Medication Use Evaluation; YOU Can Shift the Paradigm!

BY

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Learning Objectives

- Define a medication use evaluation (MUE).
- Determine concrete outcomes for a particular MUE.
- Outline the Plan, Do, Check, Act process for a MUE.
- Design a continuous performance improvement project for your facility determined by a MUE.

Medication Use Evaluation

- **Medication-use Evaluation (MUE): is a performance improvement method that focuses on evaluating and improving medication-use processes with the goal of optimal patient outcomes.**
- **MUE may be applied to a medication or therapeutic class, disease state or condition, a medication-use process (prescribing, preparing & dispensing, administering, and monitoring), or specific outcomes.**

ASHP Guidelines on medication-use evaluation. *Am J Health-Syst Pharm* 1996;53:1953-55.

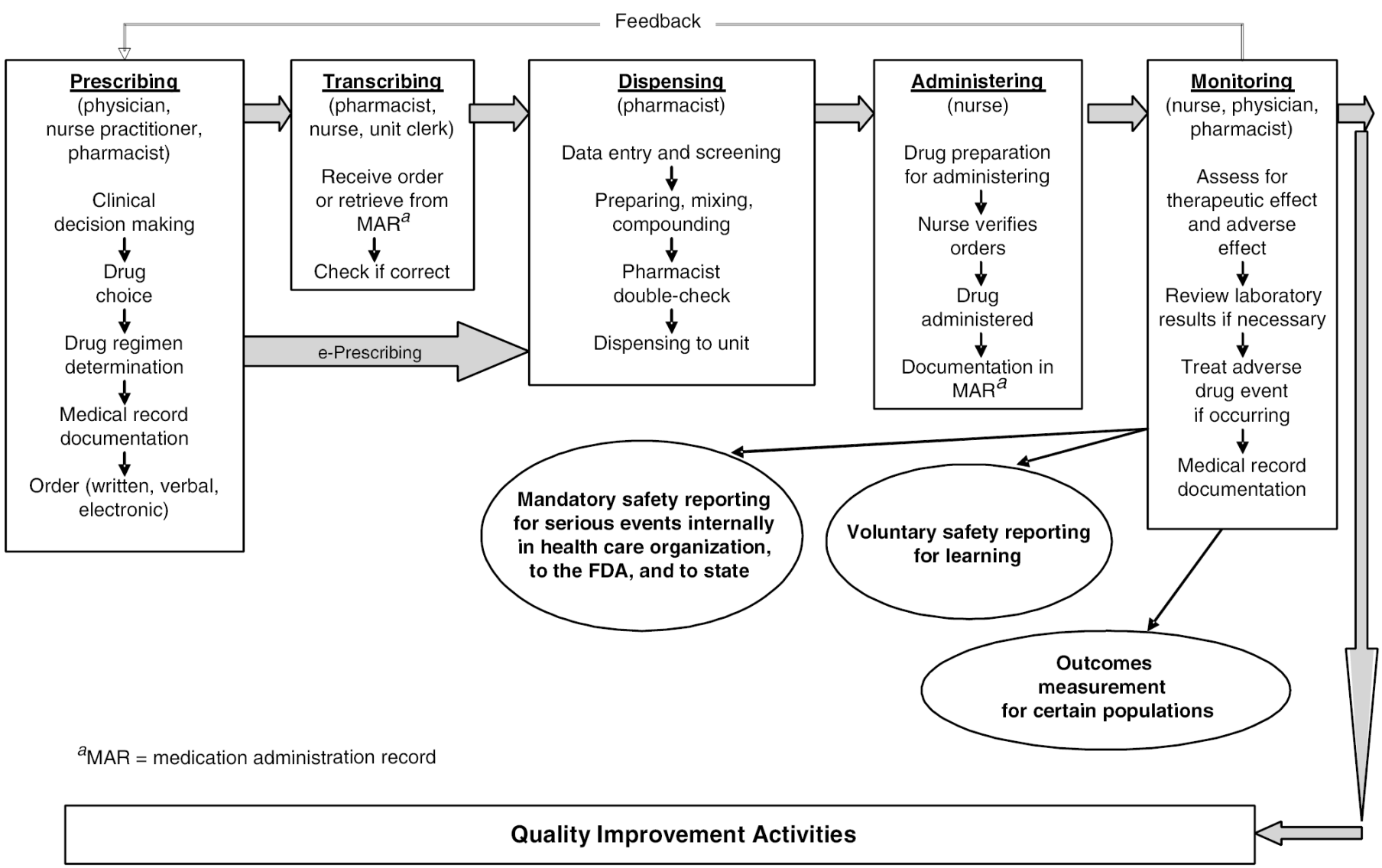
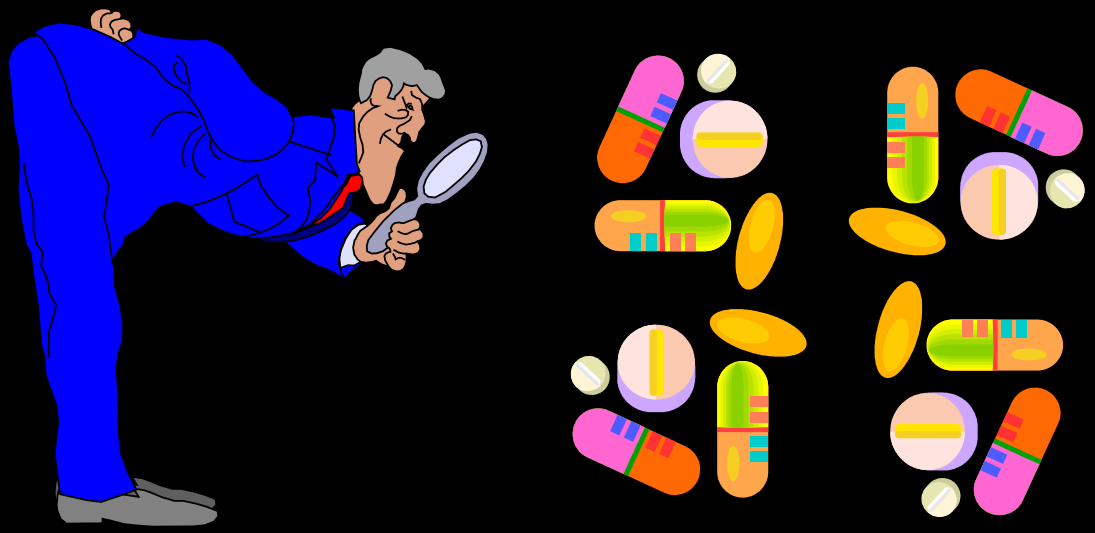


FIGURE 2-2 Medication-use process for hospital and long-term care.

Bootman JL, *IOM Report Preventing Medication Errors*, The National Academies Press, Washington, DC, 2007.

FOCUS P-D-C-A Model

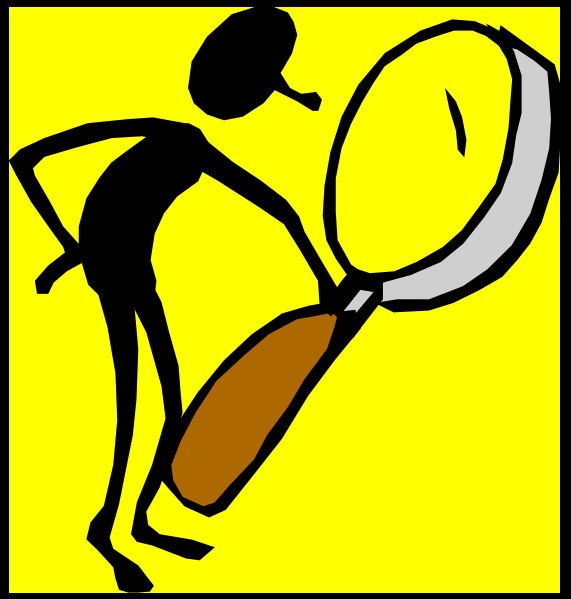
A Nine Step Process Guide To Quality Improvement



Source: Hospital Corporation of America

F-O-C-U-S

- FIND
- ORGANIZE
- CLARIFY
- UNCOVER
- START

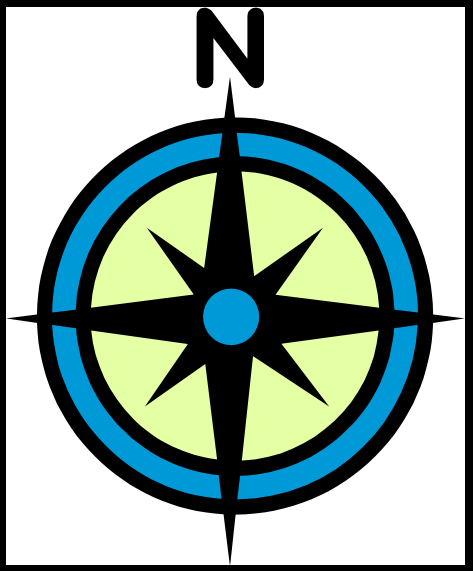


FOCUS

- **F**ind a process improvement opportunity.
- **O**rganize a team who understands the process.
- **C**larify the current knowledge of the process.
- **U**ncover the root cause of variation/poor outcome.
- **S**tart the “Plan-Do-Check-Act” Cycle.

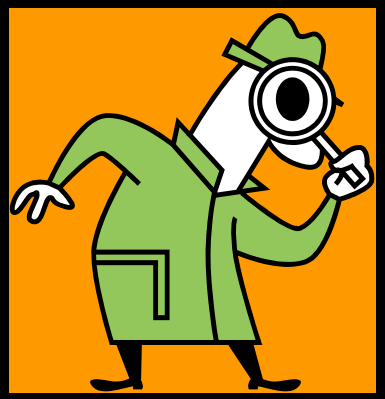
FIND

- Sources of improvement opportunities.
  - Sentinel event reports
  - Closed record screens
  - M&M reports
  - Plaintiff claim allegations
  - Congressional inquiries
  - News media stories



FIND-A Process To Improve

- Is there a clear simple description of the process?
- What is the process?
- What are the major process problems?
- What are the perceived boundaries?
- What are the resource boundaries?
- What are the key issues?

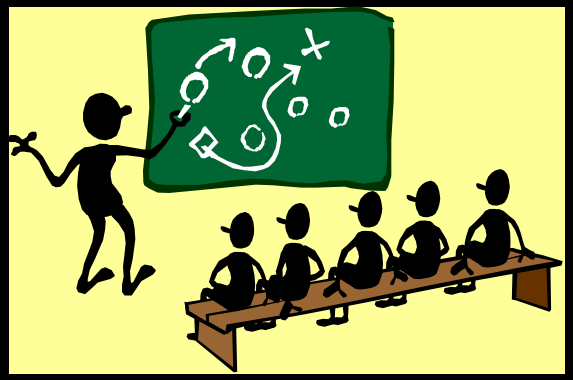


FIND-Possible Tools

- Brainstorming
- Data Collection
- The 7 Management Tools
  - Affinity Diagrams
  - Interrelationship Diagrams
  - Tree Diagrams
  - Matrix Diagrams
  - Prioritization Matrices
  - Process Decision Program Chart
  - Activity Network Diagrams

ORGANIZE

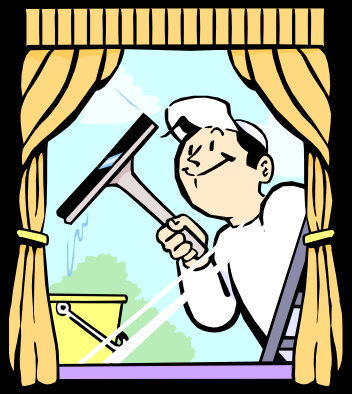
- Are there people who work in this process including?
  - Internal customers
  - External customers
- A team that knows the PROCESS
- Is technical guidance and support available?



ORGANIZE-Possible Tools

BRAINSTORMING!

CLARIFY



- Current knowledge of the PROCESS
  - Who are the customers?
  - What are their needs?
  - Should boundaries be defined?
  - What is the actual flow of the process?
  - Is there needless complexity/redundancy?
  - What are the outcomes/best way for the process to work?

CLARIFY-Possible Tools

- Data Collection

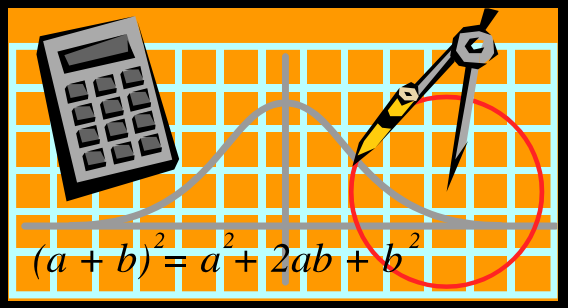
- Flow Charting

UNCOVER

- Causes of PROCESS variation or poor quality:
  - What are the major causes of variation or poor quality?
  - Which key characteristics are measurable?
  - What…Who…Where…When…How will data be collected?
  - Does the data reflect common or special cause?
  - Which causes of variation can we change to improve the process?

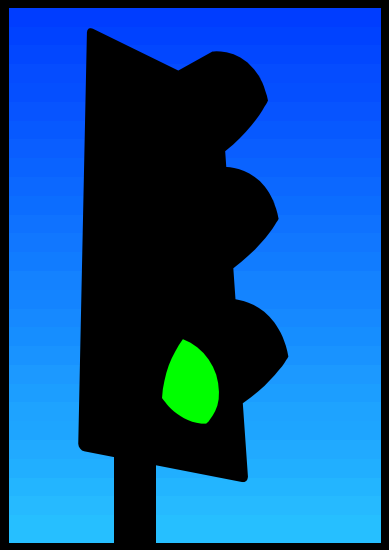
UNCOVER-Possible Tools

- Brainstorming
- Cause and Effect Diagram
- Inverse Tree Diagram
- Multi-Voting
- Scatter Diagrams
- Run and Control Charts
- Histograms

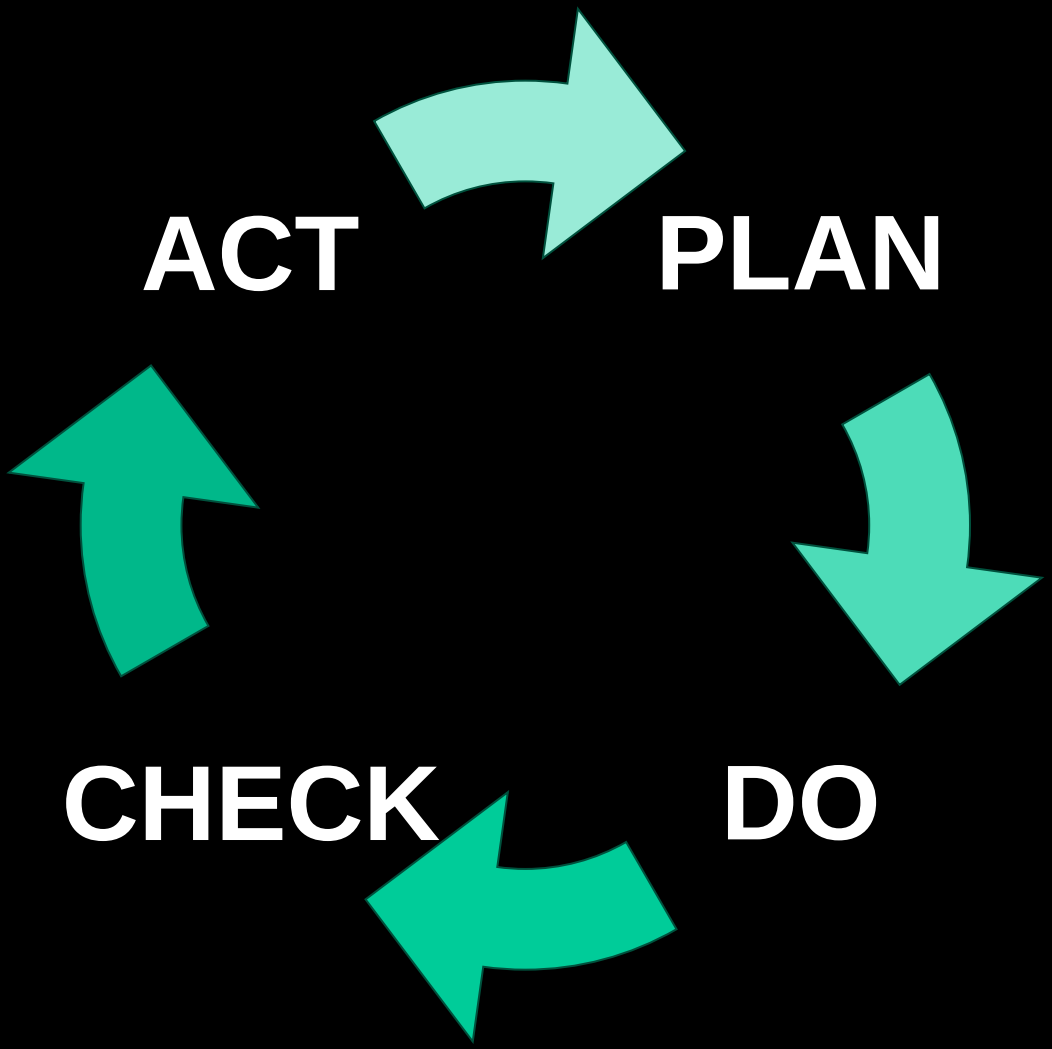


START-The P-D-C-A Cycle

- Select a portion of the process to improve.
- What is the proposed process improvement?
- Write the major goal of the proposed process improvement.
- What changes to the process are most feasible?



Deming Cycle



Deming Cycle: When to Use

- As a model for continuous improvement.
- When starting a new improvement project.
- When developing a new or improved design of a process, product or service.
- When defining a repetitive work process.
- When planning data collection and analysis in order to verify and prioritize problems or root causes.
- When implementing any change.

Deming Cycle: Procedure

- Plan. Recognize an opportunity and plan a change.
- Do. Test the change. Carry out a small-scale study or pilot.
- Check. Review the test, analyze the results and identify what you've learned.

Deming Cycle: Procedure Continued

- **Act. Take action based on what you learned in the study step: If the change did not work, go through the cycle again with a different plan. If you were successful, incorporate what you learned from the test into wider changes. Use what you learned to plan new improvements, beginning the cycle again.**

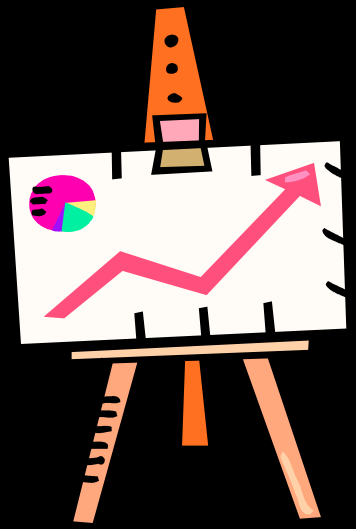
PLAN-The Improvement

- What…Is the process improvement to be piloted?
- Who…will do the pilot?
- How…will it be piloted?
- Where…will it be tested?
- When…will it be tested?
- What data must be collected to measure the improvement?

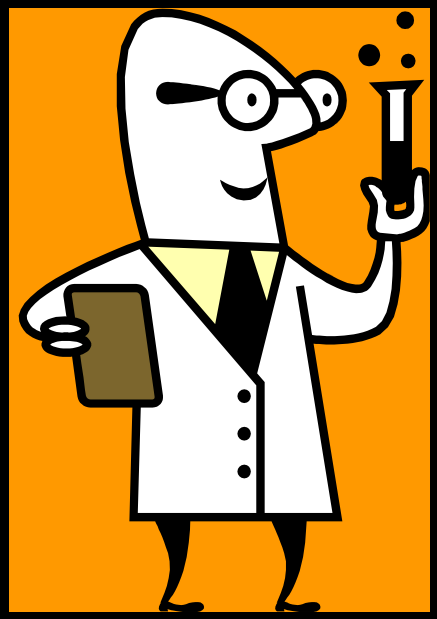
PLAN-Possible Tools

- Brainstorming

- Process Decision Program Charts



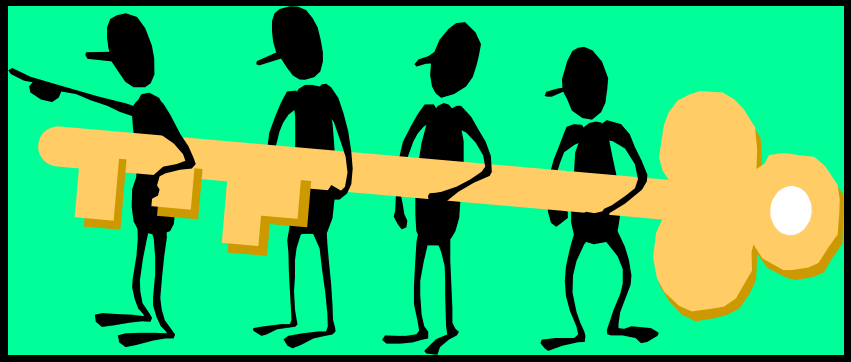
DO



- Do the improvement
  - Collect data
  - Analysis
- Are there significant changes needed in the pilot or data collection efforts?

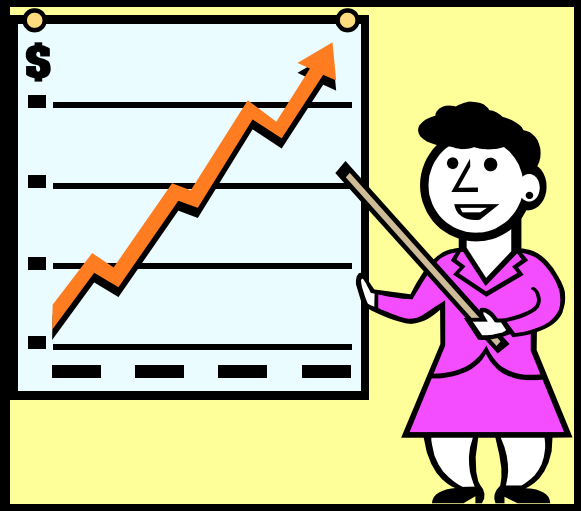
CHECK

- The Results and Lessons Learned
  - Did the process improve as expected?
  - Did the process improve from the customer's point of view?
  - Does the data support the improvement?
  - How could the team efforts be improved?

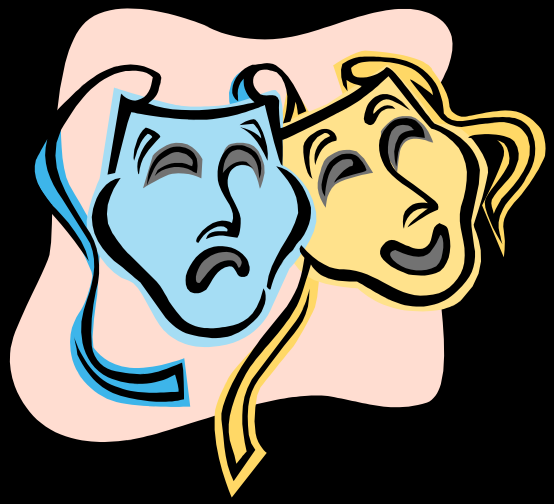


CHECK-Possible Tools

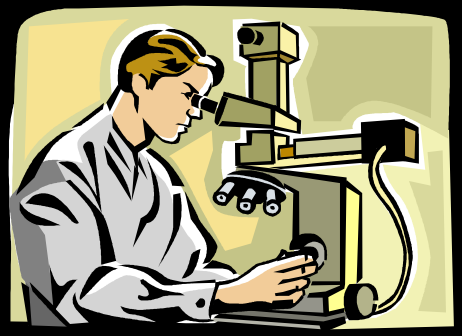
- Data Collection
- Scatter Diagrams
- Run and Control Charts
- Histograms
- Customer Surveys



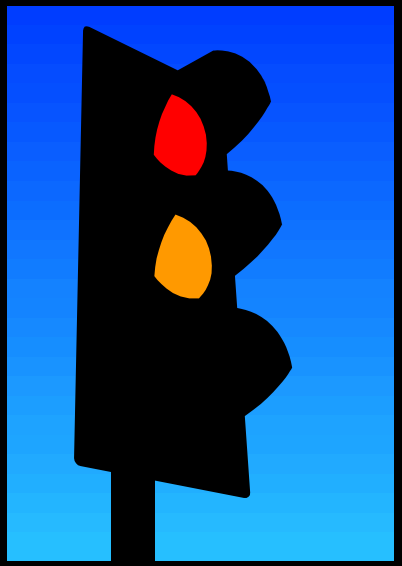
ACT



- To Hold the Gain
- Adopt
- Adjust



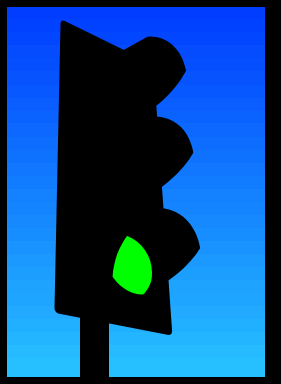
- Abandon the Change



Summary of Performance Improvement Process

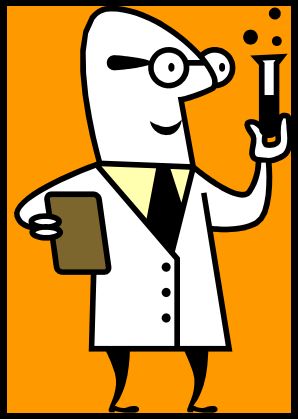
- MUE Definition

- **FOCUS** P-D-C-A

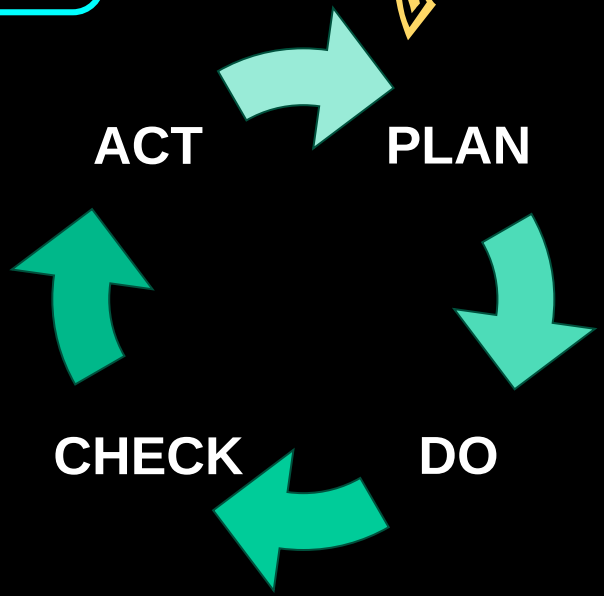


Summary of Performance Improvement Process

- FOCUS P-D-C-A



- Now that we've looked at the MUE definition and process, let's look at some individual MUEs with performance improvement in mind.



AGE/WEIGHT/THROMBUS BURDEN HEPARIN PROTOCOL

By
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RAPID CITY REGIONAL HOSPITAL

Problem Identification

- Previous DUE in ’92 only 54% therapeutic in 24 hours.
- Repeated phone calls regarding obese patients.
- Heparin is a dangerous anticoagulant & needs to be administered appropriately.
- It is needed to be administered very rapidly and a therapeutic level is desired ASAP.

Dates of Measurement

- January through June 1995 & October-January 1996.
- Benchmark Data Used
  - Weight Based Heparin was used as our benchmark from Raschke RA, et al. *Ann Intern Med* 1993;119:874-81.

PLAN

- Weight based heparin orders were developed with the P&T Committee based on the previous article.
- The laboratory was consulted regarding the therapeutic aPTT range.
- A housewide pilot and anticoagulation sheet were developed with nursing (Sandi Weinmaster, R.N.).

DO

- New weight based heparin orders were implemented in August of 1995 for a 1 month housewide pilot.
- Before the pilot was implemented the new orders were circulated through the various sections of the Medical Staff along with the article and suggestions were solicited.

CHECK

- A housewide pilot was performed with new weight based heparin and anticoagulation tracking sheet.
- The orders and tracking sheet were revised in late September 1995.
- A series of 7 housewide extensive mandatory nursing inservices were conducted along with a videotape on the importance of rapid therapeutic aPTTs and weight based heparin dosing.

ADULT ROUTINE HEPARIN ORDERS
SEPTEMBER 1995

PLEASE LINE THROUGH ANY ORDERS NOT INDICATED FOR THIS PATIENT

I. If Heparin therapy has not been initiated follow A through F below.
II. If patient is already receiving Heparin therapy draw STAT PTT.
III. If PTT in II above is less than 40 seconds, follow A through F below.
IV. If PTT in II above is 40 seconds or greater, follow F below.

A. Admitting body weight _____kg. (Do not change with daily weight.)
B. Prior to anticoagulation PTT, PT, Bl Ct if not drawn in last 24 hours.
C. Give bolus heparin, 80 units/kg = _____ units bolus IV one time only upon initiation of routine heparin orders.
D. Continuous IV heparin infusion, 18 units/kg/hour.
E. Laboratory:
Bl Ct q 3 days.
STAT PTT 6 hours after heparin bolus.
If patient on Warfarin (Coumadin), PT/INR q day.
Use the Sliding Scale Protocol for Heparin.
F. Use the Sliding Scale Protocol for Heparin.
☐No Sliding Scale Orders. Call PTT results to physician for heparin orders and PTT orders.
☐Yes

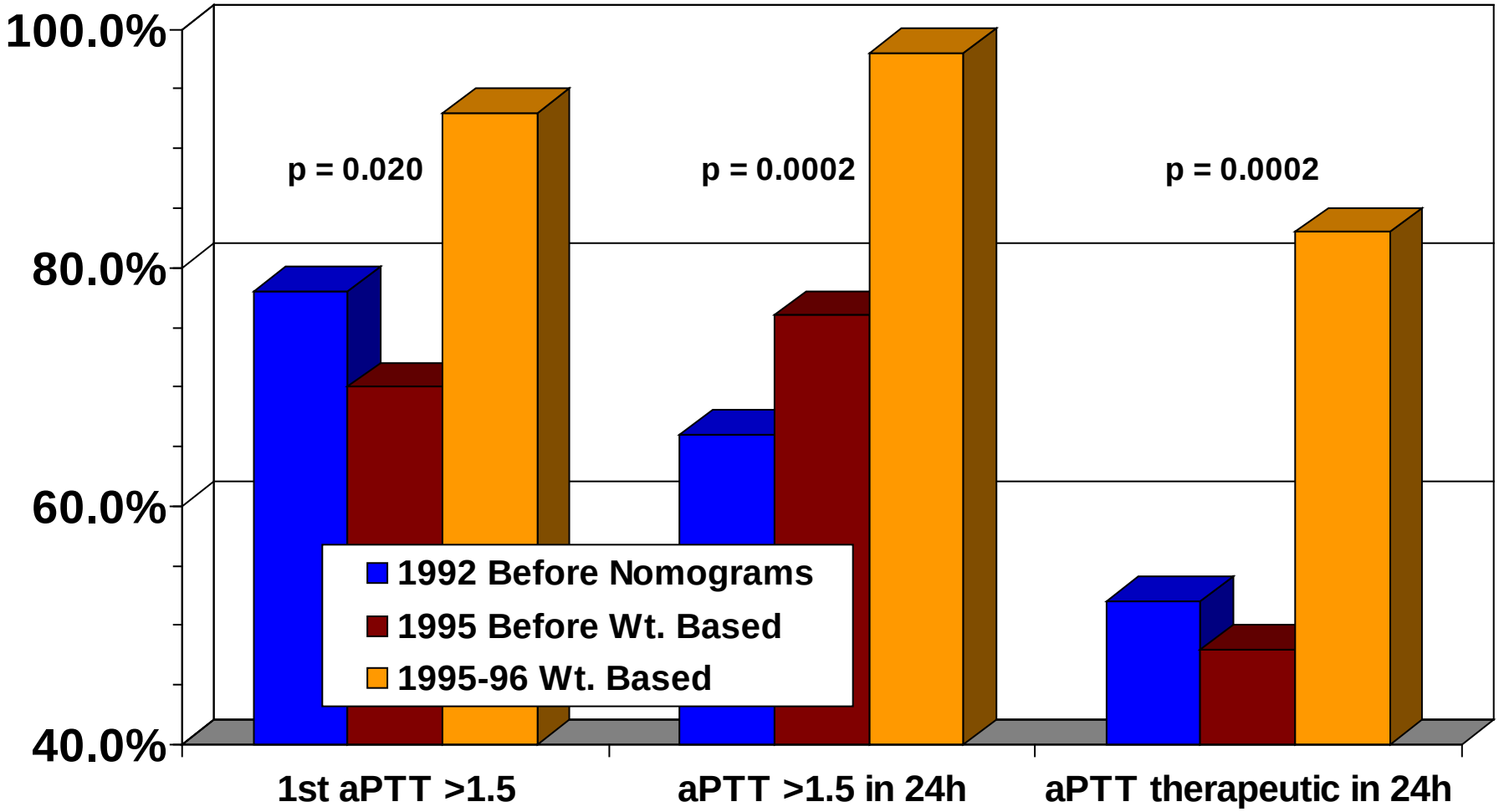
SLIDING SCALE FOR HEPARIN

1. Adjust continuous heparin infusion based on Sliding Scale:

PTT <32	80 units/kg bolus = _____ units Increase drip 4 units/kg/hour.
PTT 32 to 39	40 units/kg bolus = _____ units Increase drip 2 units/kg/hour.
PTT 40 to 70	No change
PTT 71 to 90	Reduce continuous heparin drip 2 units/kg/hour.
PTT >90	Hold heparin for 1 hour. Reduce drip 3 units/kg/hour.

2. PTT 6 hours after any dosage change, adjusting heparin infusion by the Sliding Scale until PTT is therapeutic (40 to 70 seconds). When PTT is therapeutic, daily PTT.
3. Please notify MD if any problems or questions.

Weight Based Heparin MUE All Patients



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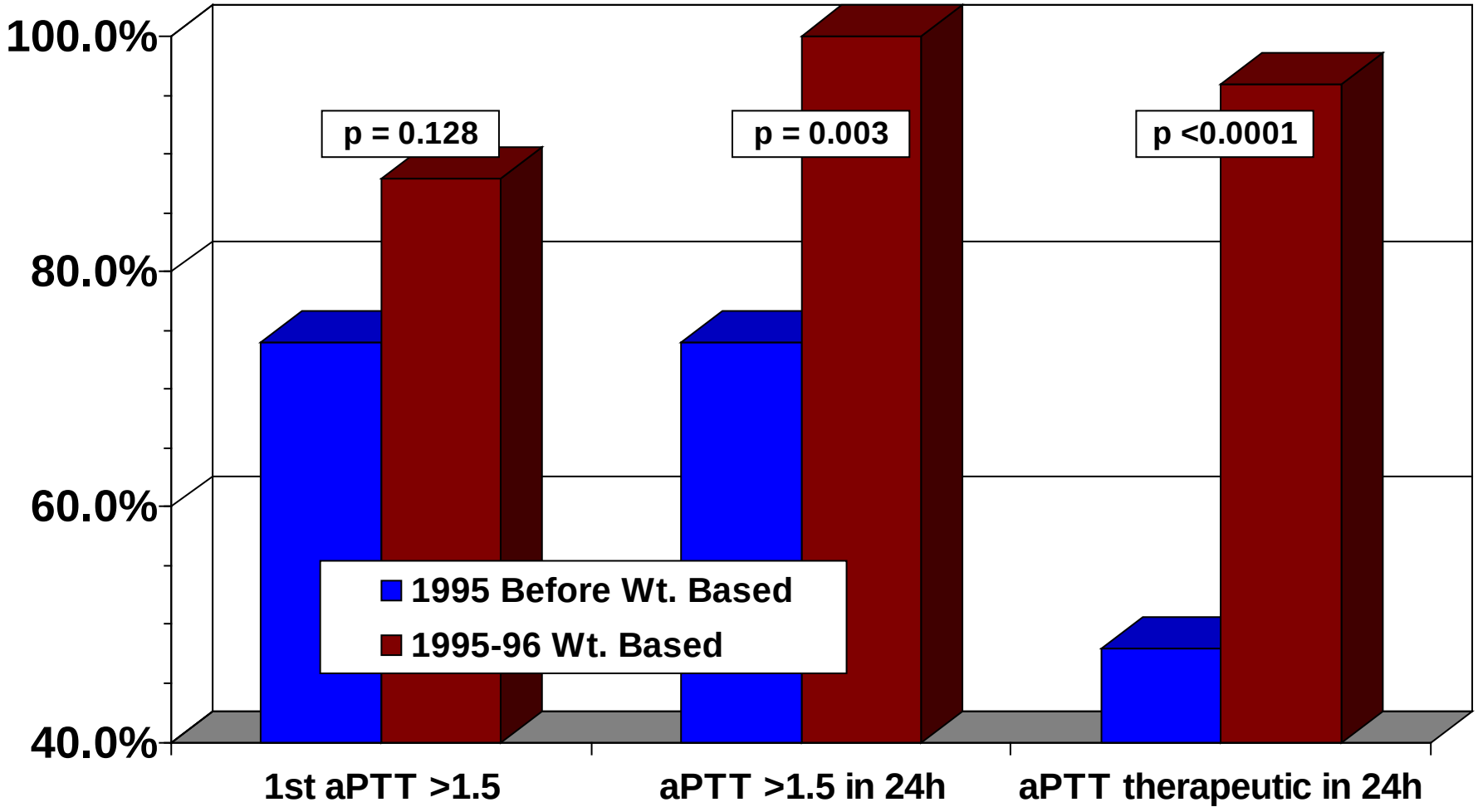
Weight Based Heparin MUE
DVT & PE Patients



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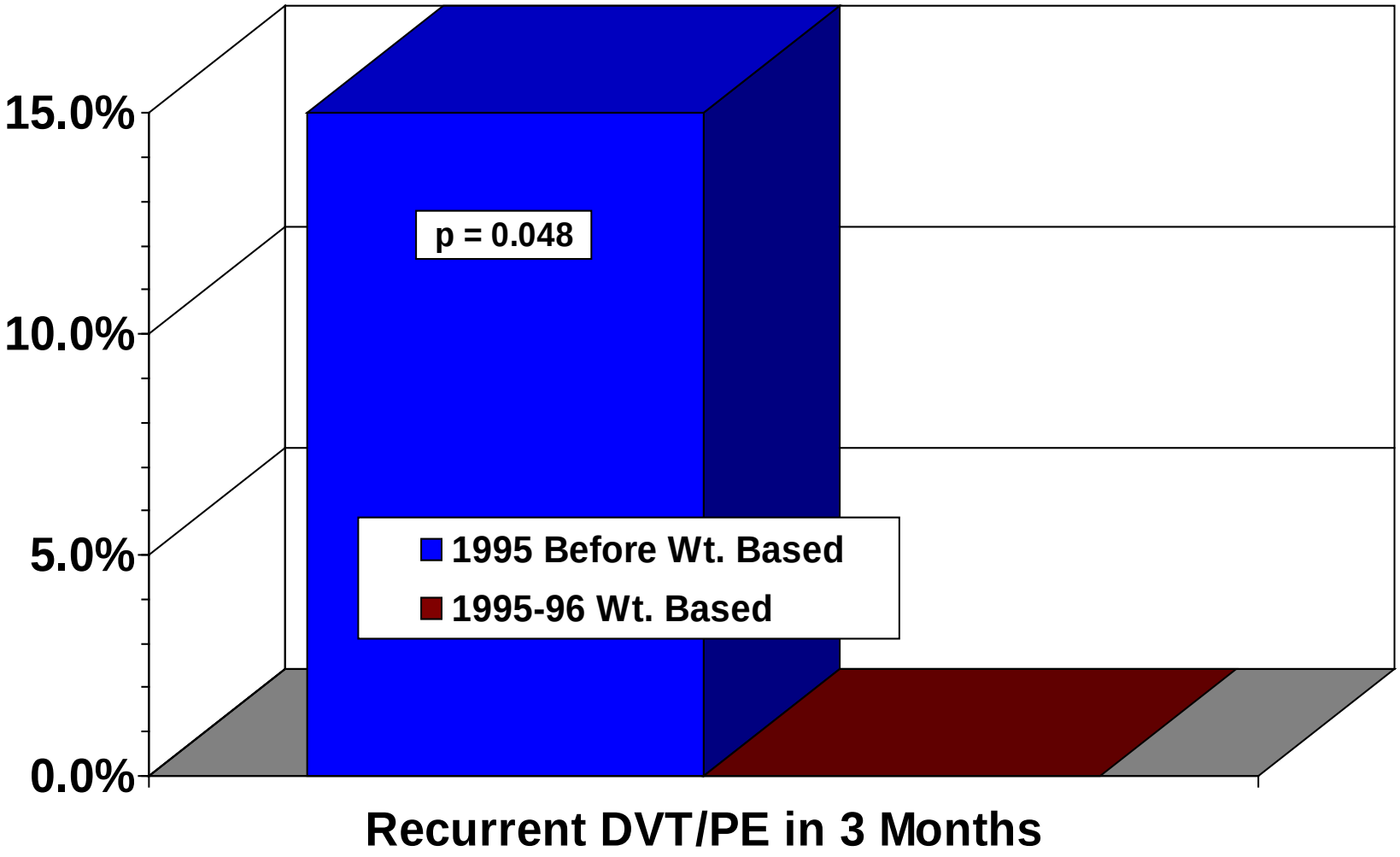
Weight Based Heparin MUE
DVT & PE Patients



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ACT

- Due to MI patients being supra-therapeutic at 24 hours, weight based heparin orders were further revised to include not only weight but thrombus burden and age.
- New orders were implemented on 5/20/96 with re-evaluation in 6 months.

ADULT ROUTINE HEPARIN ORDERS
MAY 1996

PLEASE LINE THROUGH ANY ORDERS NOT INDICATED FOR THIS PATIENT

I. If Heparin therapy has not been initiated follow A through F below.
II. If patient is already receiving Heparin therapy draw STAT PTT.
III. If PTT in II above is less than 40 seconds, follow A through F below.
IV. If PTT in II above is 40 seconds or greater, follow F below.

A. Admitting body weight _____kg. (Do not change with daily weight.)
B. Prior to anticoagulation PTT, PT, Bl Ct if not drawn in last 24 hours.
C. Give bolus heparin, 80 units/kg = _____ units bolus IV one time only upon initiation of routine heparin orders.
D. Continuous IV heparin infusion.
   1. If documented thrombus (e.g., deep venous thrombosis, pulmonary embolism, or acute arterial occlusion), 18 units/kg/hour.
   2. If no documented thrombus follow a through c below.
      a. Patient <65 years of age, 18 units/kg/hour.
      b. Patient 65 to 79 years of age, 14 units/kg/hour.
      c. Patient ≥80 year of age, 10 units/kg/hour.
E. Laboratory:
   Bl Ct q 3 days.
   STAT PTT 6 hours after heparin bolus.
   If patient on Warfarin (Coumadin), PT/INR q day.
   Use the Sliding Scale Protocol for Heparin.
F. Use the Sliding Scale Protocol for Heparin.
   ☐No Sliding Scale Orders. Call PTT results to physician for heparin orders and PTT orders.
   ☐Yes

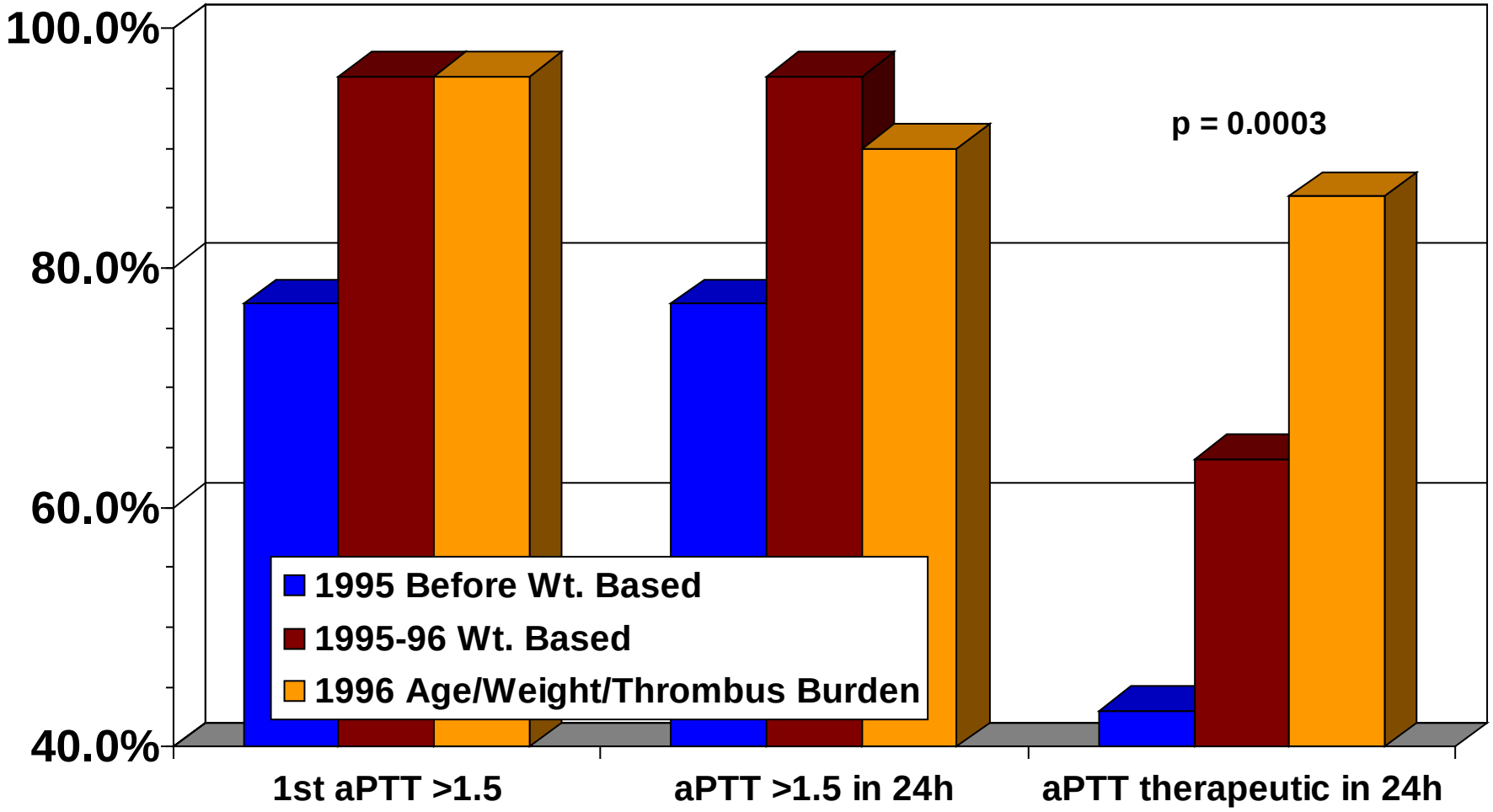
SLIDING SCALE FOR HEPARIN SAME AS 9/95

RAPID CITY REGIONAL HOSPITAL

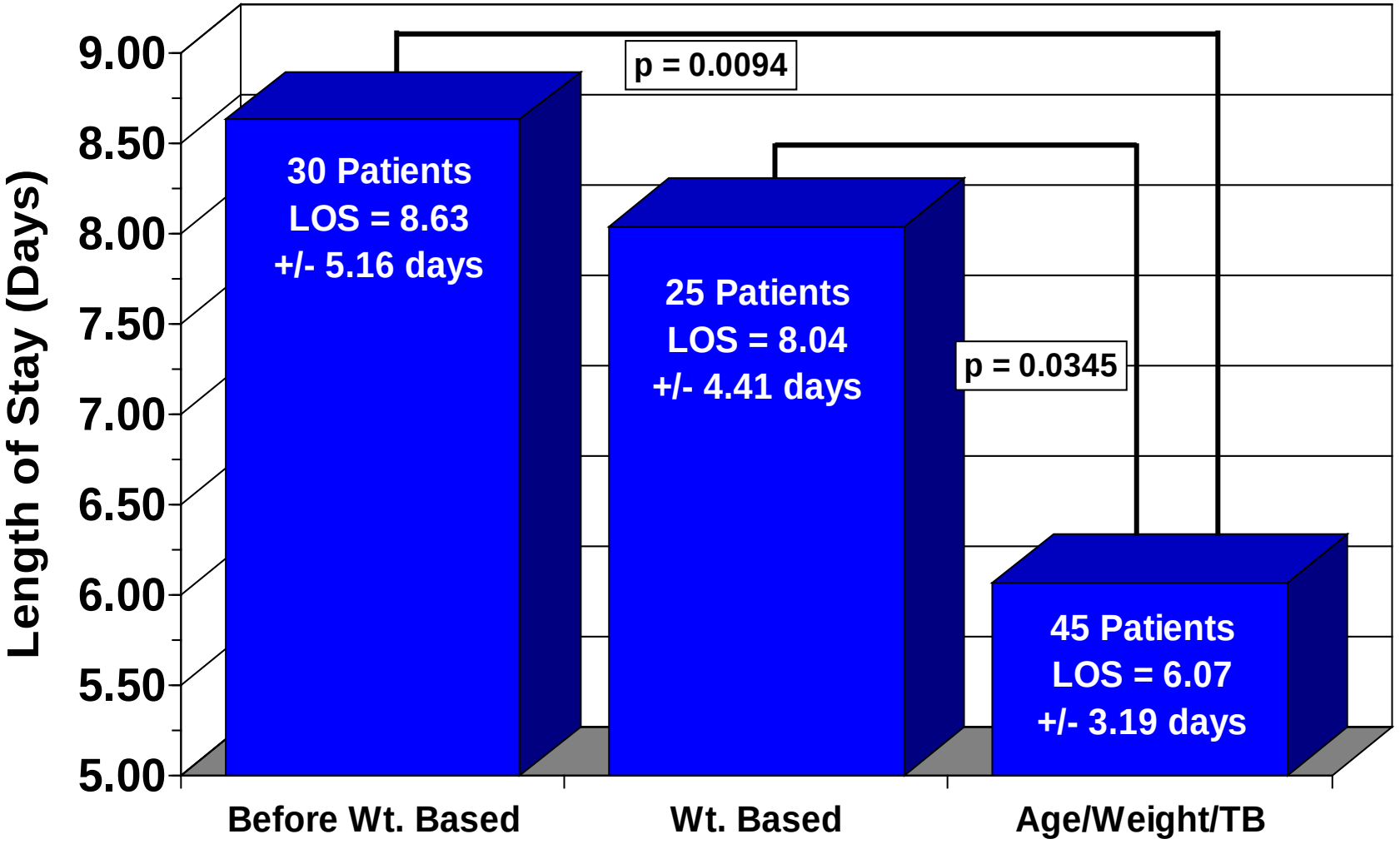
D. Continuous IV heparin infusion.

1. **If documented thrombus (e.g., deep venous thrombosis, pulmonary embolism, or acute arterial occlusion), 18 units/kg/hour.**
2. **If no documented thrombus follow a through c below.**
   a. **Patient <65 years of age, 18 units/kg/hour.**
   b. **Patient 65 to 79 years of age, 14 units/kg/hour.**
   c. **Patient ≥80 year of age, 10 units/kg/hour.**

Heparin Adjusted by Age, Weight, and Thrombus Burden in MI Patients



Heparin Adjusted by Age, Weight, and Thrombus Burden in MI Patients



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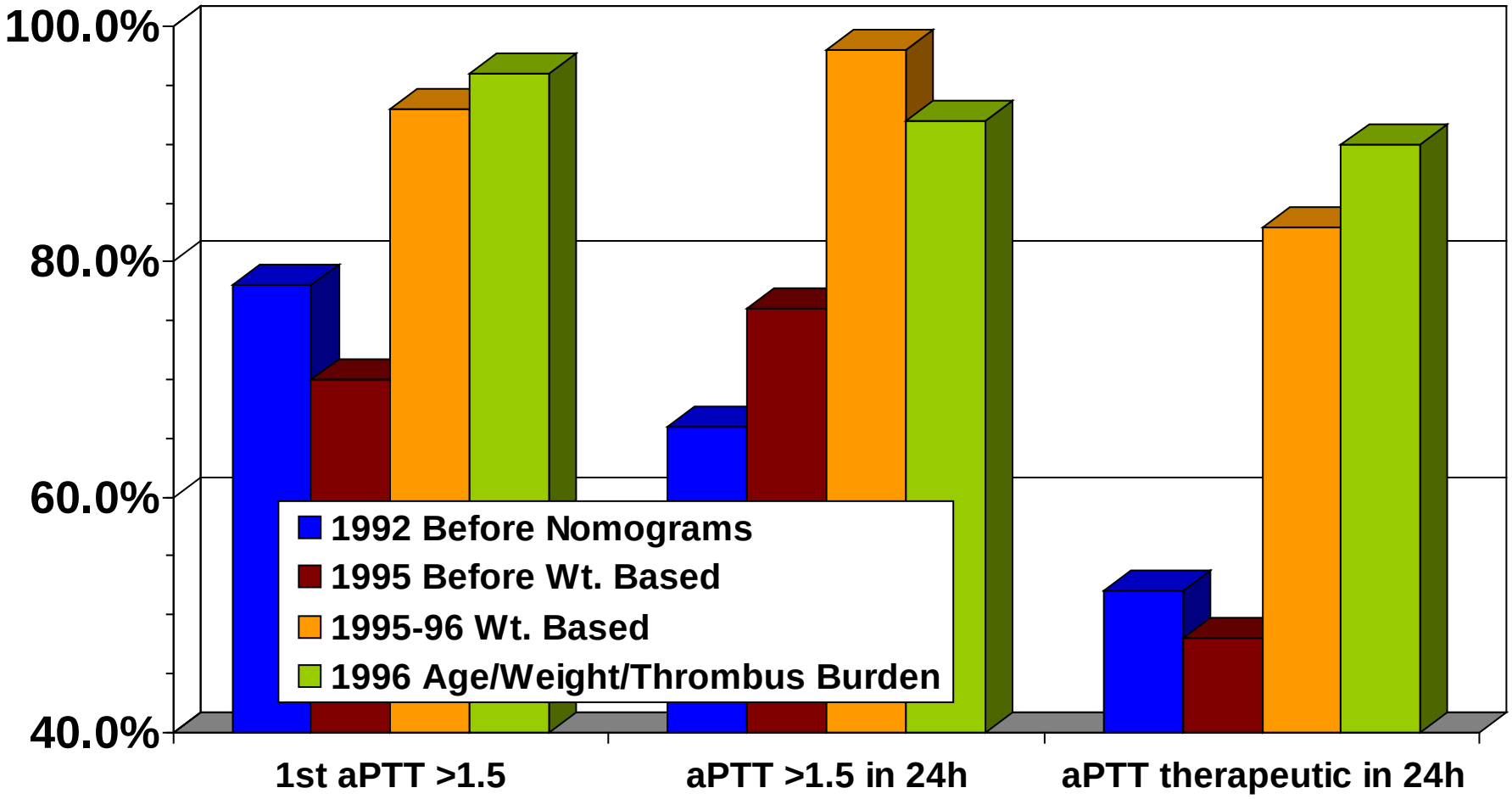
Heparin Adjusted by Age, Weight and Thrombus Burden All Patients



Summary of MUE on Heparin

- Simple Heparin Protocol can have a dramatic effect on real outcomes.
  - RCRH had approximately 450 patients per year with DVT/PE (15% recurrence rate at a cost of $5000 each. (450 X 0.15 X $5000 = $337,500).
  - RCRH had approximately 180 MI patients per month with costs of $800/day. (180 X 12 X $800 X 2.56 = $4,423,680)

Summary of MUE on Heparin

- Get Medical Staff input up front.
- Don't have to win everyone over at first.
- Nurses have tremendous impact on the care of patients especially when effort is concerted and supported by nursing administration.
- EDUCATION, EDUCATION, EDUCATION!
  - Severe bleeding complication rates were higher after wt. based protocol (5% which was comparable to literature). Bleeding rate will be higher if patients are therapeutic vs subtherapeutic.

Antimicrobial Use in Pseudomonal VAP

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FEATURED ARTICLE

The Use of Combination Antimicrobials in Critically-Ill Ventilated Patients with Pseudomonal Pneumonia

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Objectives

- Define ventilator-associated pneumonia
- Review prior studies on inappropriate antimicrobial use in VAP
- Overview of our study results

Ventilator-Associated Pneumonia (VAP)

- Pneumonia >48 hours after intubation
- Prognosis
  - Most common nosocomial infection that leads to death
  - *Pseudomonas*:
    - Mortality 160% of APACHE *(Chest 1996; 109:1019-29)*
    - 44% vs 15% (vs other VAP) *(Am J Med 1993; 94:281-99)*
- Pathogens
  - Early <5 days- common resp pathogens
  - Late ≥5 days- Early + *Pseudomonas*, MRSA, *Acinetobacter*
- ATS VAP Guidelines 2005
  - *(Am J Respir Care Med 2005; 171:399-416)*
  - *"the benefits of combination therapy are unclear, except…"*

Drugs to Tx *Pseudomonas*

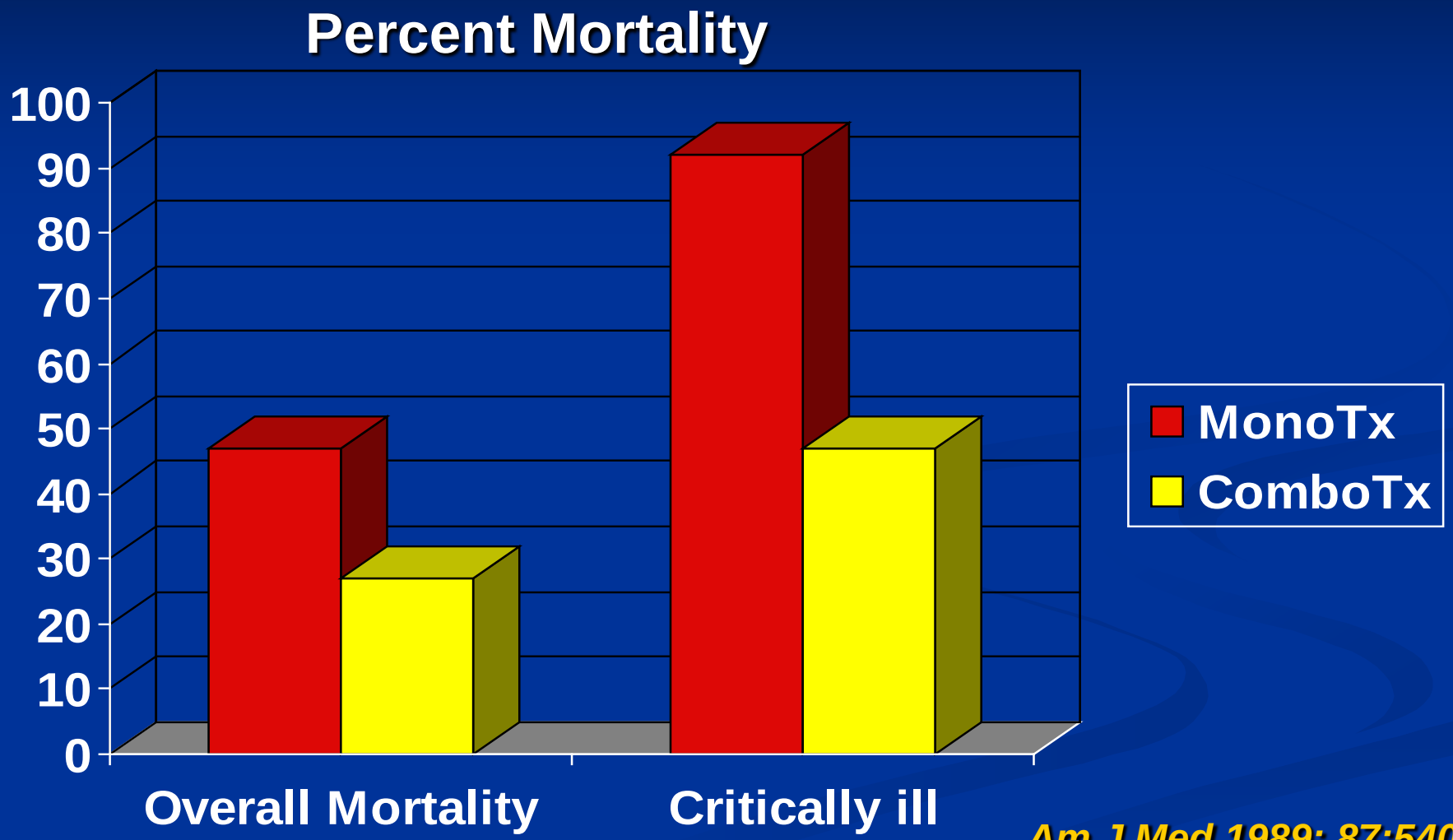
Choices:

- AG
- B-lactam
- FQ

TTUHSC 2003	% Suscept
Pip/Taz	83
Amikacin	77
Tobramycin	75
Aztreonam	70
Imipenem	70
Ceftazadime	63
Cefepime	57
Gentamicin	55
Ciprofloxacin	54

"the benefits of combination therapy are unclear, except…"

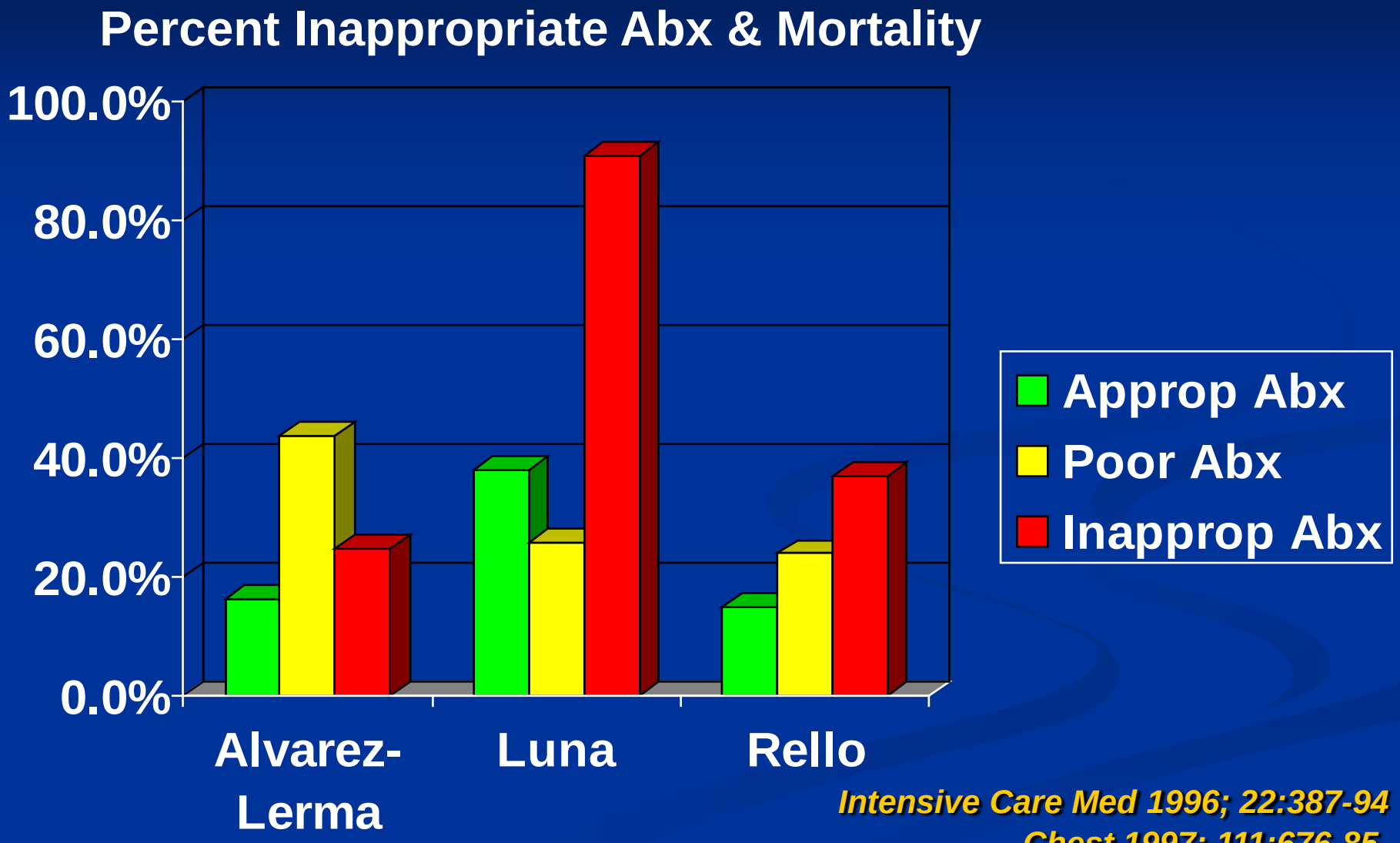
Pseudomonal Bacteremia- Abx ?



Am J Med 1989; 87:540-6

"Consider adding an aminoglycoside for 5 days with a B-lactam"

Inappropriate Abx Use in VAP



Intensive Care Med 1996; 22:387-94
Chest 1997; 111:676-85
Am J Respir Care Med 1997; 156:196-200

Study Objectives

- Quantify our institution's use of antimicrobial agents in Pseudomonal VAP
- Evaluate the association of patient factors and antimicrobial selection on treatment outcomes

Methods

- Retrospective cohort (Jan 2003-Nov 2004)
- Micro lab: ICU resp/blood *Pseudomonas aeruginosa* isolates (not PICU)
- VAP: Cx(+), intubation, ⇑ WBCs, (+)chest x-ray
- Pt variables: demographics, SAPS variables at antimicrobial initiation (illness acuity)
- Antimicrobials: agent(s), dose(s), duration
  - Over 2 week duration following culture reports
- Outcomes: organ failure, survival at DC

Methods- Definitions

- **SAPS II:** (At Abx start)
  - Admit type, immune Dz, Temp, BUN, Na^+, K^+, HCO_3^-, T.bili, WBC, PaO_2/FiO_2, BP, HR, GCS, urine output

    JAMA 1993; 270:2957-63
- **>2 Organ Failure progress:** (surrogate endpoint)
  - resp (all), CV (pressors), renal (ARF/dialysis), hepatic (⇑INR/T.bili, ⇓albumin)
- **Appropriate Antimicrobials:**
  - Sensitive Abx as reported by *P. aeruginosa* Cx data
  - retrospective

Methods- Statistics

- Nominal data analyzed
  - Age >64, SAPS>54, BMI>30, B-lactam/AG
  - Allow for greater statistical power with small sample size
- Chi-square and Fisher exact tests used
- Level of significance set at $\alpha = 0.05$

Results

- n = 59 patients
- 42 males & 17 females
- 39 SICU, 20 MICU
- Age: 57 ± 15.7 years old
  - 18 >64 yo
- BMI: 28.5 ± 6.1 kg/m^2
  - 25 BMI>30
- SAPS II: 45 ± 13.7 (33% mortality)
  - 16 SAPS>54
- Survival: 35/59 (59%)

Peeters MJ, Seifert CF. *Hospital Pharmacy* 2006;41:848-54.

Results

Initial Abx Treatment:

- 2 Approp Empiric Abx: 12%
  - 2 Cx-sensitive Abx: 15%
- 1 Approp Empiric Abx: 66%
  - 1 Cx-sensitive Abx: 58%

Peeters MJ, Seifert CF. *Hospital Pharmacy* 2006;41:848-54.

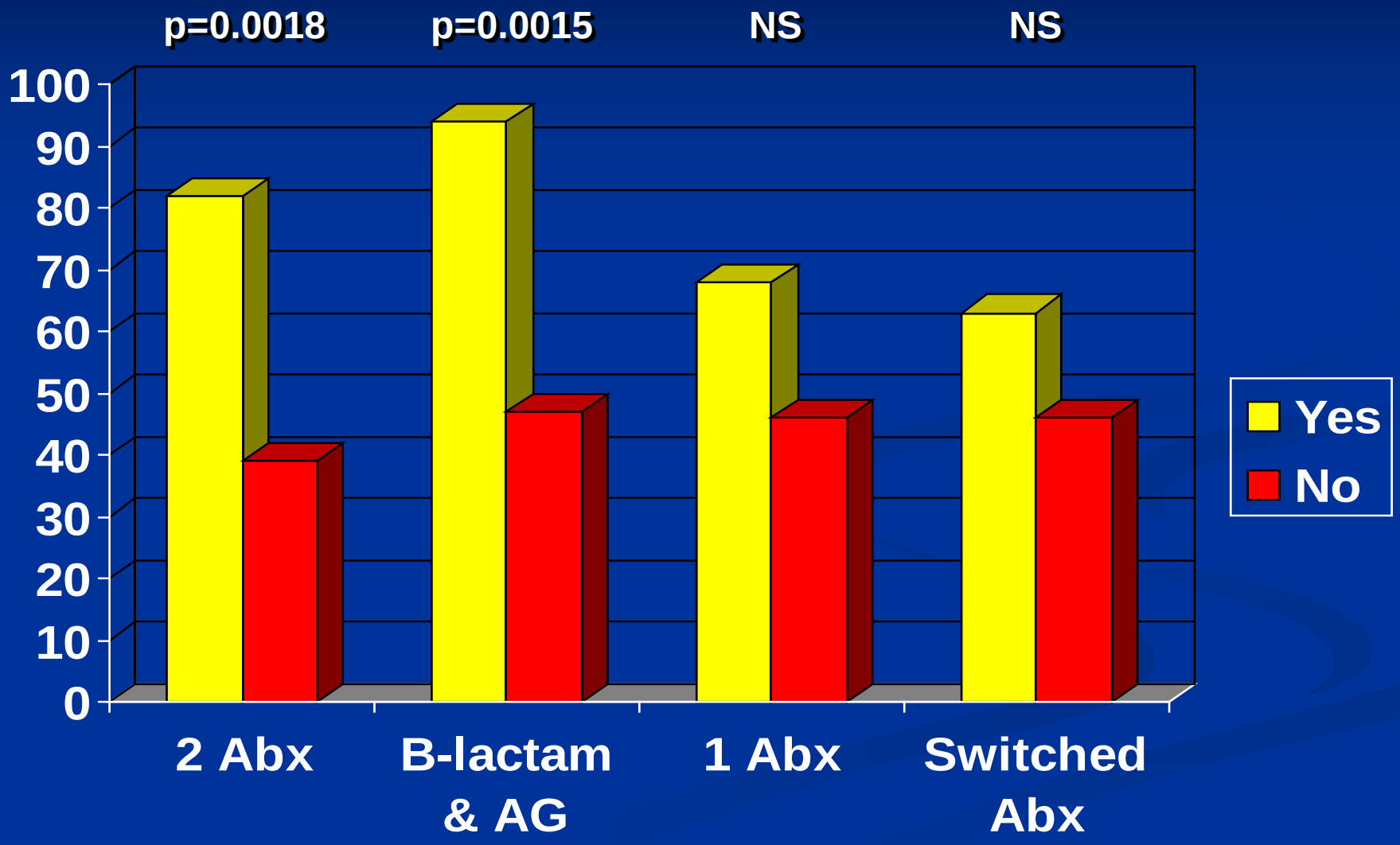
Results

Eventually on Appropriate Abx:

- 2 Agents: 47%
  - B-lactam & AG: 16
  - B-lactam & FQ: 2
  - Combo B-lactams: 7
  - Other: 3
- 1 Agent: 63% (+16%)
- 58% switched to Cx-sensitive Abx
  - Switched in 3.3 days (±1.4)

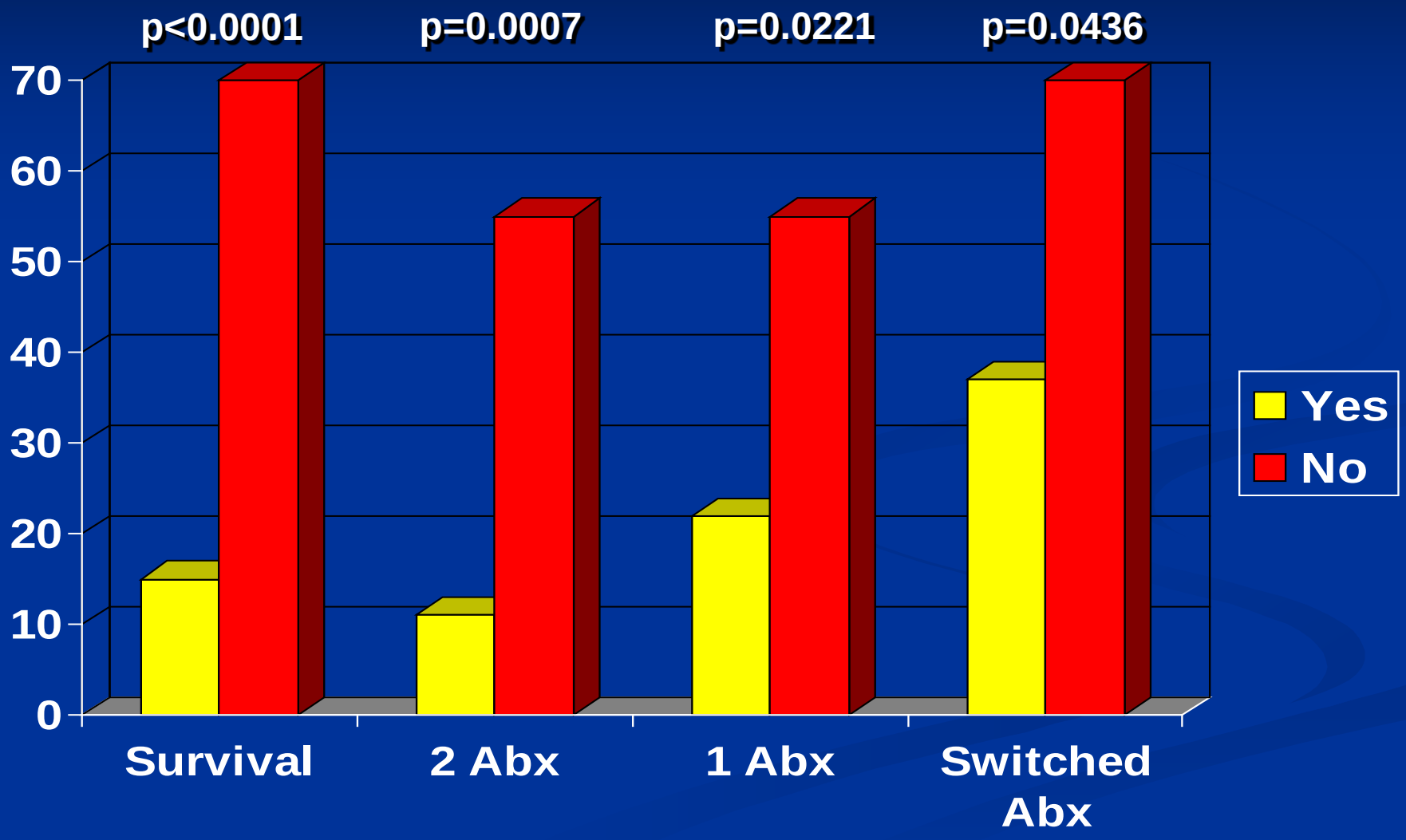
Peeters MJ, Seifert CF. *Hospital Pharmacy* 2006;41:848-54.

Results- % Survival



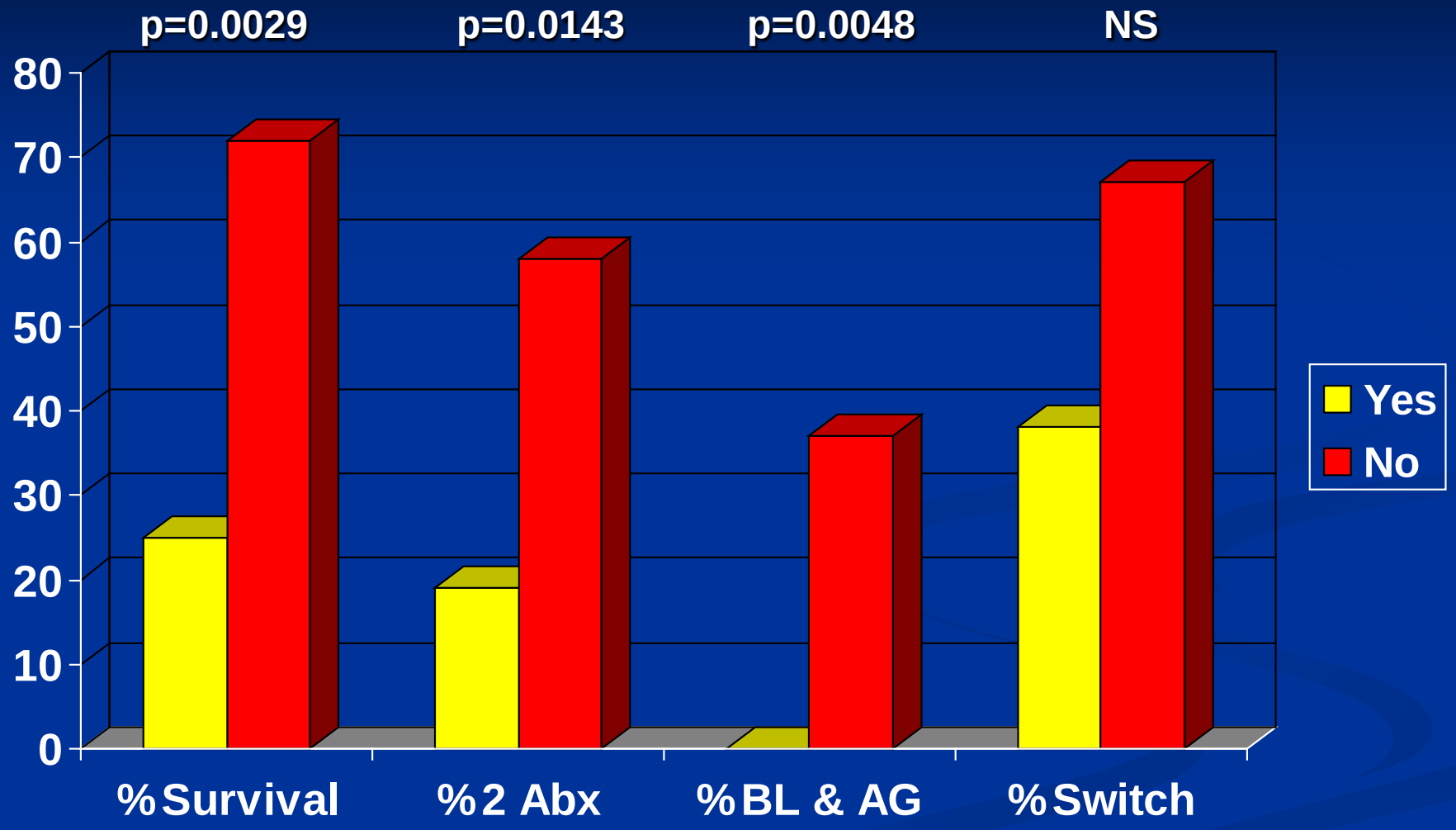
Peeters MJ, Seifert CF. *Hospital Pharmacy* 2006;41:848-54.

Progression to >2 organs failing



Peeters MJ, Seifert CF. *Hospital Pharmacy* 2006;41:848-54.

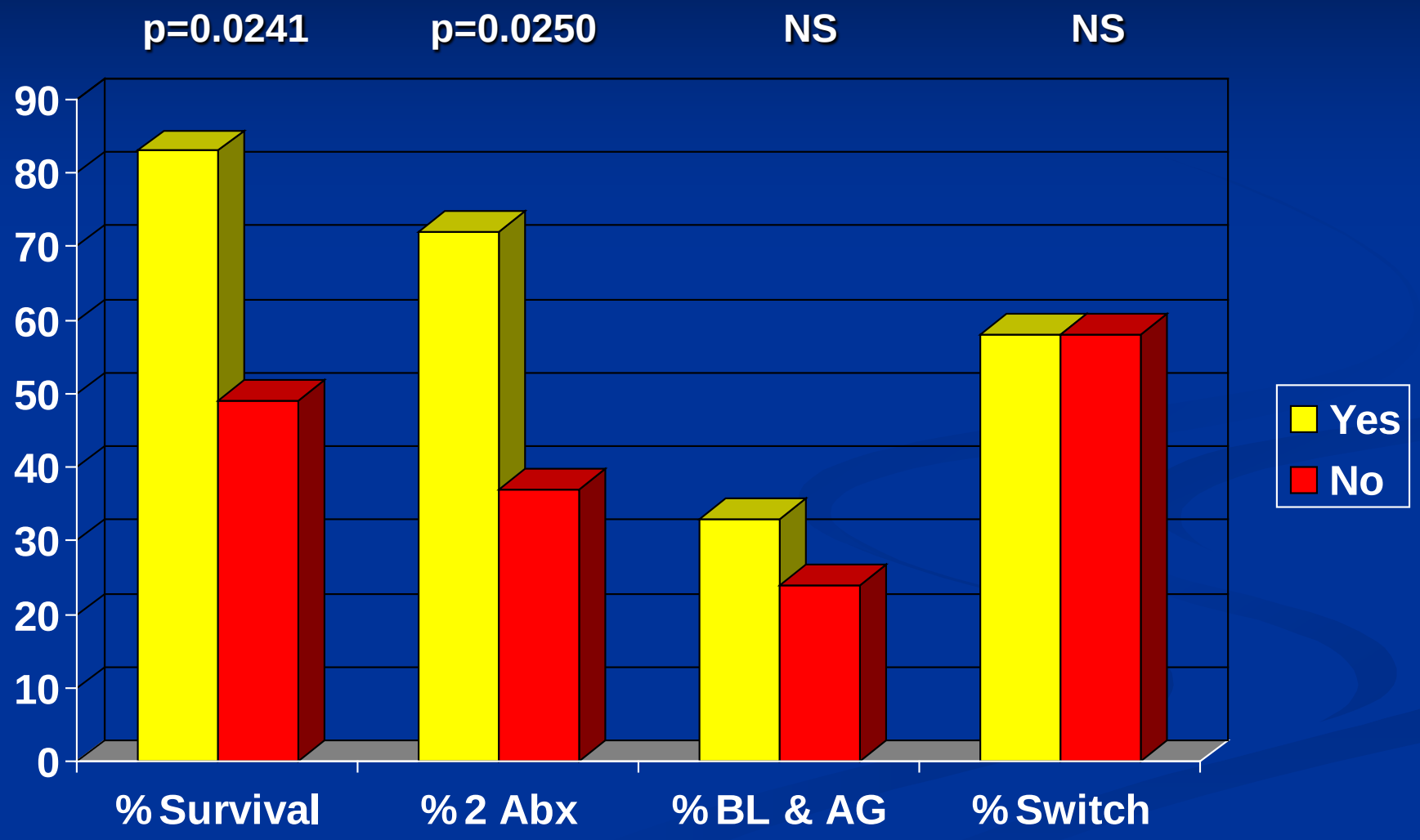
Acute illness (SAPS >54)



*Survival remained significant until SAPS <40

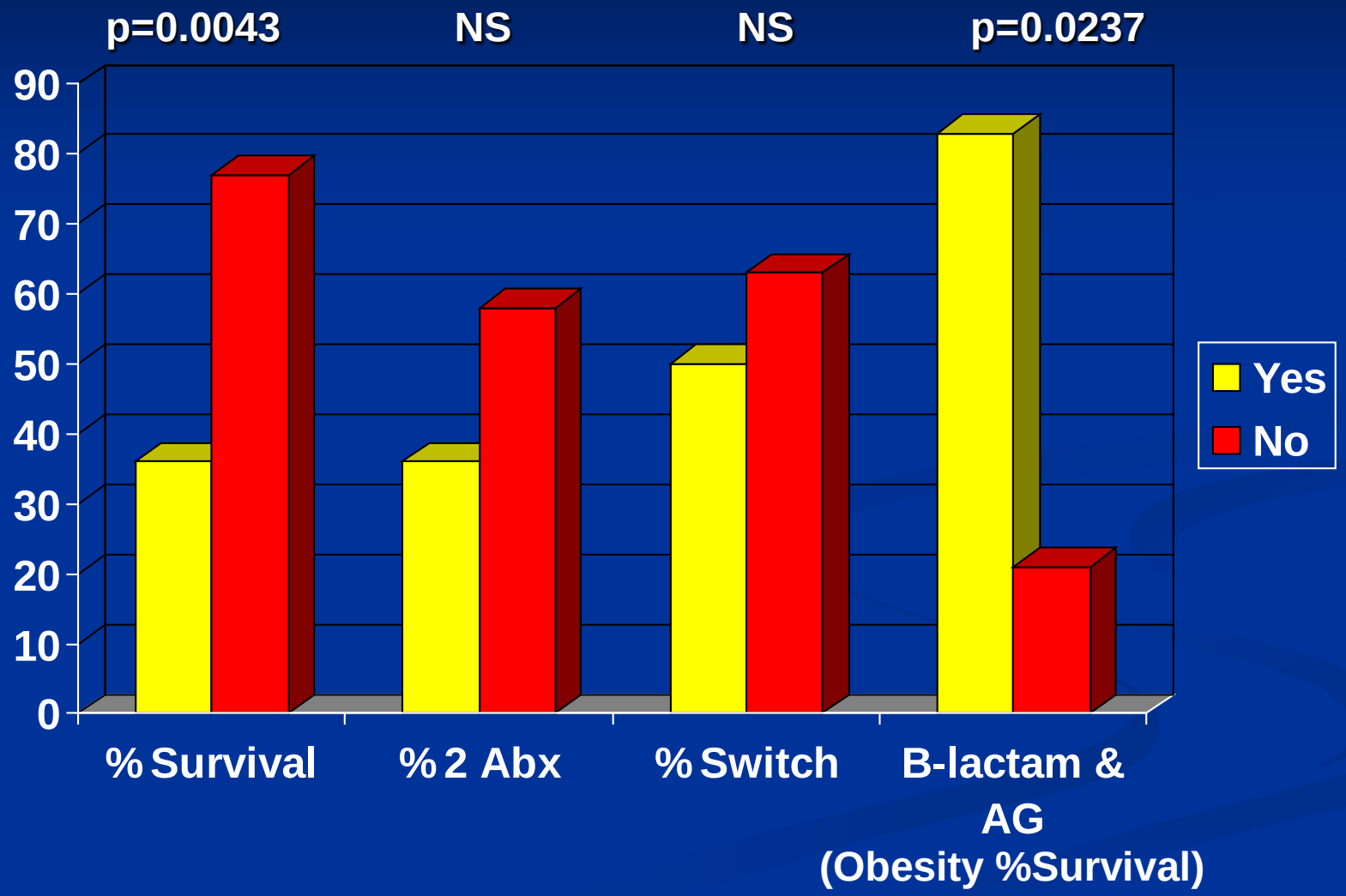
Peeters MJ, Seifert CF. *Hospital Pharmacy* 2006;41:848-54.

Elderly >64 years



Peeters MJ, Seifert CF. *Hospital Pharmacy* 2006;41:848-54.

Obesity (BMI >30)



Peeters MJ, Seifert CF. *Hospital Pharmacy* 2006;41:848-54.

Combo B-lactam & AG

- Only 27% were on a combo B-lactam & AG
- 75% of cultures were sensitive to both
- Almost all patients on combo lived
- Almost all obese pts on combo lived
- None of most critically ill pts were on combo
- Not significant vs switching (BMI, SAPS, Age)
  - Empiric combo best? (Survival: 71% vs 58%)

Peeters MJ, Seifert CF. *Hospital Pharmacy* 2006;41:848-54.

Limitations

- Retrospective analysis
  - Cause & effect? B-lactam/AG & outcome
  - Difficult data collection (secondary source)
- Limited sample size (n=59)

Peeters MJ, Seifert CF. *Hospital Pharmacy* 2006;41:848-54.

Conclusions

- Improved survival with *Pseudomonas aeruginosa* VAP was associated with combination antimicrobials, especially a B-lactam + AG
  - TTUHSC- best empiric option: amikacin (78%) + piperacillin/tazobactam (91%)
- Culture sensitivity data NEEDS to be properly followed and acted upon especially in critically ill patients!

Peeters MJ, Seifert CF. *Hospital Pharmacy* 2006;41:848-54.

Follow-Up Letter

Agreement with antimicrobial management for pseudomonal ventilator-associated pneumonia

To the Editor:

We read with interest the article by Dr. Garnacho-Montero and colleagues (1), published in the August 2007 issue of *Critical Care Medicine*, which provides evidence for antimicrobial selection in pseudomonal ventilator-associated pneumonia. Previously, we reported similar results from an American academic institution (2). We

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Crit Care Med 2007 Vol. 35, No. 12

Garnacho-Montero J, et al. *Crit Care Med* 2007;35:1888-95.
Peeters MJ, Seifert CF. *Crit Care Med* 2007;35:2882.
Peeters MJ, Seifert CF. *Hospital Pharmacy* 2006;41:848-54.

Conclusions

- MUE is a useful process for all pharmacists to become actively involved in.
- It can look at any or all of the medication use process. Seventy percent of drug related problems are related to prescribing and 60% of that is related to physician's lack of knowledge on drugs.
- FOCUS P-D-C-A.
- Look at hard outcomes like LOS, morbidity & mortality, and $.
- Publish your work so others can benefit.

As Pharmacists, YOU CAN Shift the Paradigm!

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