Can We Ever Get To Never? Reducing Infections in a Surgical ICU

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Michigan TQIP

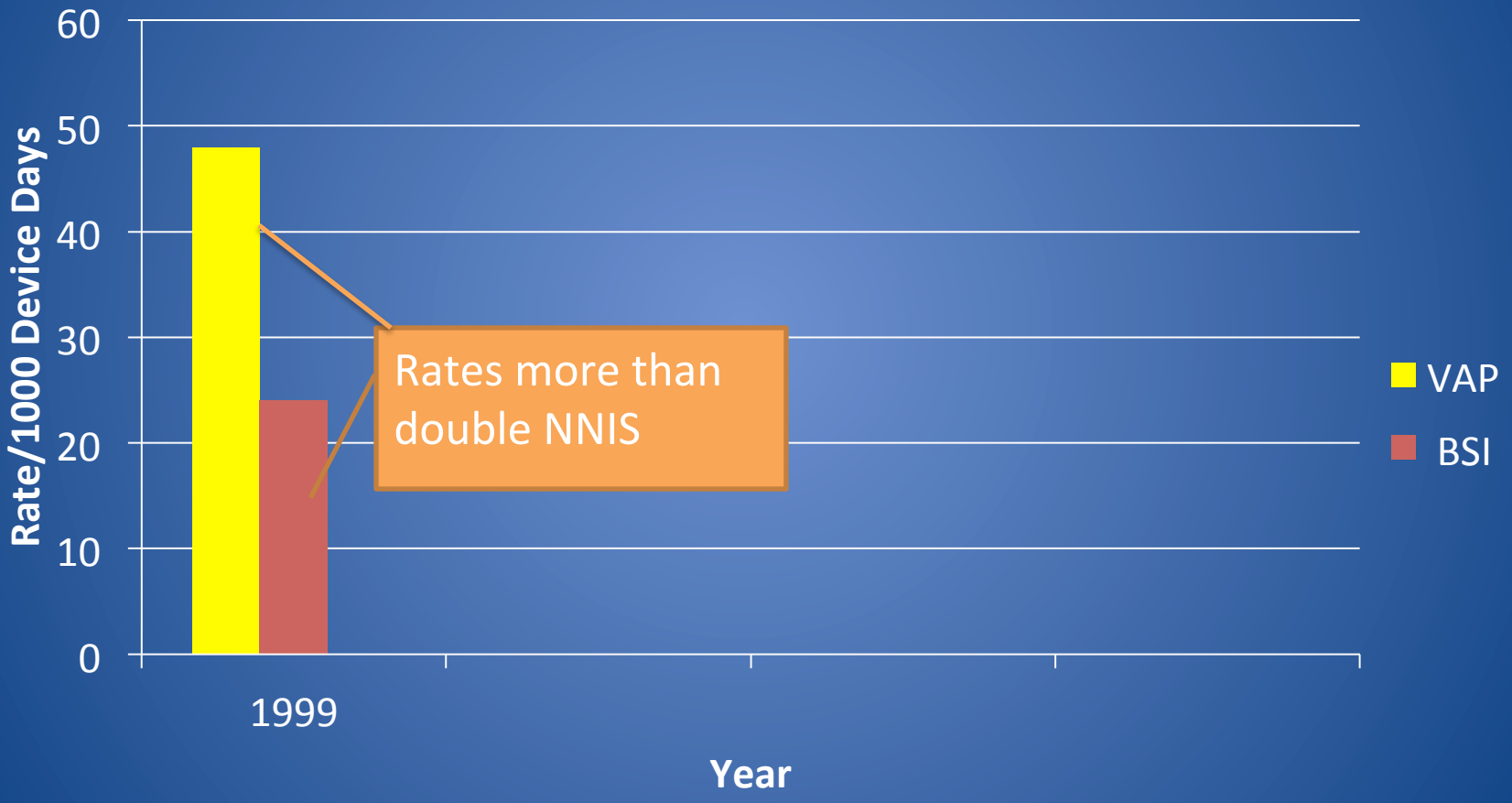
“The Unit”

- 10 ICU beds, 6 floor status beds
  - Trauma, Burns, Emergent General Surgery patients
  - Dedicated surgical intensivists
  - Protocols for patient care since ~1996

The Problem-State of the Unit in October 1999

- Infection rates high compared to NNIS
  - Ventilator associated pneumonia
  - Catheter associated (related) blood stream infections
- No routine reporting of infection rates to medical director/nurse manager
- No routine discussion between unit director and nursing leadership/staff about rates

BSI and VAP Rates in 1999



Rates at Least Two Times > NNIS!

- How did this make me feel?
  - Disbelief
  - Anger
  - Sadness
  - Acceptance
  - Desire to improve (surgeon's competitiveness!)

- What was "I" going to do about it?

The Plan

- Decision to form a multidisciplinary team
  - ICU medical director
  - Nurse manager
  - Bedside nursing
  - Respiratory therapy
  - Infection control liaison

Multidisciplinary Team

- Review rates
  - Compared to unit's own data
  - Compared to NNIS (National Nosocomial Infection Surveillance) rates
    - What type of centers are these?
- Review current policies for the ICU
  - How did these compare to hospital-wide policies?
  - How was the information disseminated?

The Team's Approach

- Review of best practices available in literature and CDC recommendations for infection control practices
  - Plan to comply with at least the minimum CDC recommendations
  - Plan to add other best practices from literature review
- Regular meetings with the "shareholders"

What Happened?

- Almost no change in rates for most of 2000
  - Reviewed education
  - Ensured most up to date recommendations
- Had not “looked” at the process
  - For successful change must see the process in practice

Walked the Walk and Stopped the Talk

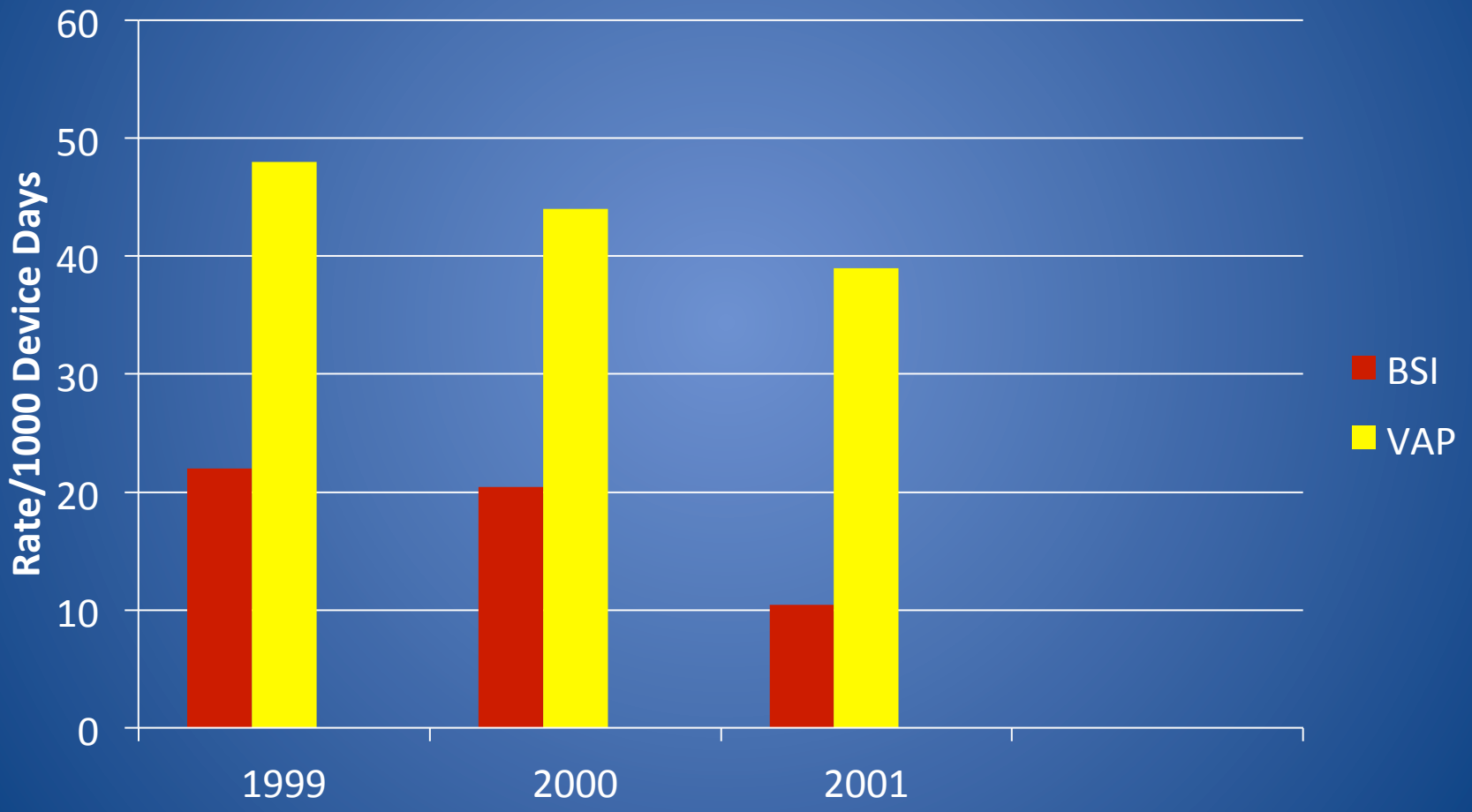
- Observed care of central venous catheters
  - During routine catheter care
  - During complex dressings changes
  - During patient “baths”
- Observed oral care and routine ventilator care
  - Frequency of care
  - How suctioning was performed

New Developments

- 2000-switch to central venous catheters (CVC)-coated with silver-chlorhexidine
  - Hospital chose silver-chlorhexidine rather than Rifampin-minocycline
  - CDC recommendation only to use coated catheters if rates > benchmark

- Reviewed data about ventilator tubing changes, in-line suctioning….

2001-Are we there yet?

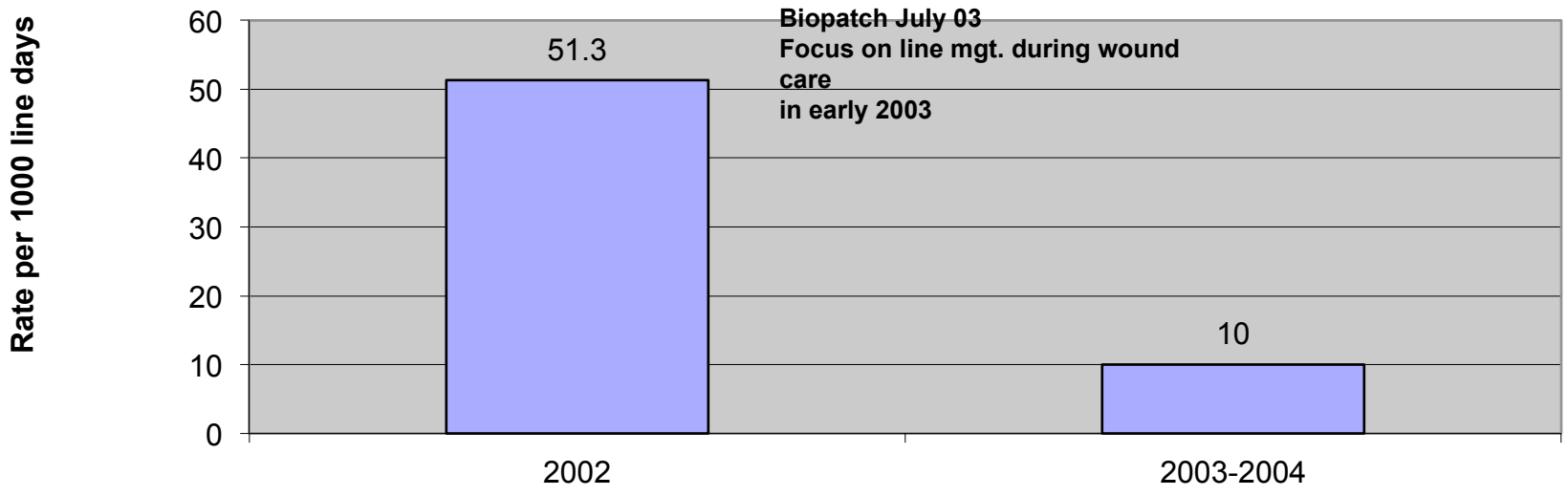


BSI 2001-2003

Encouraged after drop from 1999 to 2001

- 7/2001-Second generation CVC used
- 2002-All non-burn line changes performed as clinically indicated rather than routinely
- 7/2002-Chloraprep used for skin site preparation and line carts available for supplies
- 2003 Use of insulin drips recommended but not mandatory for goal of glucose <150 mg/dL (after visit to friend's hospital who was a cardiothoracic surgeon)
- 7/2003 Biopatch® trial for patients with wounds and central venous catheters

Burn Only BSI Rates
Before and After Biopatch Use



CDC benchmark Burn-8.8

*Aug03-Jul04
p=<0.01

VAP 2001-2003

- 2003-changed unit protocol to bronchoalveolar lavage (BAL) for primary mode of VAP diagnosis
- Trials of various mouth care products throughout the hospital and in our ICU
- Use of insulin drips start, not mandatory

Interest Waning

- Despite focused efforts and modest improvements, interest waning UNTIL:
  - Change in nurse manager
  - Change in infection control liaison
  - Change in respiratory therapist manager
  - Changes in bedside nursing representation

Keystone in Michigan 2005

- Apply what was thought to be best practices to reduce mortality and infectious complications in ICU's
  - Targeted VAP and BSI due to incidence and costs in ventilated patients
    - DVT prophylaxis
    - Stress ulcer prophylaxis (SUP)
    - 8 am glucose <110 mg/dL
    - Head of bed at 30°
    - Daily weaning parameters
    - Daily wake up
    - Sedation holiday

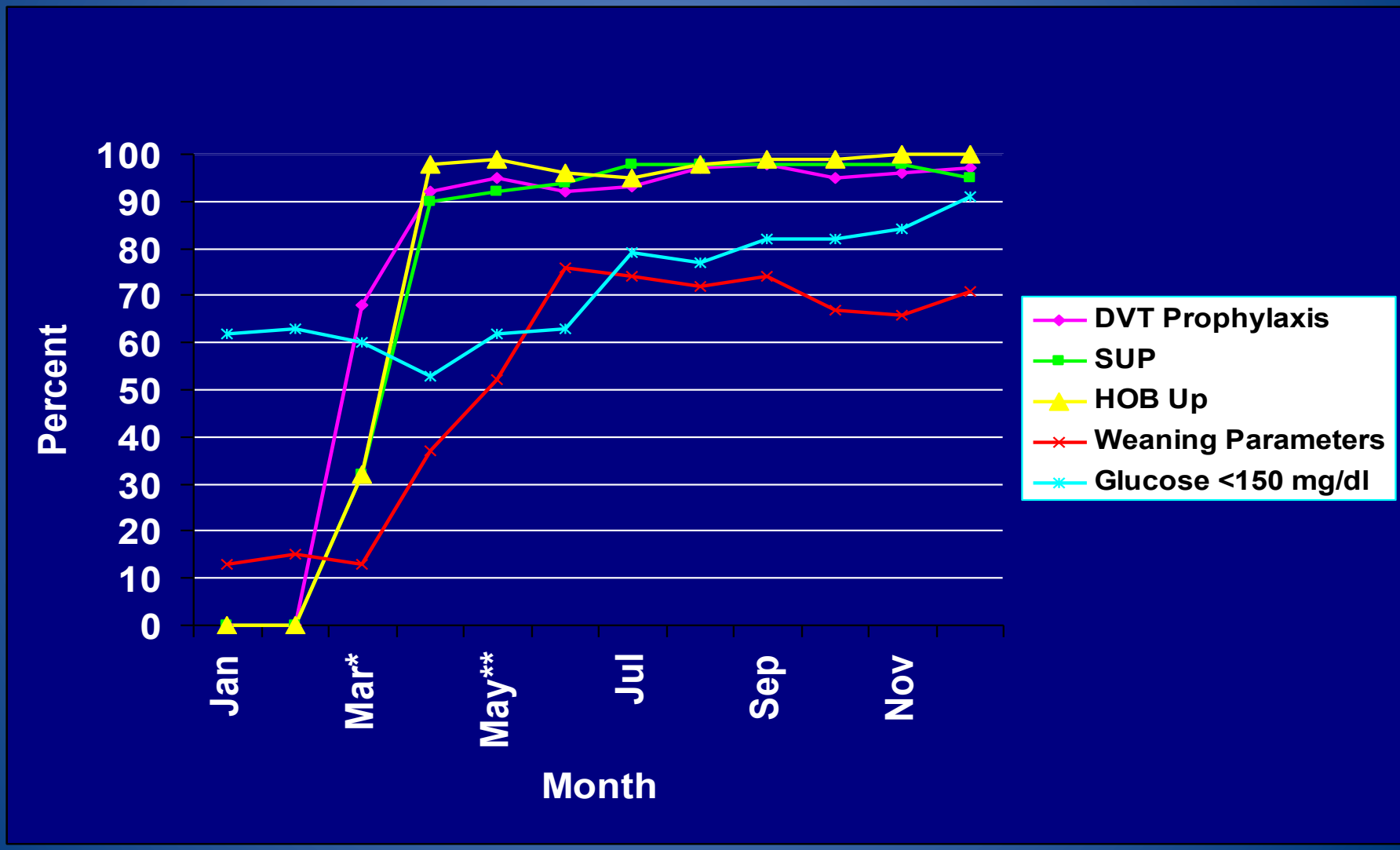
Keystone in our ICU

- Elective decision to submit data (CCMU was the target ICU submitting data)
  - Electronic data capture
  - Daily print out of compliance
- Protocols already in place for stress ulcer prophylaxis, DVT prophylaxis, weaning parameters
    - Head of bed at 30° (HOB up) and glucose compliance added
    - DID NOT KNOW compliance with existing measures

Keystone-Non-Scientific Side

- Brought together the “team” again
  - New leaders
  - New ideas
  - New goals
- Sense of teamwork-”It takes a village”
- Reinvigorated past efforts

ICU Core Measure Compliance 2005



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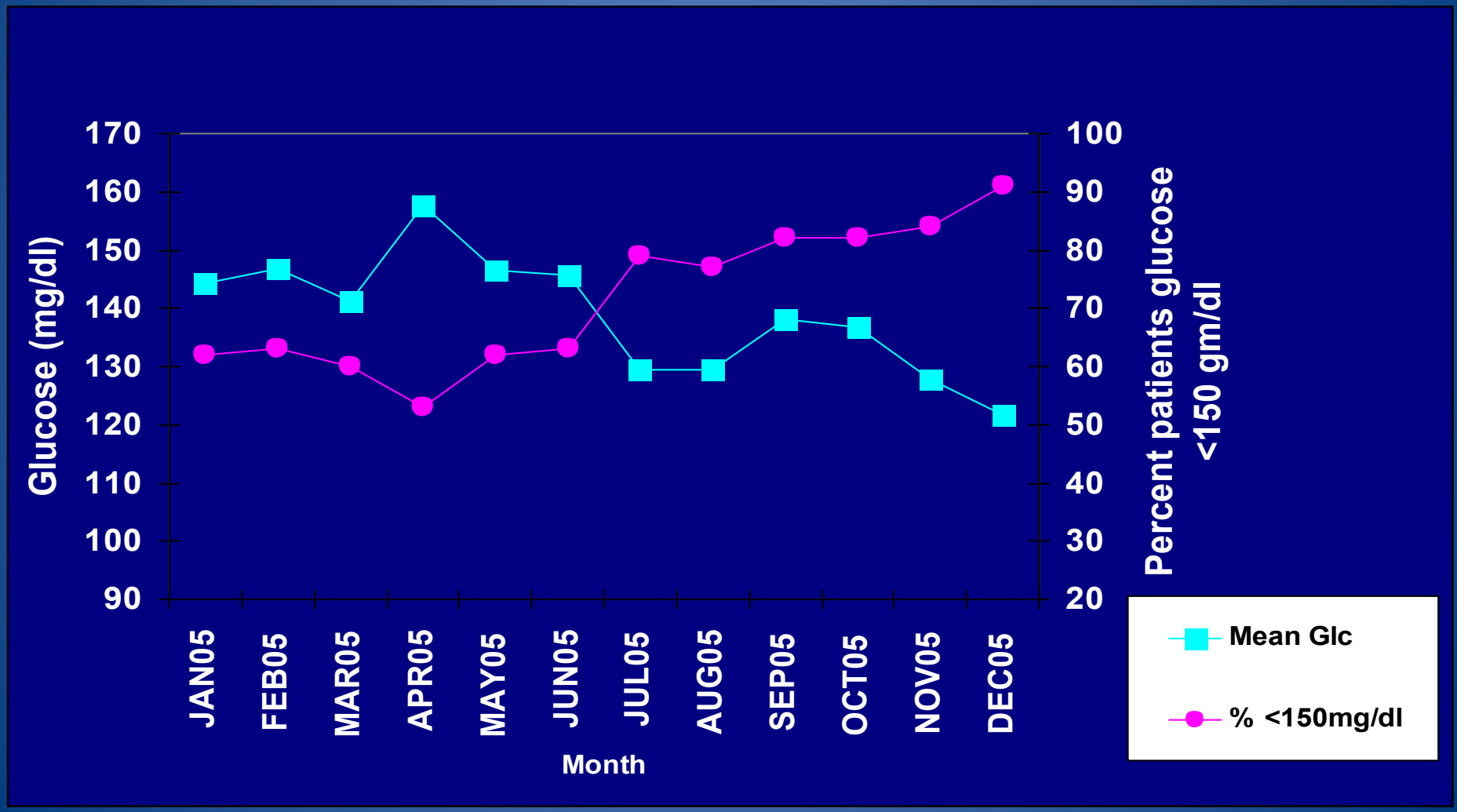
Mean Glucose Over Time Compared to Compliance with Glucose <150 mg/dL



Wahl, et al. Surgery 2006

Highlights of Glucose Control

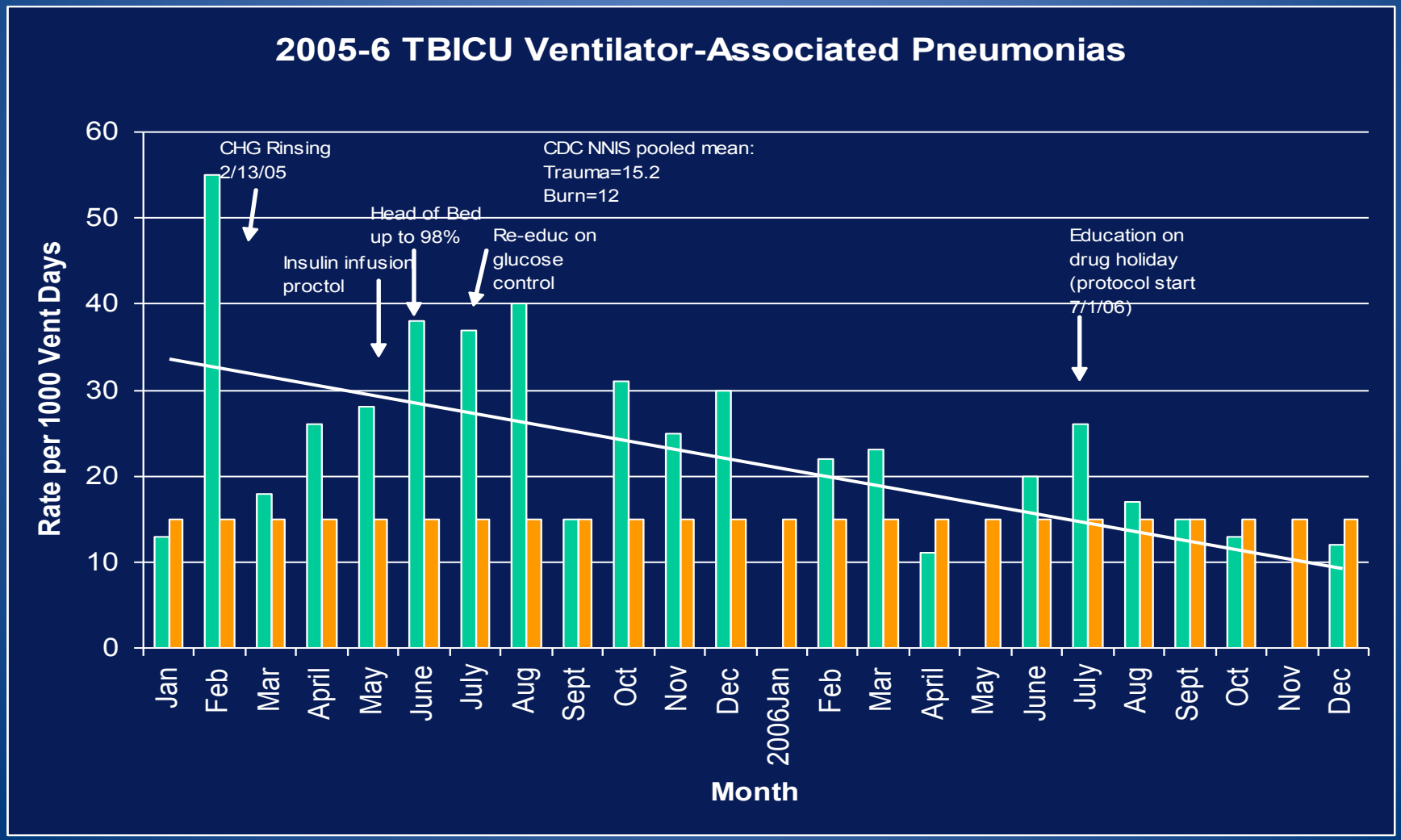
- % of patients with all glucose values <150 mg/dl rose from 62% to 91%
- Mean glucose fell from 144 to 122 mg/dl (all values NOT just am values) $p<0.01$
- Mean number of glucose checks rose from 1.5/patient to a high of 8.2/patient
  - Estimated 19 hours/month (1300 glucose checks/month X 3.8 minutes/check)

Wahl, et al. Surgery 2006

Keystone Study 2005

	Study 2005	Pre-study 2004	NNIS SICU	NNIS Trauma	NNIS Burn
VAP #/1000	31	36	9.3	15.2	12
CRBSI #/days	3.3	5.5	4.6	7.4	7

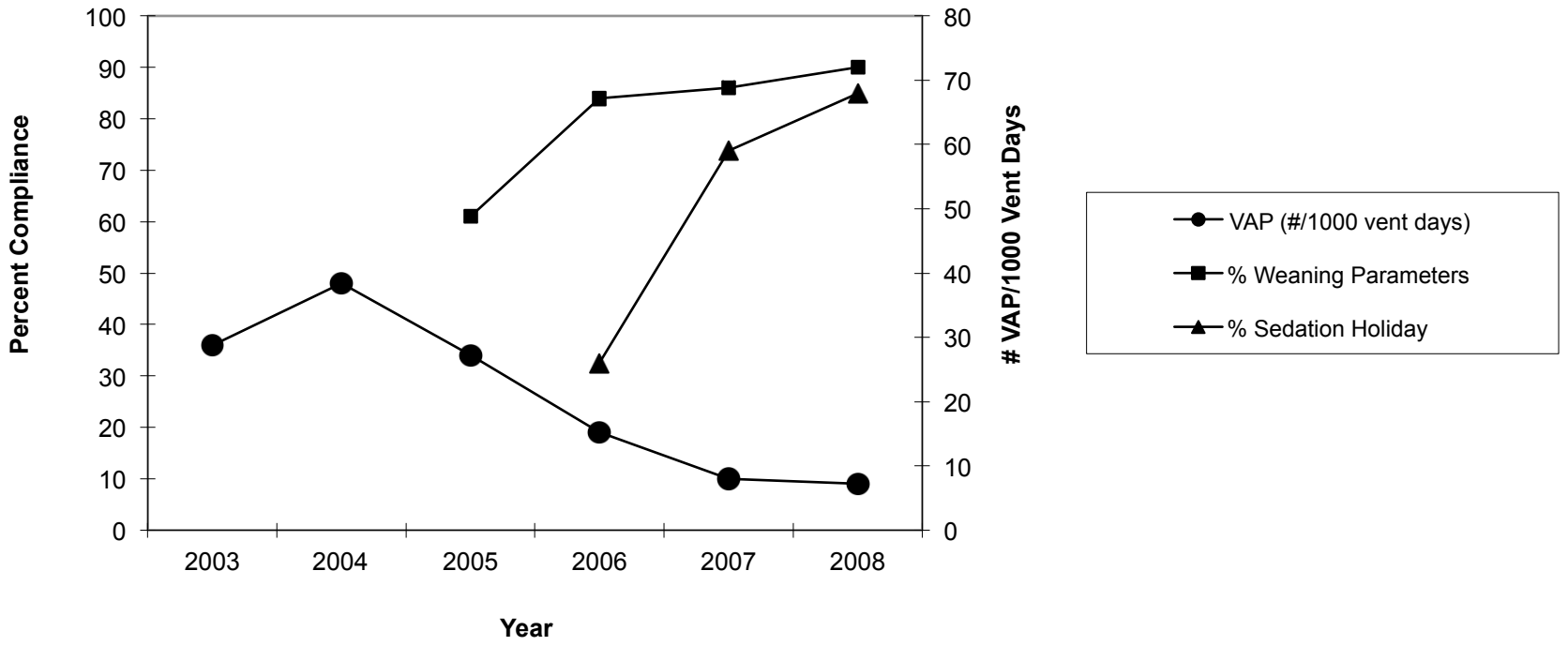
VAP Rates During and First Year after Implementation of Keystone Measures



Since Keystone Inception

- BSI AND VAP less than benchmarks
- CVC changes PRN
- Periodic education on rates to staff and reinforcement of goals
- Looking at specifics of the infections
  - Timing and organisms in VAP
  - Organisms in BSI

Sedation Holiday and Weaning Parameter Compliance and VAP Rates



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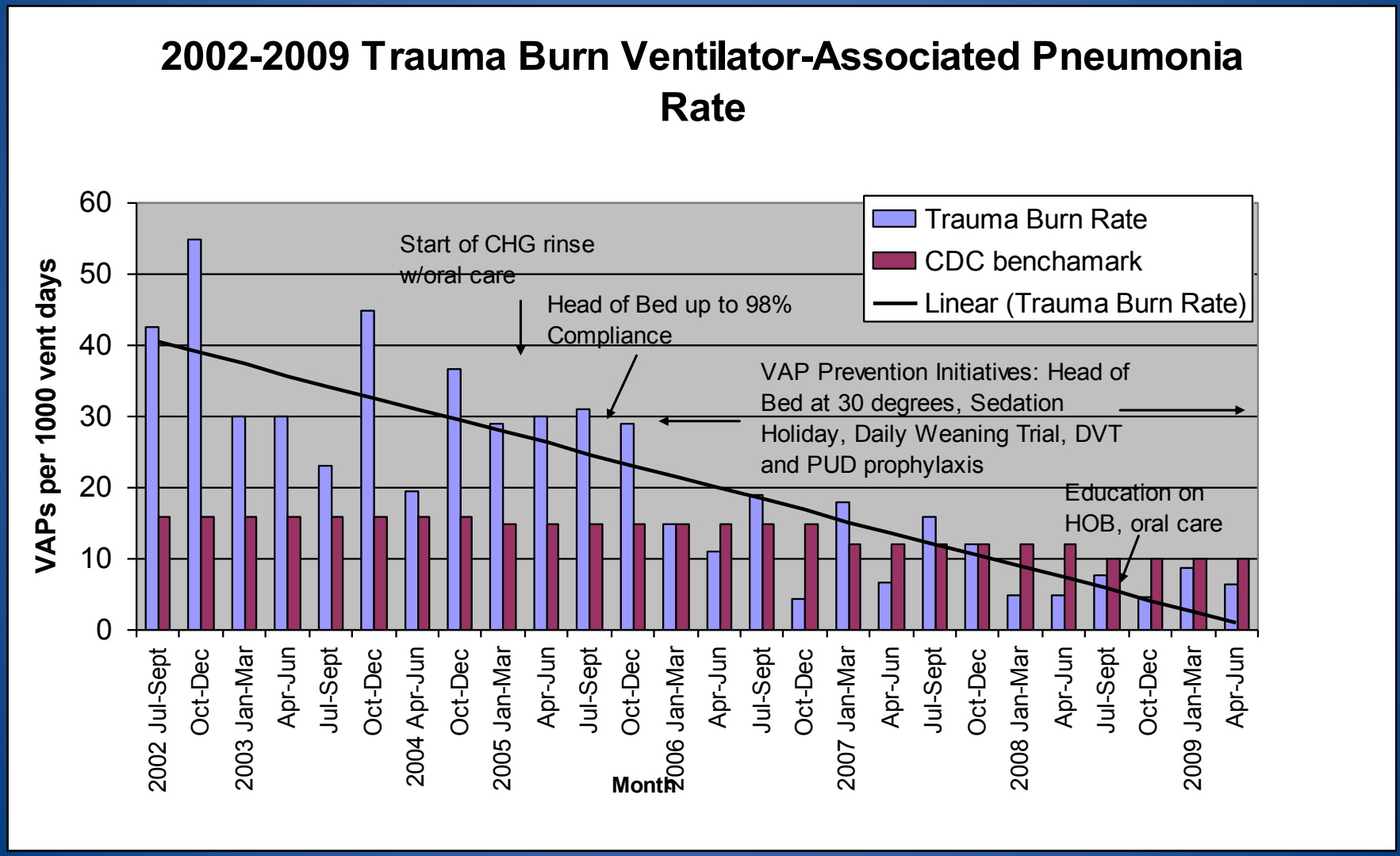
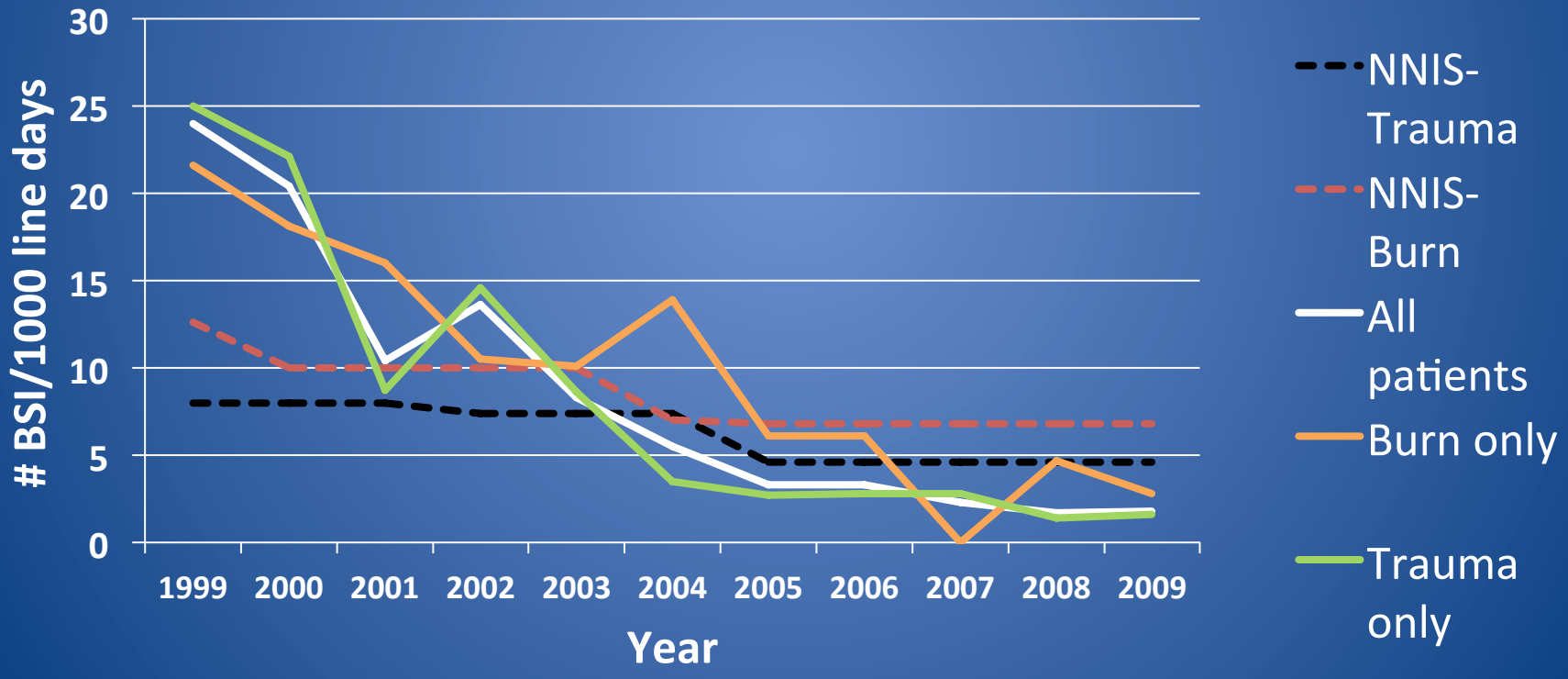
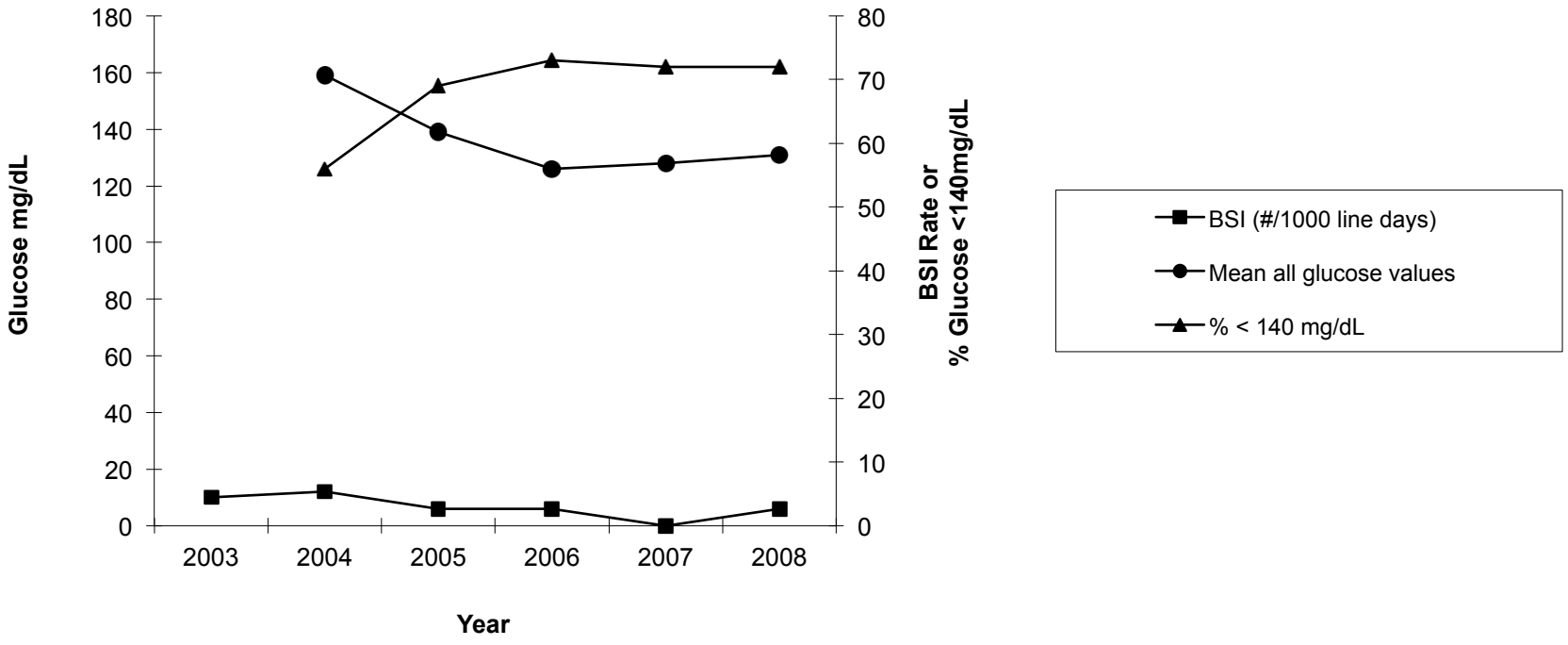
SUCCESS-BUT NOT A NEVER EVENT!



BSI Over Time By Patient Type



Glucose Values Compared to Bloodstream Infection Rates



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CAN WE GET TO ZERO?

- Have been below NNIS benchmarks for VAP for 10 quarters, BUT NOT ZERO
- Have gone as long as 6 months with no BSI, BUT NOT ZERO
- Have gone an entire year with no Burn BSI, BUT NOT LONGER

- WHY?

New Goals: Understanding if We CAN Get to Never

- Patient/Disease specific factors
  - Emergent intubation
    - Often unprotected airway
    - Often in face of aspiration of blood/oral or gastric contents
    - Often in less than optimal conditions (fields, highways…)
  - Injury to respiratory system
    - Damage to airway epithelium(burns)
    - Pulmonary contusion
    - Hemo or pneumothorax
  - Relatively long period after airway secured spent evaluating patient/stabilizing initial injuries
    - Initial "damage" may not be reversible at time of ICU arrival

The Second Hit: From Injury/ Inflammation to Infection Assessment of our Bronchoalveolar Lavage (BAL) data

- 2006-2008-BAL performed for either fever/ mucous plugs/evaluation of airway after inhalation injury (208 patients):
  - 105 patients studied during first 48 hours in ICU
    - 58% ≥ 10^4 cfu/ml (consistent with pneumonia but not VAP since not on vent 48 hours)
    - 32% ≤ 10^4 cfu/ml
    - **ONLY 10% had no growth!**

Early Bacterial Growth and Resistant Organisms

BAL cfu/ ml	All Patients in first 48 hours N(%)	No Growth N(%)	Aspiration Type N(%)	Resistant GNR/ MRSA N(%)	Other GNR N (%)
$< 10^4$	44 (42)	10 (10)	23 (22)	5 (5)	6 (6)
$\geq 10^4$ =pneumonia	61 (58)	n/a	36 (34)	13 (13)	12 (11)

Use of BAL for Diagnosis of VAP

Group	N (%)	R≠L BAL		R=L BAL	Only One Side
<10,000 cfu/ml	56 (27)	Δquantity	3	26	9
		ΔOrganism	15		
		ΔBoth	3		
≥10,000 cfu/ml, <48 hours on vent (pneumonia)	60 (29)	Δquantity	10	30	10
		ΔOrganism	7		
		ΔBoth	3		
≥10,000 cfu/ml, +VAP	76 (36)	Δquantity	14	33	13
		ΔOrganism	11		
		ΔBoth	5		
No Growth	16 (8)			13	3
TOTAL	208	Δquantity	27	102	35
		ΔOrganism	33		
		ΔBoth	11		

What Does This Mean

- Prior to anything done by the ICU, patients have bad bugs and often an early pneumonia
  - Patient injury definitely has a role
  - Should we treat earlier?
    - Risk of resistance goes up with unnecessary antibiotics
    - Can not predict who will clear and who will worsen
  - Other therapies
    - Need to understand progression of disease (from the nose/oropharynx/lack of ciliary clearance??)

What is the impact of BSI and VAP?

- Increase costs!
- Debate as to whether mortality really goes up with catheter BSI vs just marker for severity of disease (as opposed to bacteremia from other sites which is associated with mortality)
- Many (not all) studies have shown that mortality does appear to go up with VAP-but no randomized, prospective trials!

Failure to rescue

- Recognized in general surgery patients with complications and now trauma patients with complications
  - Mortality not necessarily related to the complication, but the failure to rescue the patient from the complication
    - Better performing centers had lower mortality but not necessarily lower complications
    - Should we be focusing on the complication or the rescue from the event or both?

Ghaferi, Birkmeyer, Dimick NEJM 2009.
Haas, Gomez, Hemmila, Nathens, AAST Oral Presentation 2010.

Will Never Ever Happen?

- Not sure we can get to never or zero for some complications but applying best practices does help for some types of complications
- It takes a team to accomplish meaningful change
- It takes time and constant review of the process (dynamic not static)

Conclusion

- Given the emerging body of work on what happens once a patient develops a complication, we may shift our focus to rescue strategies IN ADDITION to prevention
- Remains to be seen if most infectious complications can be zero other than in a perfect world