all EBGs are created equal



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**Evidence based**  
**Preference based**  
**Consensus based**

Adapted from D Eddy MD, PhD

# Questions?

The Center for Clinical  
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Knowledge translation  
research

Process mapping/AGE

Bronchiolitis/financial  
measures



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Effectiveness

Centers of  
Excellence

Policy and  
Advocacy

Patient Safety

Evidence Based  
Outcomes Center

Health Information  
Technology  
Integration

Education and  
Community Outreach

Data Transformation

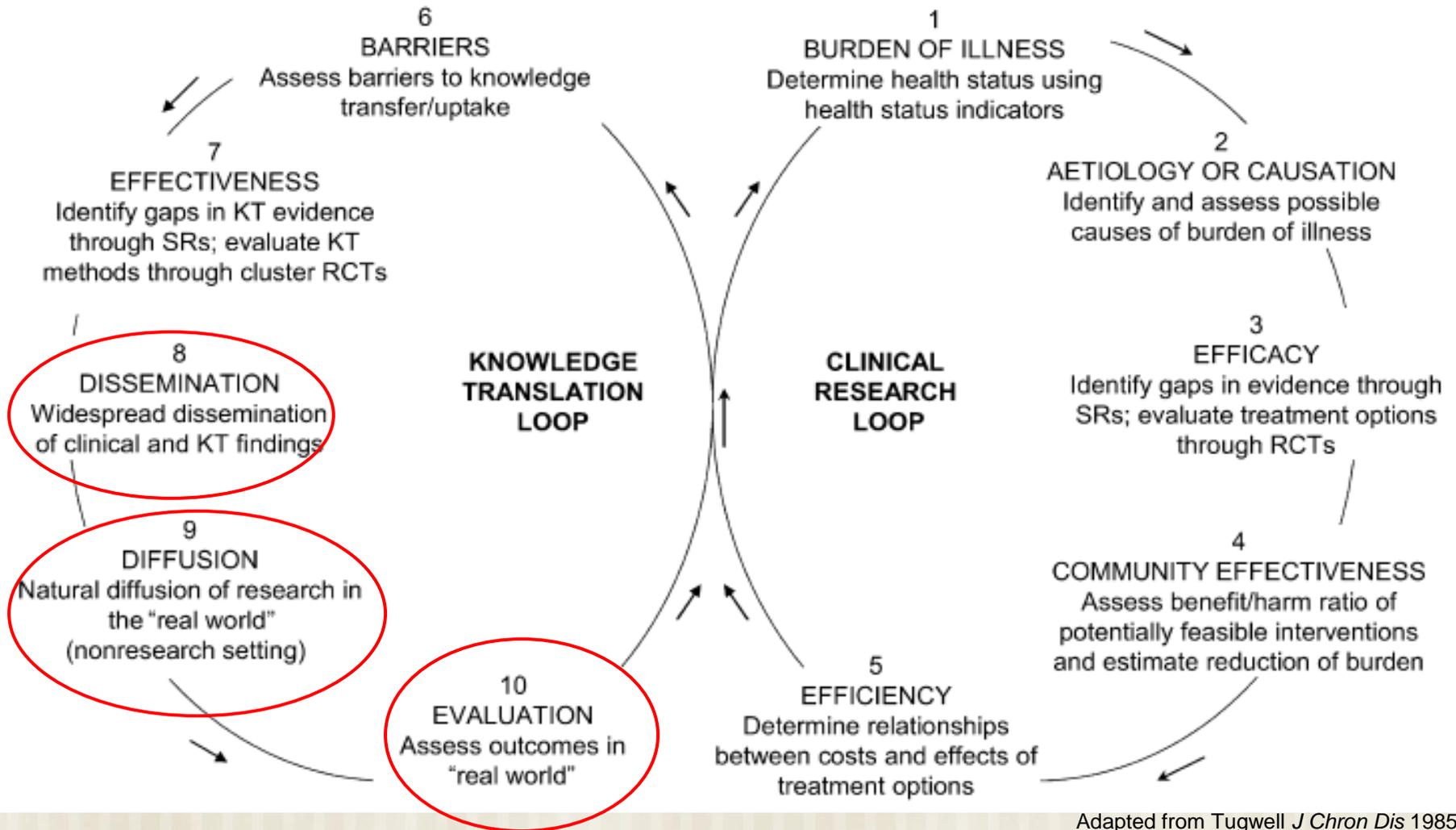
Health Services Research

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# Knowledge translation



# Acute Gastroenteritis EBG



February 2009

## TEXAS CHILDREN'S HOSPITAL EVIDENCE-BASED CLINICAL DECISION SUPPORT

### ACUTE GASTROENTERITIS (AGE) CLINICAL GUIDELINE (ACUTE VOMITING AND/OR DIARRHEA)

**Definition:** Acute gastroenteritis (AGE) is a decrease in the consistency of stools (loose or liquid) and/or an increase in the frequency of stools (typically  $\geq 3$  in 24 hours), with or without fever or vomiting. However, vomiting alone is typical of early presentation. Duration of illness is typically less than 14 days. <sup>(1-2)</sup>

**Epidemiology:** In the United States, approximately 1.5 million outpatient visits, 200,000 hospitalizations and 300 deaths are recorded each year for children with gastroenteritis. Approximately one-third of all hospitalizations for diarrhea (children < 5 years) were due to rotavirus. <sup>(3)</sup> In February 2006, routine use of a pentavalent human-bovine rotavirus vaccine was recommended. <sup>(4,5)</sup> Since these recommendations have been implemented, there has been a delayed season and atypically low percentage of rotavirus positive tests. <sup>(6)</sup> In children seen in the Emergency Center at Texas Children's Hospital, pentavalent rotavirus vaccine (RV5) was noted to be highly effective in preventing rotavirus disease. <sup>(7)</sup>

**Etiology:** The most common causes of AGE are infectious agents. In the developed world, viruses are responsible for 70 to 80% of infectious diarrhea cases. Rotavirus and norovirus are the leading viral pathogens with nearly every child in the U.S. being infected with rotavirus by 5 years of age. <sup>(4,8)</sup> Various bacterial pathogens account for another 10 to 20% of cases and as many as 10% may be attributable to diarrheagenic *Escherichia coli*. <sup>(9)</sup> Parasitic organisms such as *Giardia* species cause fewer than 10% of cases. Incidence is affected by climate and season. Other factors that increase the risk of AGE in children include day care attendance and impoverished living conditions with poor sanitation. <sup>(10)</sup>

#### **Guideline Eligibility Criteria:**

Age  $\geq 60$  days to 17 years  
Healthy children without underlying conditions  
Clinical findings of AGE

#### **Guideline Exclusion Criteria:**

Toxic appearance  
Episodes of diarrhea lasting > 14 days

#### **Differential Diagnosis:**

Ingestion	Urinary Tract Infection (UTI)
Food-borne illness	Bowel obstruction
Allergic reaction	

#### **Diagnostic Evaluation:** <sup>(8)</sup>

##### **History: Assess for**

- Age of child
- Developmentally appropriate behavior
- $\geq 3$  loose or watery stools/day
- Onset, frequency, quantity, and character (e.g., black, bloody) of vomiting/diarrhea
- Travel and/or day care exposure
- Dietary changes
- Vaccination status (especially Rotavirus vaccine)
- Last episode of vomiting
- Volume and frequency of urine output
- Use of antibiotics

Rotavirus disease typically begins abruptly. Vomiting often precedes the onset of diarrhea. <sup>(4)</sup> Norwalk-like virus is characterized by acute onset of nausea, vomiting, abdominal cramps, and diarrhea. Vomiting can appear alone in Norwalk-like disease. <sup>(11)</sup>

#### **Physical Examination:**

Severity of dehydration (none/mild, moderate, or severe) is the key factor in determining the severity of AGE which is primarily based on the child's dehydration status. Management requires a rapid risk assessment of dehydration. <sup>(5, 12-13)</sup>

A complete physical exam should be performed assessing for:

- Weight loss (pre-illness weight minus acute body weight)
- Prolonged capillary refill time ( $> 2$  seconds)<sup>\*</sup>
- Dry mucous membranes<sup>\*</sup>
- Absent tears<sup>\*</sup>
- Poor overall appearance<sup>\*</sup>
- Abnormal skin turgor
- Sunken eyes
- Abnormal radial pulse
- Tachycardia (HR  $> 150$ ; scale validated in children 1 month to 5 years) <sup>(14)</sup>
- Abnormal respirations
- Decreased urine output

Accurate body weight is considered the gold standard in determining fluid deficit (pre-illness weight minus acute body weight). <sup>(5, 14-15)</sup>

<sup>\*</sup>The presence of at least 3 out of 4 predicts a fluid deficit of 10% or more. <sup>(14)</sup>

Combination of clinical findings improves diagnostic characteristics. <sup>(12, 14)</sup>

#### **Laboratory Tests:**

Routine laboratory tests are NOT recommended for children with mild/moderate dehydration. <sup>(16)</sup>

Consider a stool culture with bloody stools, prolonged symptoms, suspicion of epidemic, and/or travel exposure. Consider urinalysis (UA) with micro and culture when concerned for UTI.

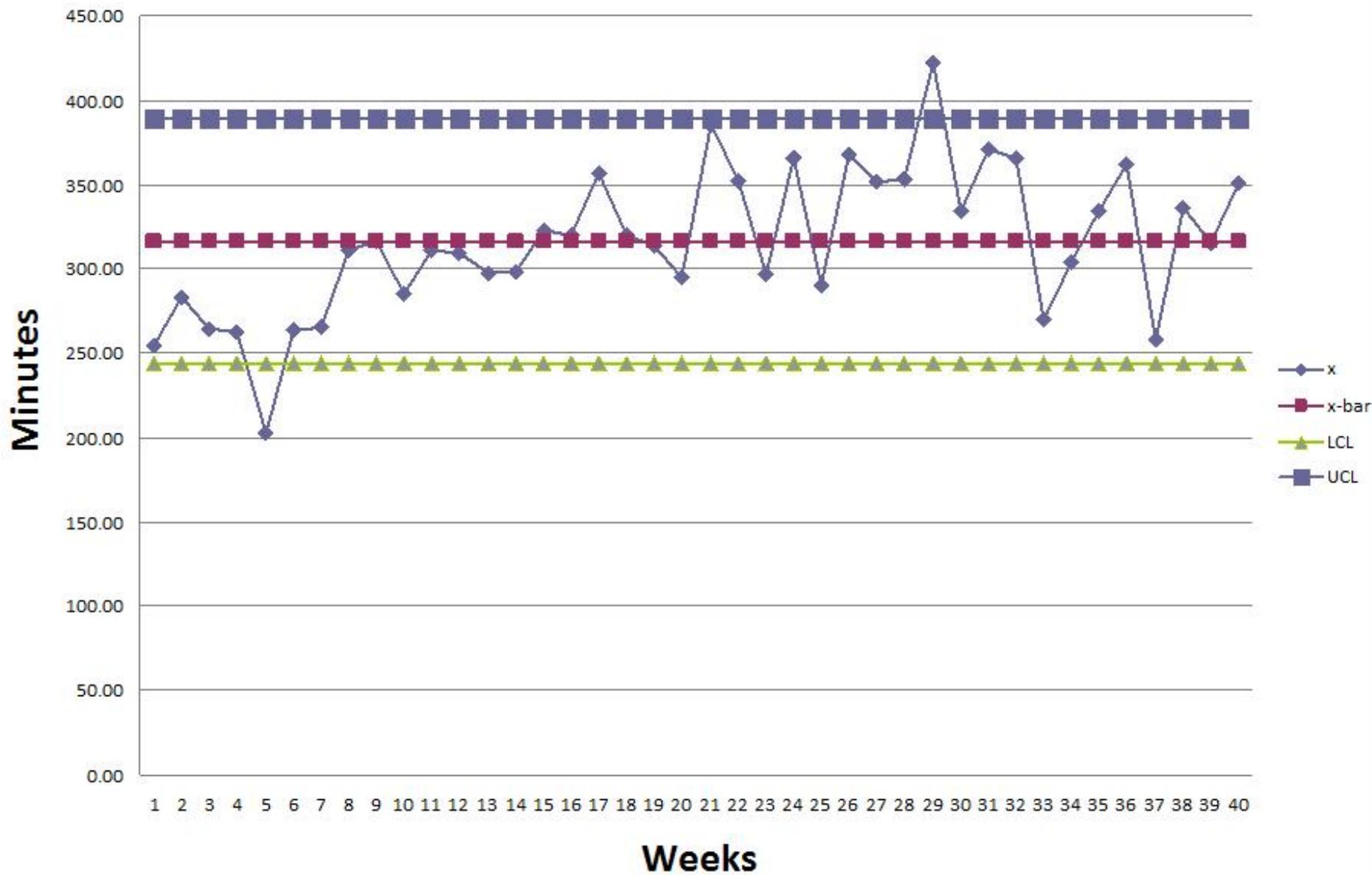
Consider C difficile if previous use of antibiotics. Serum sodium bicarbonate is an unreliable predictor for determining the severity of dehydration. <sup>(12)</sup>

Urine Specimen for Urinalysis and Culture:<sup>5</sup>  
Non-toilet trained children: transurethral catheterization <sup>(17-19)</sup>  
Toilet trained children: midstream clean catch <sup>(19-20)</sup>

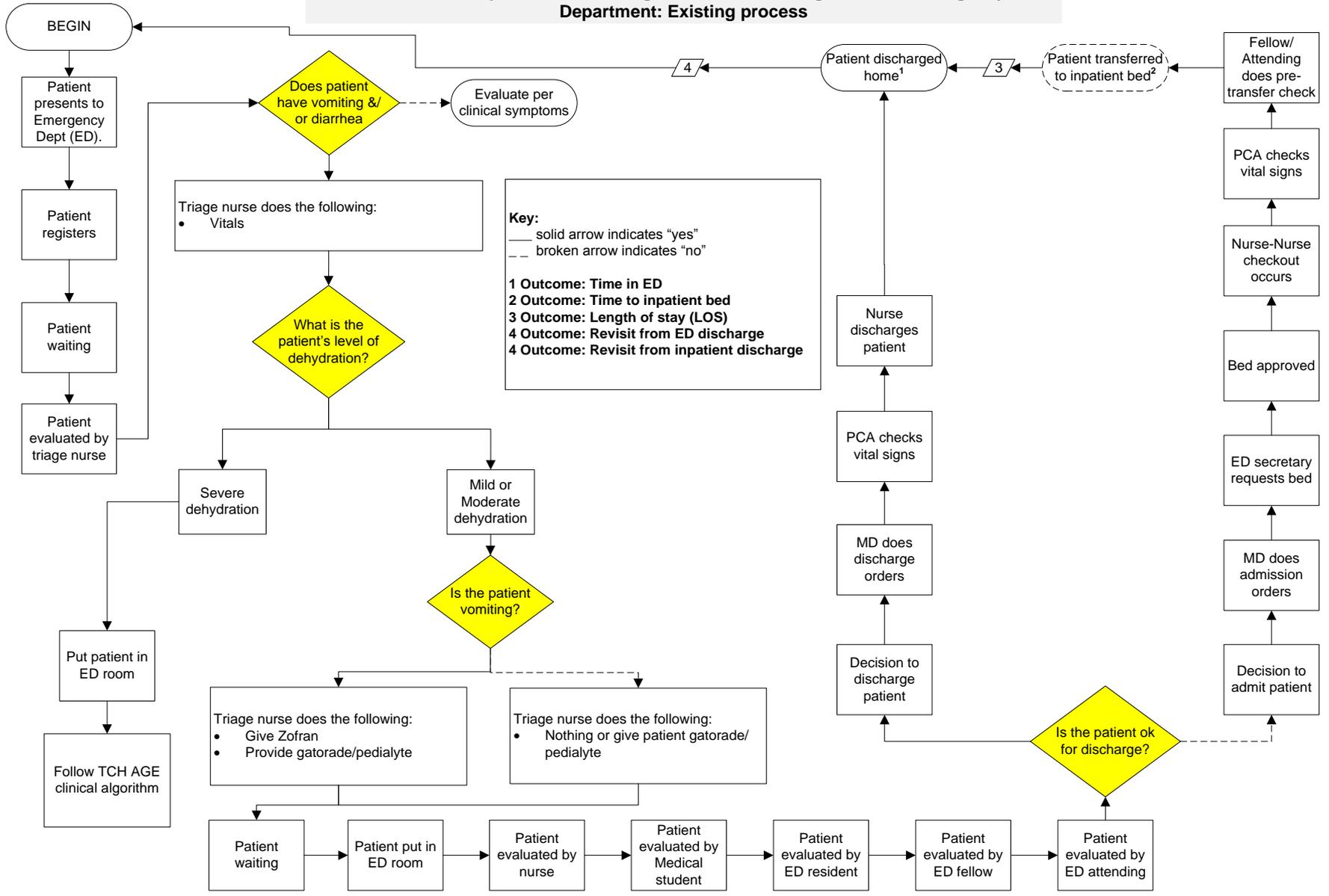
<sup>5</sup>Obtained by non-invasive method. If positive, invasive method may be necessary.

- AGE multi-disciplinary team included:
  - P Nag MD
  - J Tran MD
  - C Allen MD
  - S Patel MD
  - M Gilger MD
  - C Davis RN
  - A Hope
  - C Conkin, MS, RD
  - EBOC specialist: Q Franklin, MS
  - EBOC implementation specialist: E Crabtree

# LOS in ED for the diagnosis: Vomiting (787.03)

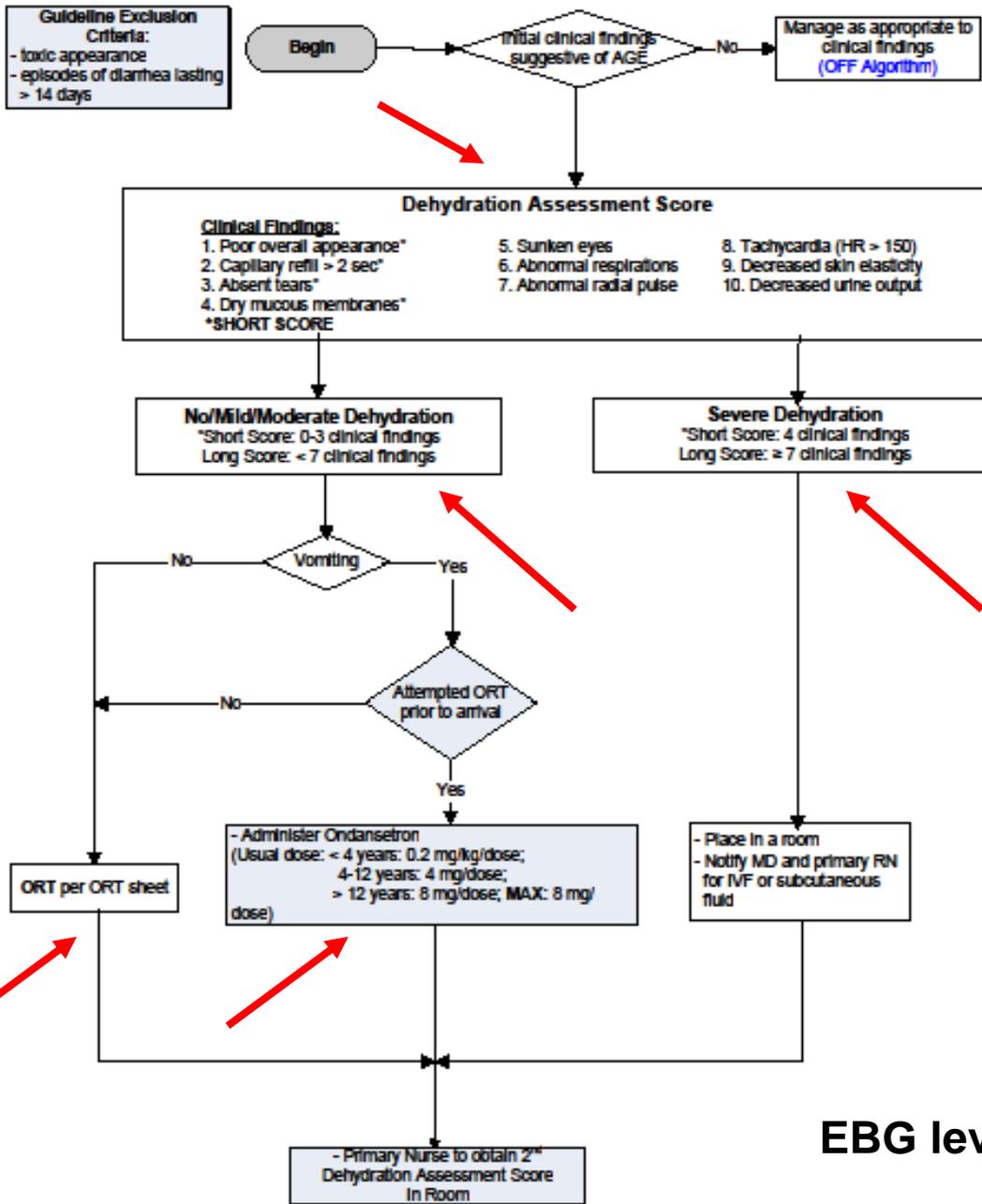


**Flow chart of a patient with acute gastroenteritis through the TCH Emergency Department: Existing process**



**Process map before EBG**

**TCH Nursing Emergency Department  
Clinical Algorithm for Acute Gastroenteritis (AGE) and Oral Rehydration Therapy (ORT)**



**EBG leverage points**



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Case, Justin DOB: 2/16/2005 Chief Complaint: ISO/INF Pt Location: Attending: Pt Flag  
MRN: 3000000410 CSN: 806141844 4 y.o. / M None WTEC PCP: PROVIDER NOT IN SYSTEM

Patient Summary

Chart Review

Results Review

History

Demographics

Allergies

Order Entry

Doc Flowsheets

Patient Events Log

ED Navigator

Arrival Info

Triage Start

Chief Complaint

CC Category

TX PTA

Allergies

History

Focus Assessmt

Vitals

Dehydration Asses...

CRS Evaluation

Protocol

Triage Plan

Hotkey List

Exit Workspace

Navigator Hotkeys

ED Navigator (Contact Date: 5/28/2009)

Triage Charting Tx Team Print AVS

Problems (0): None Allergies (0): Not on File Meds (0): None

Dehydration Assessment - Gorelick Score for Dehydration Assessment (SHIFT+F6 to enter comments)

Time Taken:

Date: 6/17/2009

Time: 1627

Gorelick Score for Dehydration Assessment	Poor General	0=No	1=Yes	
Appearance (short score)				
Capillary Refill > 2 Seconds (short score)		0=No	1=Yes	
Absent Tears (short score)		0=No	1=Yes	
Dry Mucous Membranes (short score)		0=No	1=Yes	
Gorelick Short Score		<input type="text"/>		
Sunken Eyes		0=No	1=Yes	
Abnormal Respirations		0=No	1=Yes	
Abnormal Radial Pulse		0=No	1=Yes	
Tachycardia (HR>150)		0=No	1=Yes	
Decreased Skin Elasticity		0=No	1=Yes	
Decreased Urine Output		0=No	1=Yes	
Gorelick Score		<input type="text"/>		

Restore Close F9 Cancel

Previous F7 Next F8

CRS Evaluation click to open

New Reading | Go to Doc Flowsheets

No data found.

Protocol Info click to open

New Reading | Go to Doc Flowsheets

No data found.

Triage Plan click to open

New Reading | Go to Doc Flowsheets

No data found.

# The ORT tracking sheet

Texas Children's Hospital Emergency Department  
Oral Rehydration Therapy Tracking Sheet  
**For Parents**

**Parents: Your child has been vomiting and/or has diarrhea and needs clear fluid by a syringe. Your child needs small frequent amounts so they will not vomit. Follow the 5 steps below.**

**1. Give your child ½ of a syringe** , then wait **5 minutes** .

**2. Give your child 1 full syringe** , then wait **5 minutes** .

**3. Give your child 2 full syringes** , then wait **5 minutes** .

\* If your child vomits , wait **10 minutes**  and start again. If your child vomits 3

times , tell a nurse .

**4: If your child does not vomit**, then give your child **3 full syringes**  **every 5 minutes** .

\* Please mark a box below for every syringe your child takes.

	Number of syringes taken. Mark a box with an X for each syringe taken.											

**5. Please come back to the nurse**  **in 90 minutes** at \_\_\_\_:\_\_\_\_ for them to check on your child.

Texas Children's Hospital Emergency Department  
Oral Rehydration Therapy Tracking Sheet  
**Nurse/Physician Documentation Area**

Patient Sticker:  
Weight \_\_\_\_\_ kg  
Fluid  Pedialyte (if < 1 year old)  
 Gatorade (if ≥ 1 year old)  
Patient Age: \_\_\_\_\_ (in months if < 3 years old, and in years if ≥ 3 years old)

Nurse Documentation Area			
	Time	Gorelick Score	HR
Triage assessment of dehydration			
In ED room assessment of dehydration			
Patient received ondansetron (zofran)			
Patient received intravenous fluid			

Signature of nurse verifying the above documentation upon final disposition: \_\_\_\_\_

**Physician Documentation Area**  
Resident, NP/PA/Fellow/Attending

	Time	Gorelick Score	HR
Resident assessment of dehydration			
NP/PA/Fellow/Attending assessment of dehydration			

Total amount of fluid PO: \_\_\_\_\_ cc  
Total episodes of emesis: \_\_\_\_\_  
Total episodes of diarrhea: \_\_\_\_\_

**Gorelick score (long form)**

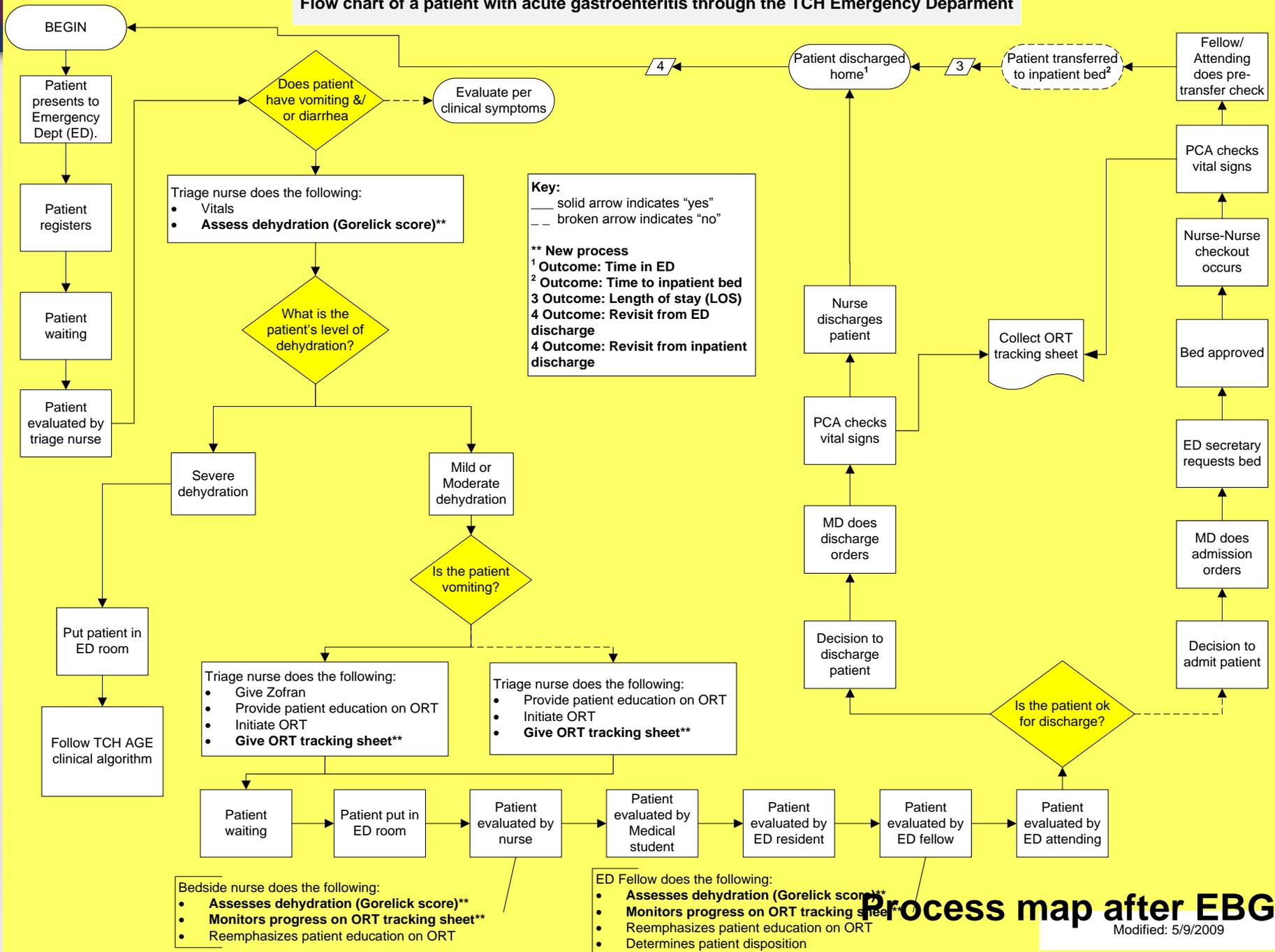
<input type="checkbox"/> Poor overall appearance	<input type="checkbox"/> Sunken eyes	<input type="checkbox"/> Decreased skin elasticity
<input type="checkbox"/> Capillary refill > 2 seconds	<input type="checkbox"/> Abnormal respirations	<input type="checkbox"/> Decreased urine output
<input type="checkbox"/> Absent tears	<input type="checkbox"/> Abnormal radial pulse	
<input type="checkbox"/> Dry mucous membranes	<input type="checkbox"/> Tachycardia (HR >150)	

< 7 points  
↓  
No /Mild/ Moderate dehydration

↓  
≥ 7 points  
↓  
Severe dehydration



# Flow chart of a patient with acute gastroenteritis through the TCH Emergency Department



**Key:**  
 — solid arrow indicates "yes"  
 - - broken arrow indicates "no"

**\*\* New process**  
 1 Outcome: Time in ED  
 2 Outcome: Time to inpatient bed  
 3 Outcome: Length of stay (LOS)  
 4 Outcome: Revisit from ED discharge  
 4 Outcome: Revisit from inpatient discharge

Bedside nurse does the following:

- Assesses dehydration (Gorelick score)\*\*
- Monitors progress on ORT tracking sheet\*\*
- Reemphasizes patient education on ORT

ED Fellow does the following:

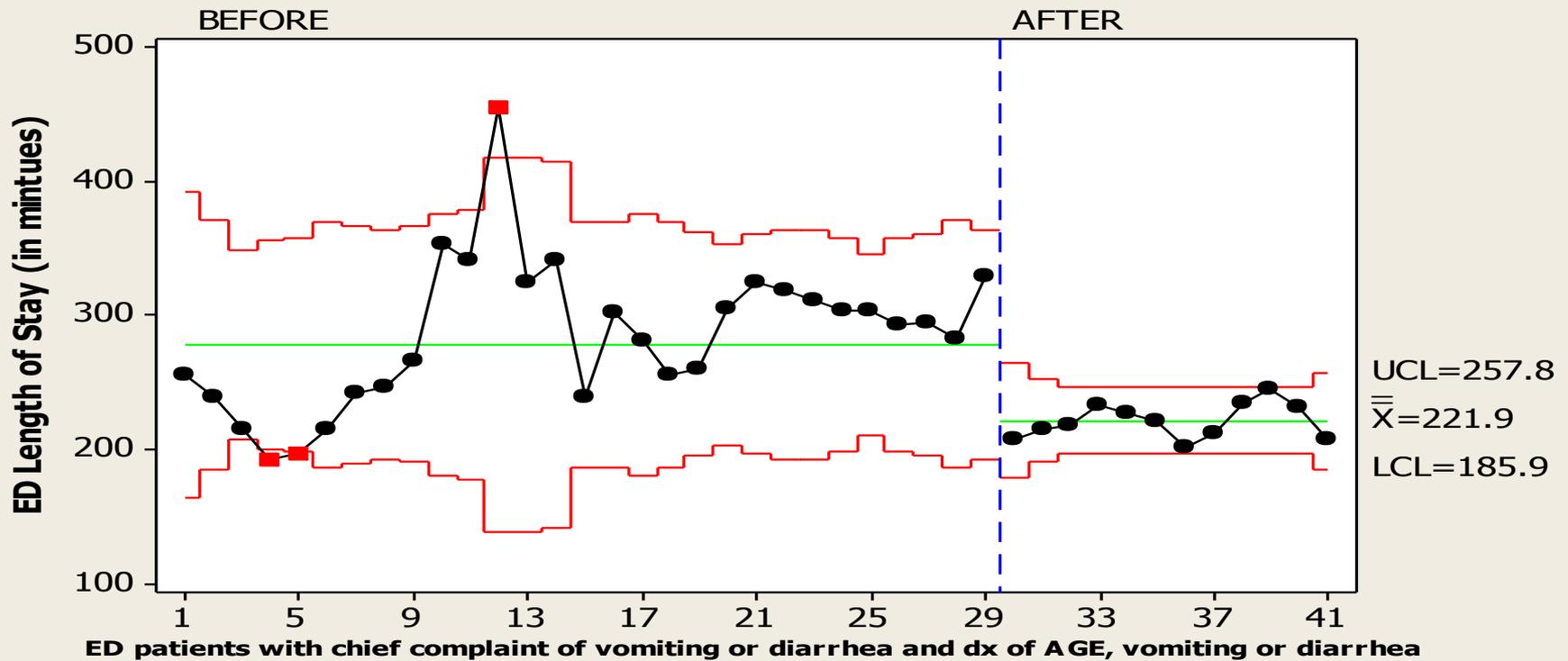
- Assesses dehydration (Gorelick score)\*\*
- Monitors progress on ORT tracking sheet\*\*
- Reemphasizes patient education on ORT
- Determines patient disposition

## Process map after EBG

Modified: 5/9/2009

# LOS in ED for AGE

**Moving Average Chart of Length of Stay in ED Before and After Introduction of ORT**



## Gains: capacity measures

<b>Time savings</b>	<b>Total ED hours</b>	<b>Number of patients/year</b>
33 min	3646 hours	691 patients
<b>Goal (d): 58 min</b>	<b>6409 hours</b>	<b>1216 patients</b>
<b>Goal (v): 91 min</b>	<b>10056 hours</b>	<b>1908 patients</b>



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Financial implications:

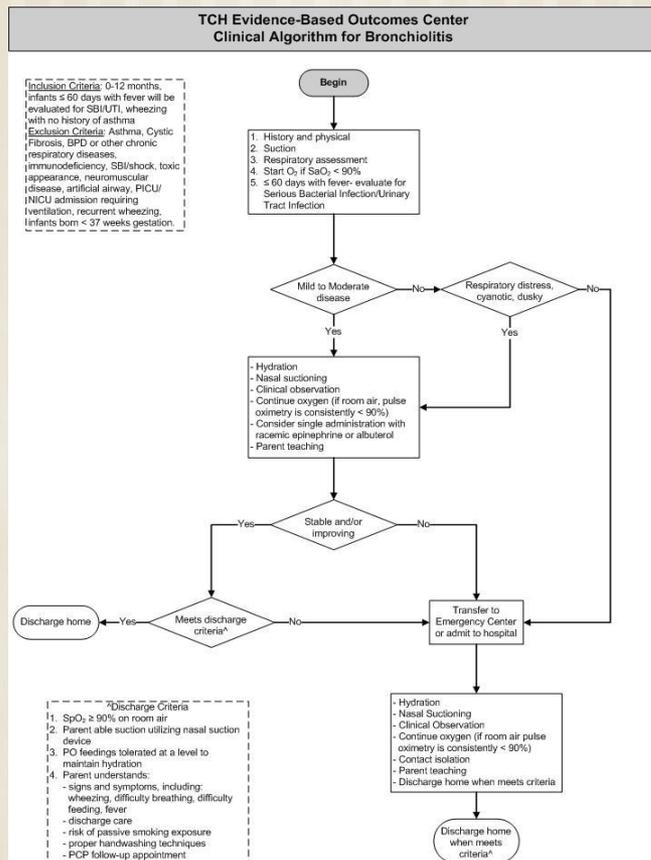
\$250,000 to 1.3 million contribution to margin

Financial planning and reporting: Alec King and Carolyn Smith

# Bronchiolitis EBG

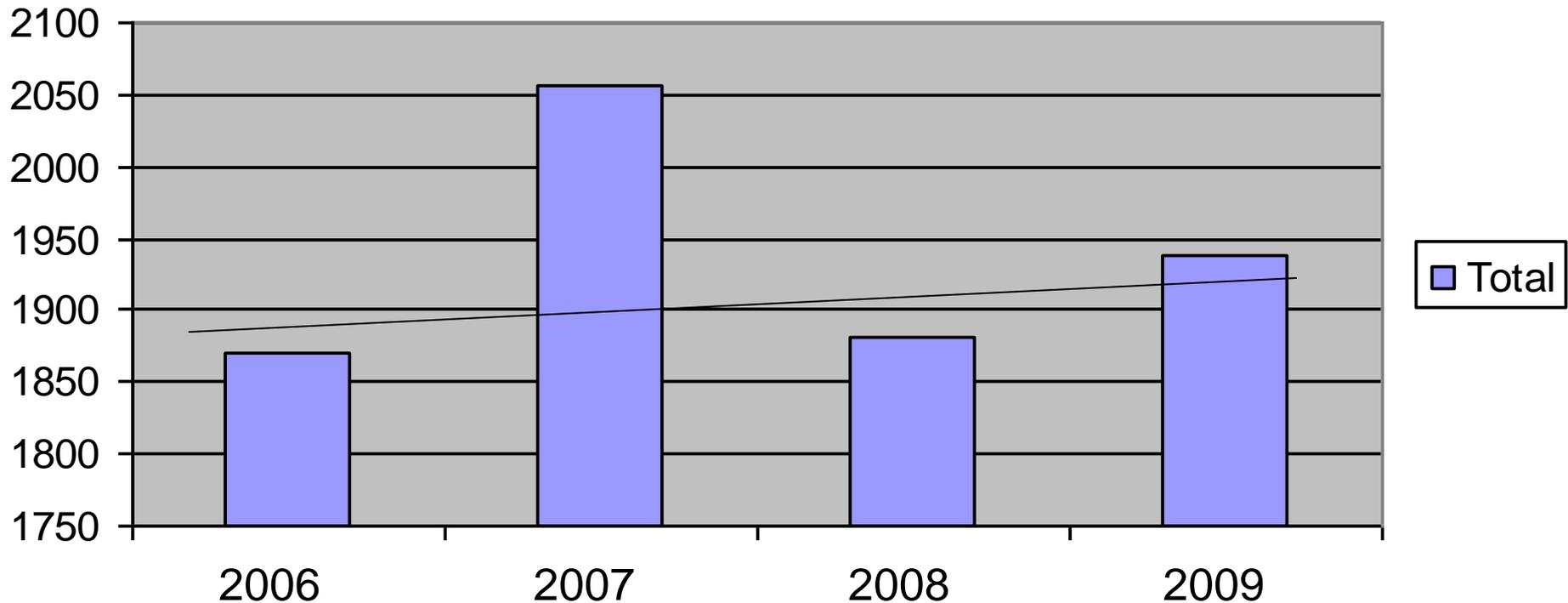
## ■ Multi-disciplinary team included:

- Y Han MD
- M McPherson MD
- B Hogan MD
- R Moore MD
- R Wolf RN
- S Iniquez RCP
- S Kim PharmD
- C Jones, EBOC specialist

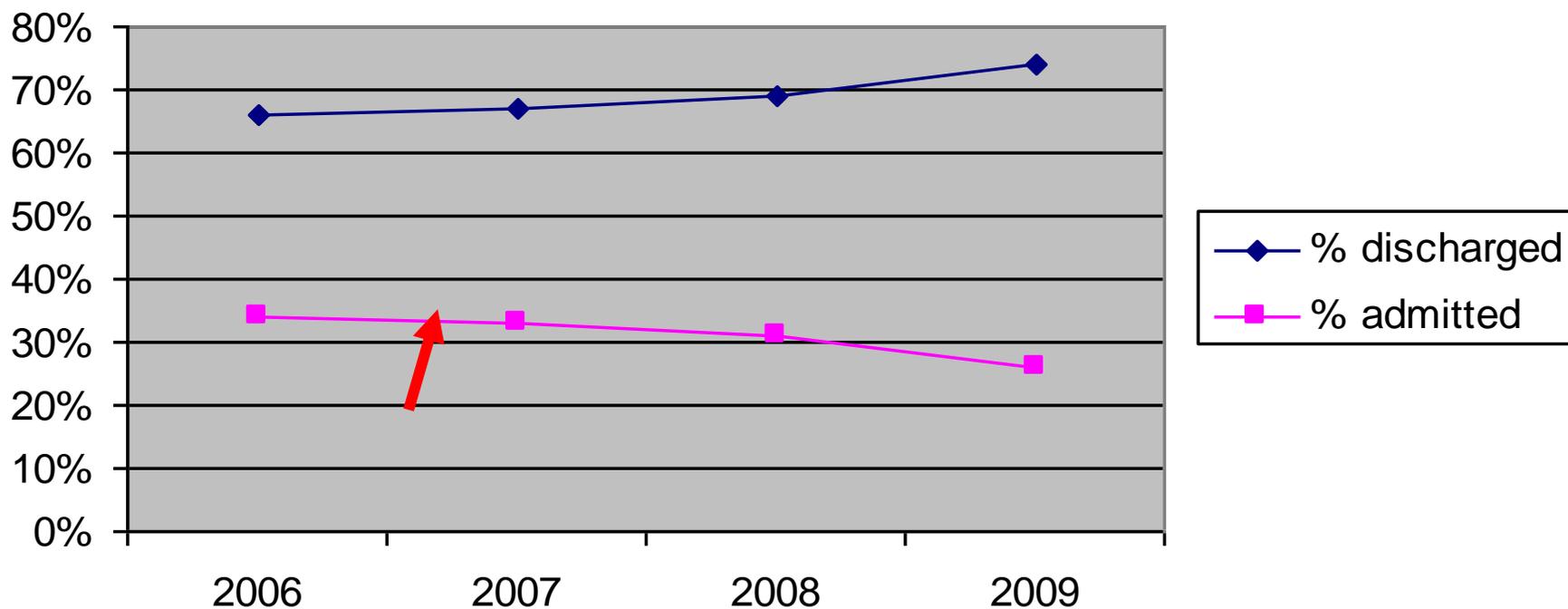


# Phase 1: Implementation focus on ED

## ED Visits for Bronchiolitis

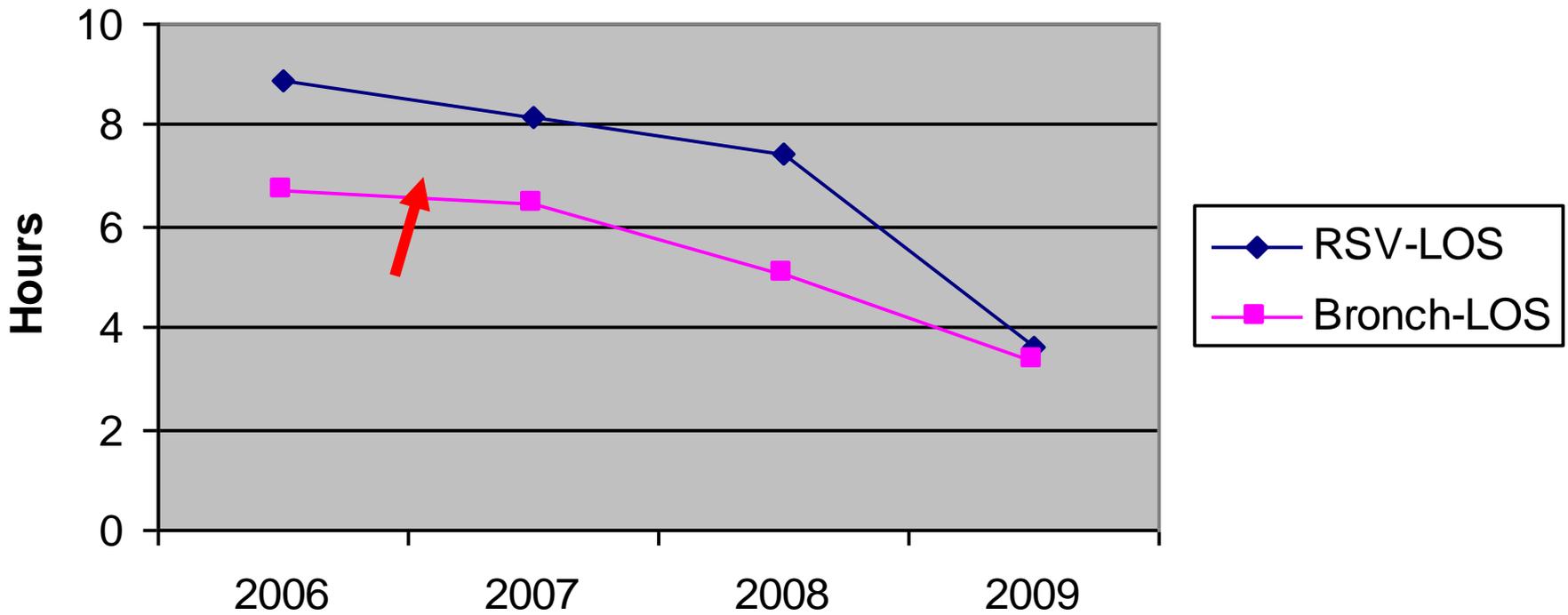


## Bronchiolitis Disposition from ED



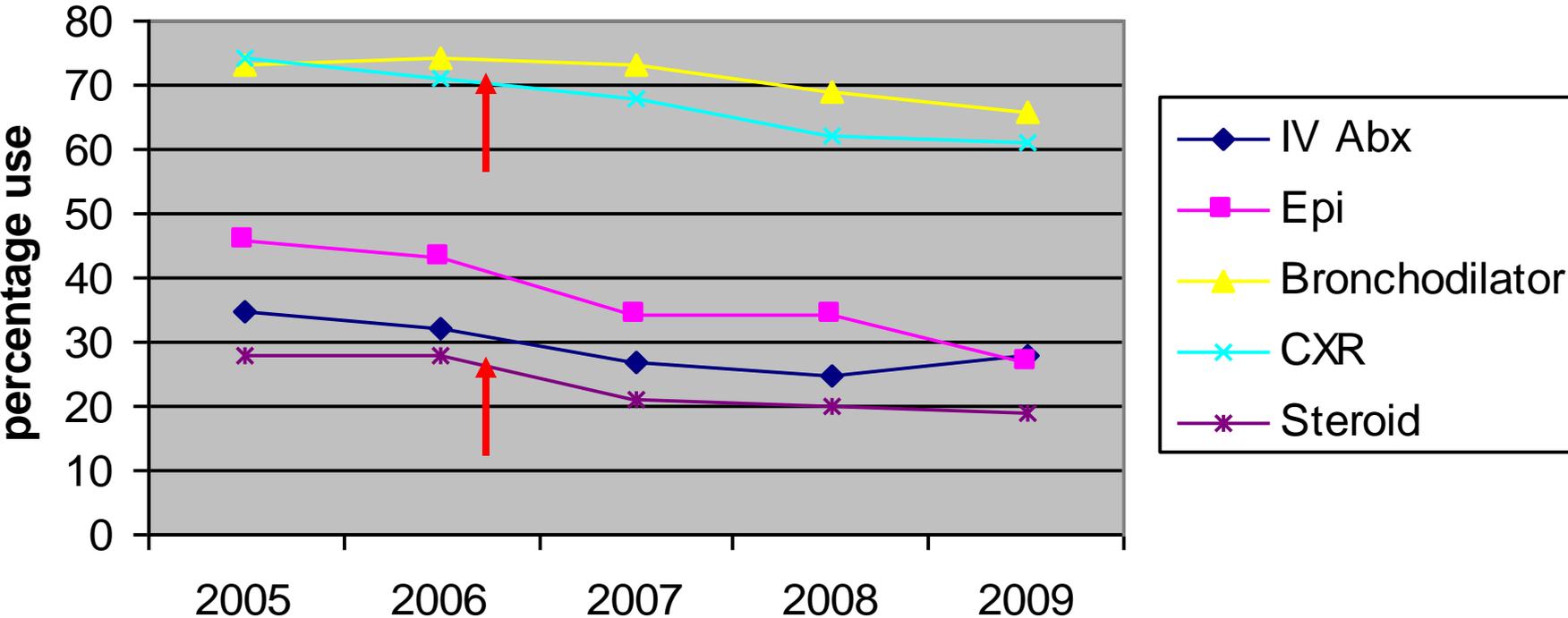
# Bronchiolitis measures

## ED LOS



# Bronchiolitis measures

## Bronchiolitis measures across the continuum



# Cost savings (bronchiolitis)

- Calculating cost savings inpatient
  - Use # of Admits for Bronchiolitis (2009 = 583)
  - Calculate days saved per year based upon ALOS decrease from 2006 pre EBG year
    - ▣ Building capacity
  - Use 2009 data to determine “variable direct cost” per day (\$2011)
  - Calculate savings in 2008 - \$128,965
  - Assumption: filling beds in early days with patients with higher margin per case
- Calculating capacity ED
  - Building ED capacity because of shorter LOS in ED
  - 2006 to 2009: ED LOS decreased 2.91 hours for bronchiolitis
  - x 1430 patients=4161 hours
  - x avg LOS in 2009 (5.27 hrs)= 789 additional patients
  - Could multiple by per patient revenue/margin for financial impact
    - ▣ Contribution margin: 1.57 million
    - ▣ Complex model with multiple caveats



# Objectives

1. To define the role of evidence based guidelines in **medical decision making**.
2. To describe strategies for the effective **creation and implementation** of guidelines.
3. To understand the relationship of evidence based guidelines to **quality improvement**.
4. To discuss strategies for linking **measures** and outcomes to guideline **implementation**.

*This discussion will focus on the merger of science and operations, both critical for high quality health care delivery.*



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