

IHC ATP Alumni Conference

16th Annual IHI National Forum on Quality Improvement in Health Care
World Center Marriott Resort & Convention Center, Orlando, Florida
Monday, 13 December 2004, 6:00p - 9:00p

Clinical Practice: The Only Constant Is Change

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- ★ ***Geography is destiny*** ("Who you see is what you get" *)
- ★ ***There is no health care "system"***
- ★ ***Supplier-induced demand:***
 - ◆ ***Field of Dreams approach: Build it and they will come***
 - ◆ ***James T. Kirk: Do something, Bones! She's dying!***
 - ◆ ***Eddy: More is better -- if it might work, do it***
 - ◆ ***Chassin: Enthusiasm for unproven methods***
 - ◆ ***Boston City / Boston University Hospital, 1998:***
 - ▶ ***Same housestaff on both services***
 - ▶ ***More beds / easier access to resources on Boston University service***
 - ▶ ***Boston University readmit rate ~50% higher***

* ***Richard Deyo, MD, MPH - in: Cherken, Deyo, Wheeler and Ciol. Physician variation in diagnostic testing for low back pain. Arth & Rheum 1994; 37(1):15-22 (Jan).***



American health care
"gets it right"
54.9%
of the time.

McGlynn EA, Asch SM, Adams J, *et al.* The quality of health care delivered to adults in the United States. *N Engl J Med* 2003; 348(26):2635-45 (June 26).

Medical injuries



Account for

44,000 - 98,000 deaths per year

in the United States

More people die from medical injuries than from breast cancer or AIDS or motor vehicle accidents

Brennan et al. New Engl J Med 1991

Thomas et al. 1999

Current health care



is the best the world has ever seen

A few simple examples:

- **From 1900 to 2000, average life expectancy at birth increased from only 49 years to almost 80 years.**
- **Since 1960, age-adjusted mortality from heart disease (#1) has decreased by 56%; and** (from 307.4 to 134.6 deaths / 100,000)
- **Since 1950, age-adjusted mortality from stroke (#3) has decreased by 70%.** (from 88.8 to 26.5 deaths / 100,000)

Initial life expectancy gains almost all resulted from public health initiatives -- clean water, safe food, and (especially) widespread control of epidemic infectious disease. But since about 1960, direct disease treatment has made increasingly large contributions.

Centers for Disease Control. Decline in deaths from heart disease and stroke--United States, 1900-1999. *JAMA* 1999; 282(8):724-6 (Aug 25).

National Center for Health Statistics. *Health, United States, 2000 with Adolescent Health Chartbook*. Hyattsville, MD: U.S. Dept. of Health and Human Services, Center for Disease Control and Prevention, 2000; pg. 7 (DHHS Publication No. (PHS) 2000-1232-1).

U.S. Department of Health and Human Services, Public Health Service. *Healthy People 2000: National Health Promotion and Disease Prevention Objectives*. Washington, DC: U.S. Government Printing Office, 1991 (DHHS Publication No. (PHS) 91-50212).

***Medicine used to be simple,
ineffective, and relatively safe.***

***Now it is complex, effective,
and potentially dangerous.***

Sir Cyril Chantler

Neal G. Reducing risks in the practice of hospital general medicine. In *Clinical Risk Management, 2nd edition*. British Medical Journal, 2001.

Chantler, Cyril. The role and education of doctors in the delivery of health care. *Lancet* 1999; 353:1178-81.

Are most failures unavoidable?



The price we pay

(for)

diseases of medical progress

Barr, David. Hazards of modern diagnosis and therapy - the price we pay. JAMA 1955; 159(115):1452-6 (Dec 10)

Moser, Robert H. Diseases of medical progress. N Engl J Med 1956; 255(13):606-14 (Sep 27)

Reasons for practice variation



Clinical uncertainty:

▶ **Complexity**

- How many factors can the human mind simultaneously balance to optimize an outcome?-- Alan Morris, MD
- "The complexity of modern American medicine exceeds the capacity of the unaided human mind" -- David Eddy, MD

▶ **Lack of valid clinical knowledge** (poor evidence)

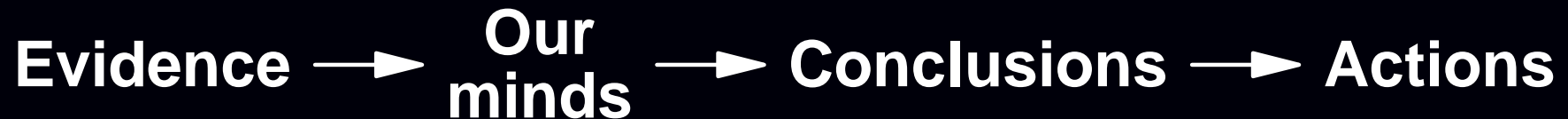
▶ **Reliance on subjective judgment**

- Subjective evaluation is notoriously poor across groups or over time
- ◆ ***Enthusiasm for unproven methods ...*** Mark Chassin, MD
- ◆ ***If it might work, do it ...*** David Eddy, MD, PhD
- ◆ ***Quality = spare no expense ...*** Brent James, MD, MStat

The core assumption



"Our minds are interpreters of evidence. We can accurately convert all forms of evidence (formal evidence, observations, experiences, colleague's experiences) into conclusions, which in turn determine our actions."



"Therefore, no one has to tell us what to do. Just give us the evidence and we will figure it out. Besides, there are lots of other factors that need to be considered. This can only be done with clinical judgment."

The core assumption is untenable

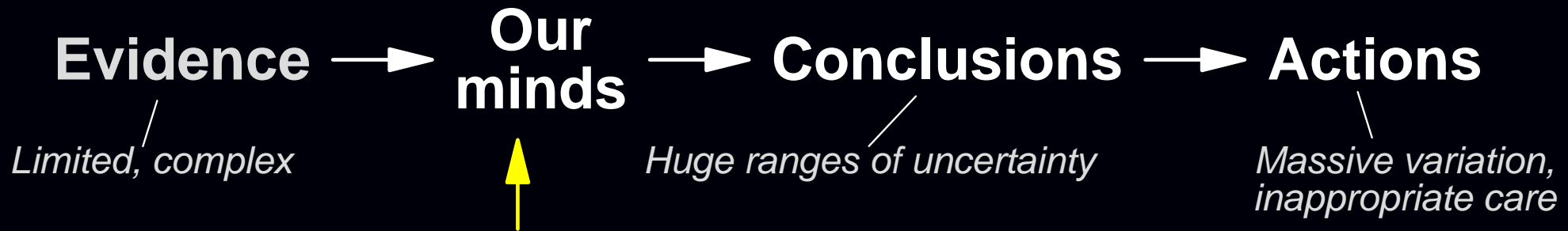


- ◆ *Poor evidence*
- ◆ *The inherent complexity of modern medicine, versus the limitations of the human mind*
- ◆ *Variations in beliefs*
- ◆ *Variations in practices*
- ◆ *High rates of inappropriate care*

Other factors affect our decisions



If our minds can't do the work very well, there are all sorts of other things to fill the void:



- ◆ **Professional interests**
- ◆ **Financial interests**
- ◆ **Personal tastes**
- ◆ **Desire to have something to offer**
- ◆ **Love for the work**
- ◆ **Wishful thinking**
- ◆ **Selective memory**
- ◆ **Pressure from patients and family**
- ◆ **Legal considerations**

Protocols can improve care



A multidisciplinary team of health professionals -

- 1. Select a high priority care process***
- 2. Generate an evidence-based "best practice" guideline***
- 3. Blend the guideline into the flow of clinical work***
 - ◆ staffing***
 - ◆ training***
 - ◆ supplies***
 - ◆ physical layout***
 - ◆ measurement / information flow***
 - ◆ educational materials***
- 4. Use the guideline as a shared baseline, with clinicians free to vary based on individual patient needs***
- 5. Measure, learn from, and (over time) eliminate variation arising from professionals; retain variation arising from patients ("mass customization")***

*The healing professions - and health care delivery - are **changing** ...*

*From **craft-based practice***

- ◆ **individual physicians, working alone** (housestaff ::= apprentices)
- ◆ **handcraft a customized solution for each patient**
- ◆ **based on a core ethical commitment to the patient and**
- ◆ **vast personal knowledge gained from training and experience**

*To **profession-based practice***

- ◆ **groups of peers, treating similar patients in a shared setting**
- ◆ **plan coordinated care delivery processes** (e.g., standing order sets)
- ◆ **which individual clinicians adapt to specific patient needs**
- ◆ **early experience shows**
 - ▶ **less expensive** (facility can staff, train, supply and organize to a single core process)
 - ▶ **less complex** (which means fewer mistakes and dropped handoffs, less conflict)
 - ▶ **better patient outcomes**

The solo practice of medicine is dead *(at an intellectual, not necessarily an economic, level)*

- ◆ ***protocols as a common baseline***
- ◆ ***mass customization***
- ◆ ***higher productivity*** *(a way to defend income)*
- ◆ ***better patient outcomes*** *(closing the quality gap)*
- ◆ ***strong ties to electronic medical records***

Issues for data automation



*Principle: Automation must improve productivity;
you can't destroy clinical work flow!*

Issue 1: Paper vs. electronic storage

Issue 2: Free-text vs. encoded data

Four types of information



1. **Sound data** (e.g., recorded voice)

*computerized
voice recognition*

2. **Image data** (pictures, stored as rasterized pixel bitmaps; e.g.,

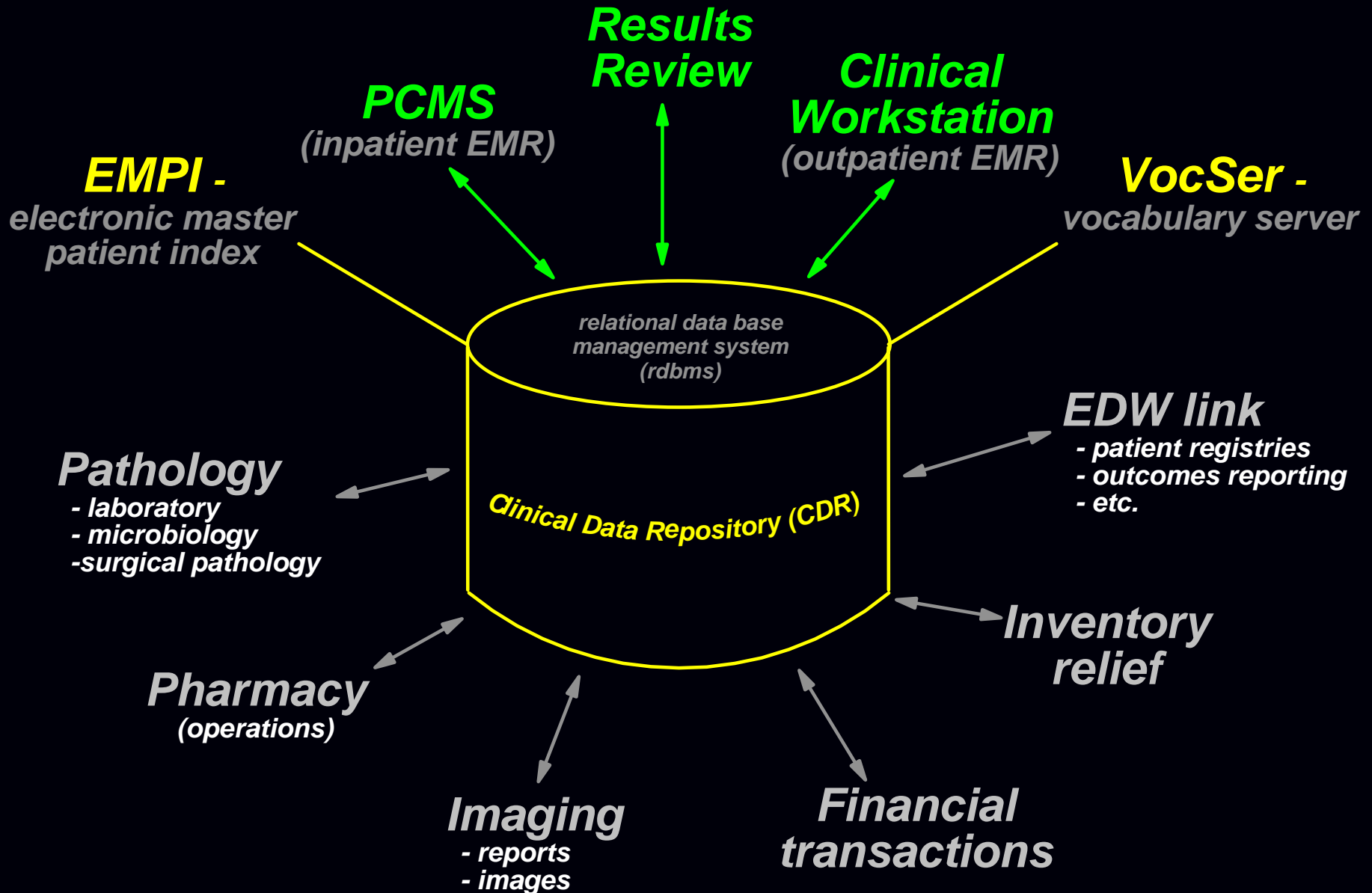
*optical
character
recognition*

- ◆ *a picture of a feature on a patient's skin;*
- ◆ *a digitized AP chest x-ray; or a*
- ◆ *a picture of a handwritten or typed medical note.)*

3. **Free-text data** ◆ *standard word processor output;* ◆ *characters stored as codes, one per byte;* ◆ *even numbers are stored as characters;* ◆ *using ASCII codes (American Standard Code for Information Interchange)*

*natural
language
processing*

4. **Encoded data** (multi-field "concepts" that computers can compare, interpret, etc.; required to do clinical decision support)

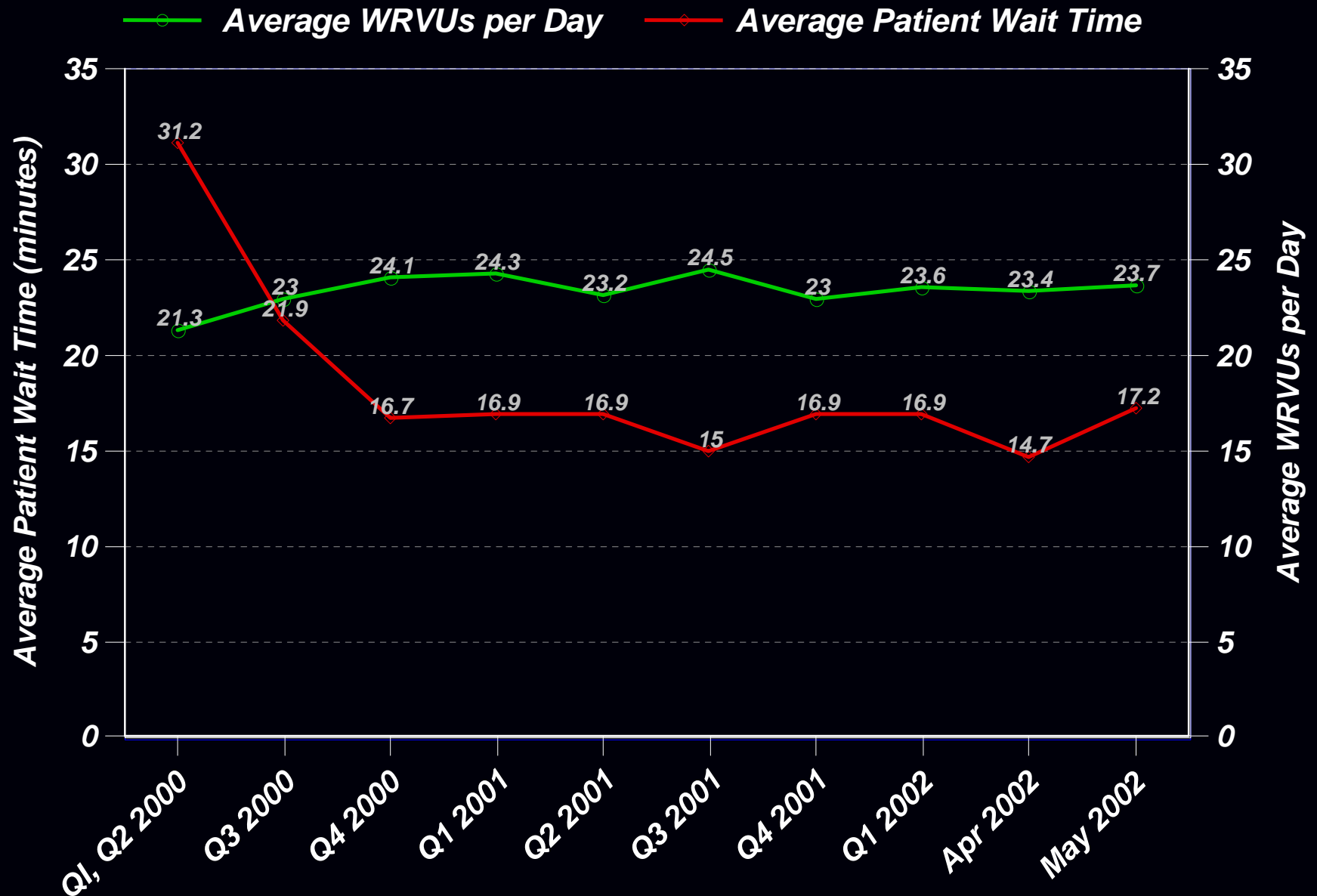


Levels of data automation

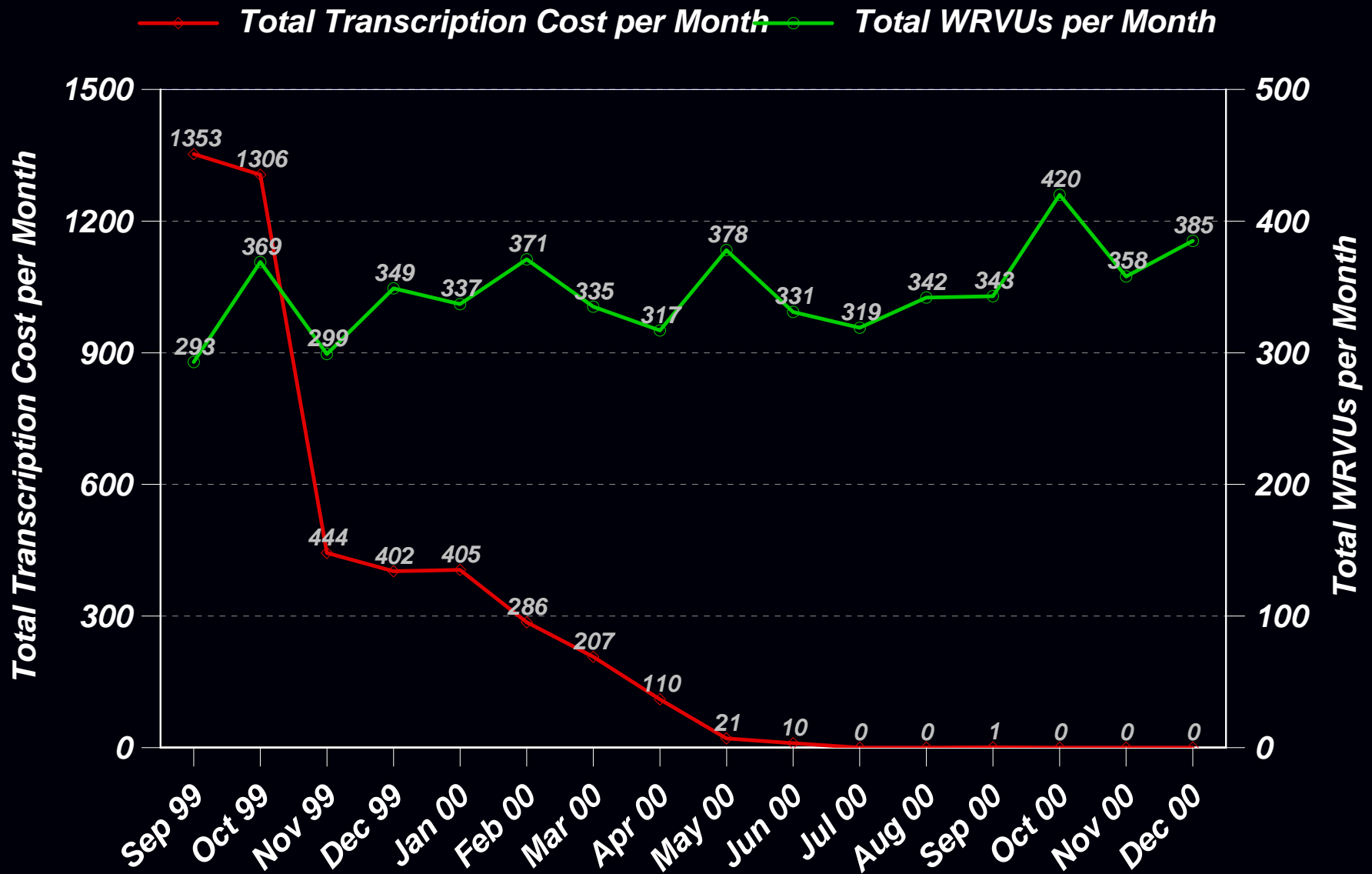


- 1. Automation of *billing scheduling*** > *encoded patient demographics*
- 2. Automation of *lab*** - (encoded) *clin path - microbiology - surgical path*
pharmacy - 3 national services, standard (encoded) formats
imaging - HL-7 formatted text (active research --> encoding)
- digital image storage
consultation reports - HL-7 formatted text
 - ◆ *message logs*
 - ◆ *InfoButton*
 - ◆ *Results Review*
 - ◆ *lab management*
- 3. The 'electronic file cabinet'** - all electronic record (don't care about encoding,
 - ◆ ***efficient data entry*** - dictation/transcription --> 'hot text,' voice recognition
 - ◆ ***efficient storage and retrieval across many care sites***
 - ◆ ***practice operations support*** - telephone call support, lab results management
- 4. Level 1 encoding** (assumes encoded patient demographics, pharmacy, and lab)
 - ◆ ***encoded problem list*** - automatic 'registries' for common chronic diseases
 - ◆ ***encoded medication list*** - first easy step in computerized order entry
 - ◆ ***encoded allergy list***
- 5. Level 2 encoding** - focused condition-specific encoding
- 6. Level 3 encoding** - fully encoded EMR, with text comments to customize

Implementing CW hot text



Implementing CW hot text



EMRs are essential tools for the future

(1) productivity enhancement; (2) protocol implementation

- ◆ ***hard to implement*** (at present time)
- ◆ ***requires a relatively large organization***
- ◆ ***we are in the era of the big systems***
- ◆ ***national effort to (1) establish standards***
(HIPAA was just the beginning) ***and***
(2) drive EMR adoption (Regional Health Information Infrastructure)

Community acquired pneumonia



	<u>without protocol</u>	<u>with protocol</u>	
"Outlier" (complication) DRG at discharge	15.3%	11.6%	↓ 24.7% p<0.001
In-hospital mortality	7.2%	5.3%	↓ 26.3% p=0.015
Relative resource units (RRUs) per case	55.9	49.0	↓ 12.3% p<0.001
Cost per case	\$5211	\$4729	↓ 9.3% p=0.002

Impact on net income



Improvement to cost structure	Payment mechanism			
	Discounted FFS	Per case	Per diem	Shared risk
Decrease cost per unit				
Decrease # units per case				
Decrease other units per case				
Decrease LOS (# nursing hours)				
Decrease # of cases				
	(45%)	(40%)	(0%)	(15%)

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Pay for performance (P4P):

- ♦ ***one form of outcomes accountability***
- ♦ ***relies of performance measurement*** *(technical problems)*
- ♦ ***two main forms:***
 - *hit performance goal, get %-age payment increase*
 - *shared savings models*

High frequency injuries sources



1. Adverse drug events (ADEs, ADRs)

2. Iatrogenic infections

- ◆ **post-operative deep wound infections**
- ◆ **urinary tract infections (UTI)**
- ◆ **lower respiratory infections (pneumonia or bronchitis)**
- ◆ **bacteremias and septicemias**

3. Pressure injuries

4. Mechanical device failures

5. Complications of central and peripheral venous lines

6. Deep venous thrombosis (DVT) / pulmonary embolism (PE)

7. Strength, agility and cognition (injuries and restraints)

8. Blood product transfusion

9. Patient transitions

Detecting Adverse Drug Events



# of ADEs / % (# per annum)	Nurse Incidence Reporting	"Enhanced" Reporting	HELP System
Total ADEs	9 / 0.025% (6)	91 / 0.25% (60)	731 / 2.0% (487)
Moderate and severe ADEs			701 / 1.9% (467)

Simple criteria for detecting ADEs



<u>Detection criterion</u>	<u>Location</u>	<u>True Positive Rate (%)</u>	<u>% of All ADEs Detected</u>	<u>Cumulative Total (%)</u>
1. use of naloxone	pharmacy	21.9	28.3	28.3
2. use of benadryl	pharmacy	21.0	20.8	49.1
3. use of inapsine	pharmacy	39.2	20.4	69.5
4. use of lomotil	pharmacy	26.8	8.5	77.0
5. nurse reports of rash/itching	nurse reporting	17.9	5.1	82.1
6. use of loperamide	pharmacy	22.3	3.4	85.5
7. test for c. difficile toxin	clinical lab	24.3	3.1	88.6
8. digoxin level > 2	clinical lab	2.3	2.2	90.8
9. abrupt med stop or reduction	pharmacy	48.0	1.0	91.8
10. use of vitamin K	pharmacy	4.8	0.9	92.7
11. doubling of blood creatinine	clinical lab	0.4	0.8	93.5
12. use of kaopectate	pharmacy	21.8	0.7	94.2
13. use of paregoric	pharmacy	9.8	0.7	95.0
14. use of flumazenil	pharmacy	77.3	0.7	95.7

(case finding through "concurrent clinical triggers")

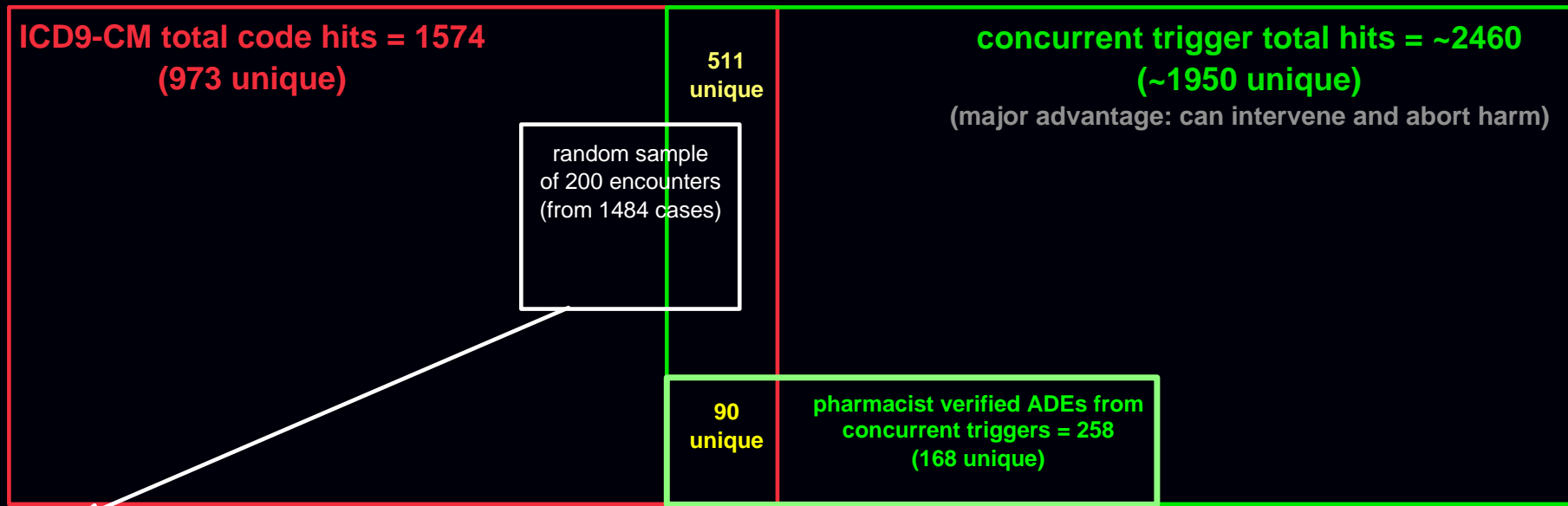
Utah-Missouri study (AHRQ)



- ◆ **Identified and validated ICD-9 Patient Safety Code set** (~1,000 codes)
- ◆ **Mined hospital discharge abstracts to identify charts for review** (verified acceptable positive predictive value)
- ◆ **Found numbers of verified injuries similar to those discovered by concurrent trigger tools** (including serious outpatient events that result in hospitalization)
- ◆ **Very little overlap with concurrent trigger methods: ICD-9 codes appear to capture a different universe of events**

(case finding through "**retrospective code triggers**")

LDS Hospital, 2001



200 charts in random sample
 - 13 charts couldn't be found (6.5%)
 187 charts reviewed

- 10 coding errors (5%)
- 24 not ADEs (false positives) (13%)
- 51 outpatient poisonings and suicides (27%)
- 59 outpatient ADEs (32%)
- 43 inpatient ADEs (true positives) (23%)
- (1484 x 0.230 = 341 unique inpatient ADEs)

Final estimates:

- 341 ADEs detected by ICD-9 codes alone**
- 90 ADEs detected by both systems**
- 168 ADEs detected by concurrent triggers alone**

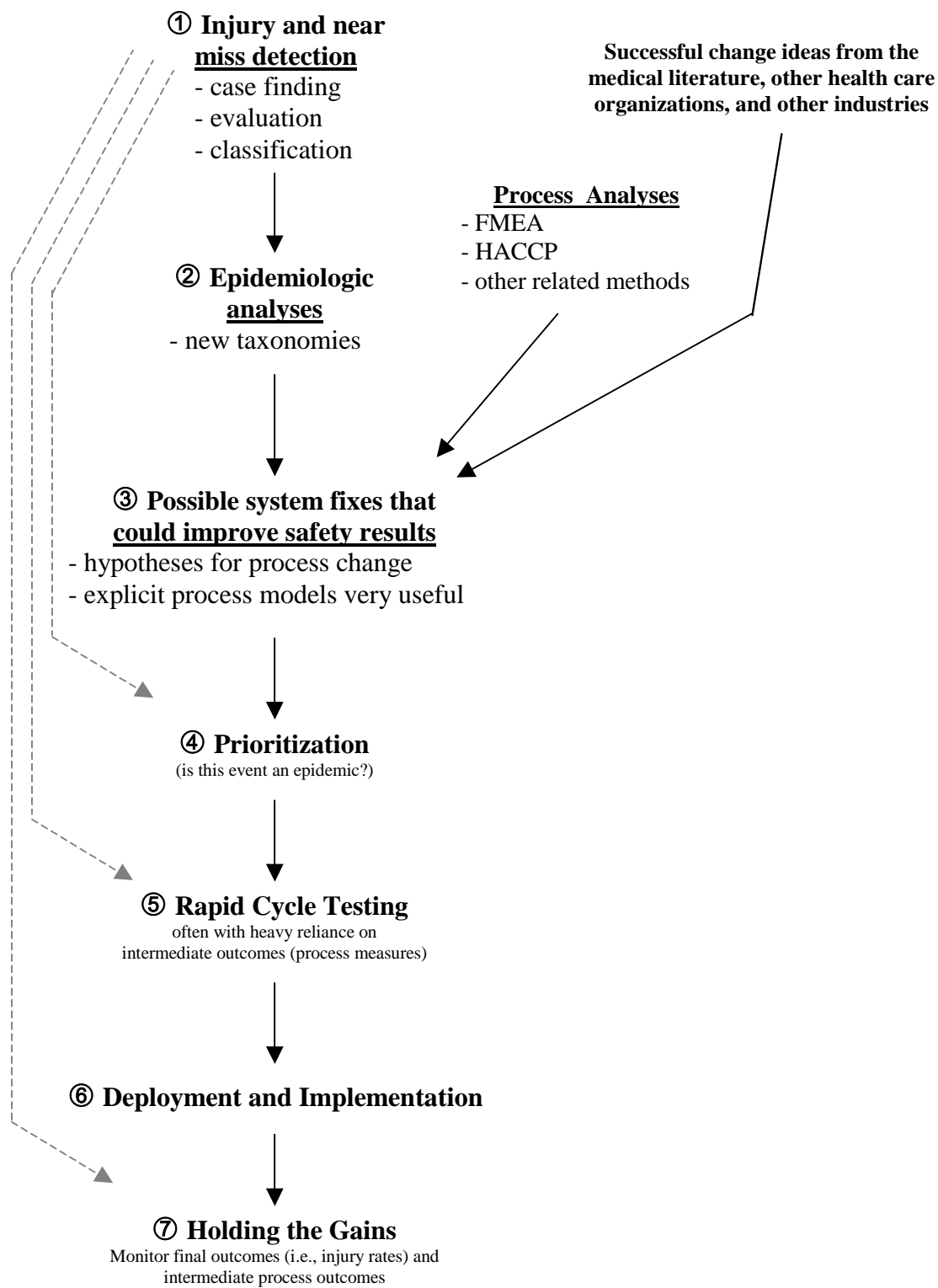
599 total ADEs detected

(43.1% of final total detected by concurrent triggers alone)

Tracking injuries



- ◆ **Current** (*voluntary reporting*) **systems miss the vast majority of injuries** (*finding only 1 in 100-150 injuries*)
- ◆ **Most often** (*e.g., >80% of the time for ADEs*), **clinical teams don't associate patient symptoms with the treatments that are causing them**
- ◆ **A more accurate perception of sources of injury can hugely change intervention strategies**



Detecting patient safety events



*External
data system
audit*

- 1. Case finding** *(based on explicit criteria)*
- 2. Evaluation** *(based on explicit criteria)*
- 3. Classification** *(based on explicit criteria)*

Case finding



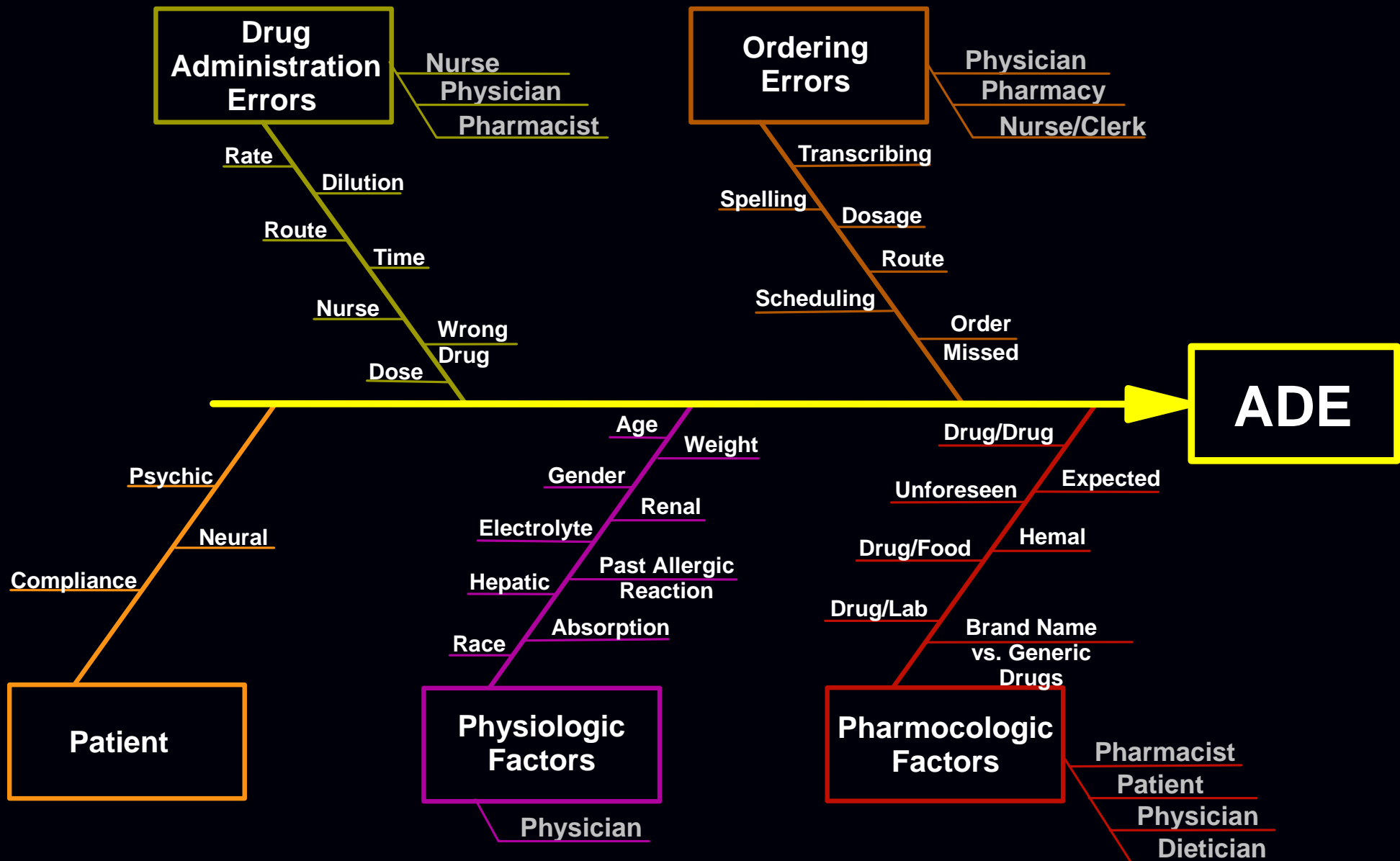
Retrospective Chart Review

<u>Common events</u>	<u>Concurrent (data-based) trigger systems</u>	<u>Abstract (ICD-9) (data-based) trigger systems</u>	<u>Criteria-based manual systems</u> (e.g, QaRNS, JCAHO SE, NQF "Never Events")	<u>Voluntary reporting</u> (in a Culture of Safety)
Adverse drug events	LDSH / B&W	Utah-Missouri (AHRQ)		
Iatrogenic infections	CDC infection control	X		
Pressure injury	X	X	Relatively poor event detection rates	Relatively poor event detection rates
Mechanical device failures	LDSH	LDSH		
Venous lines	X	X		
VTE	X	X		
Transfusions	X	X		
Patient falls	B&W	X		
Patient transitions	X	X		

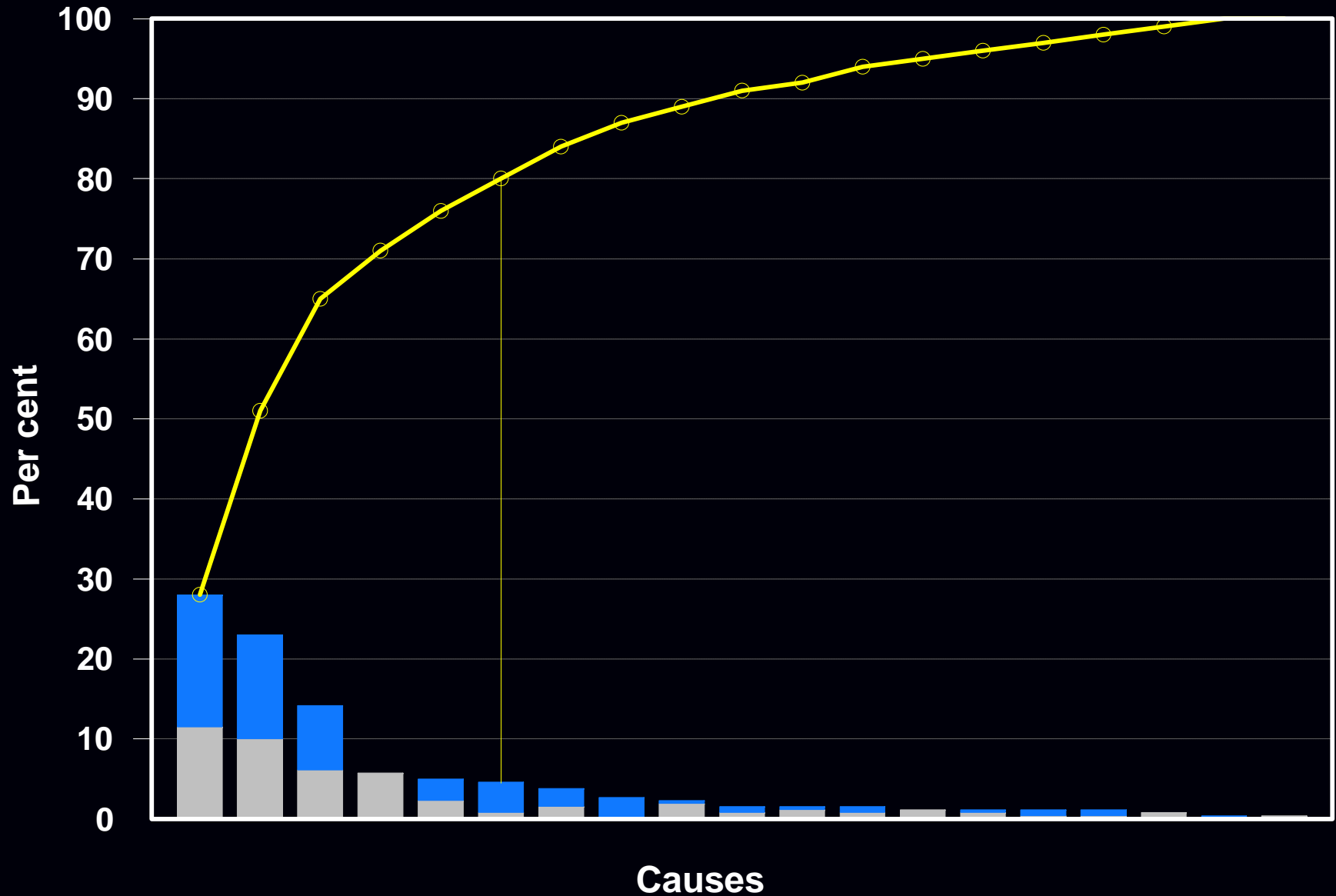
Rare events

"Wrong" surgery	X	X	Current most effective method	Current most effective method
Kidnapping				
Suicide				
- etc. -				

Preventable causes of ADEs



Causes of Adverse Drug Events



Causes of Adverse Drug Events

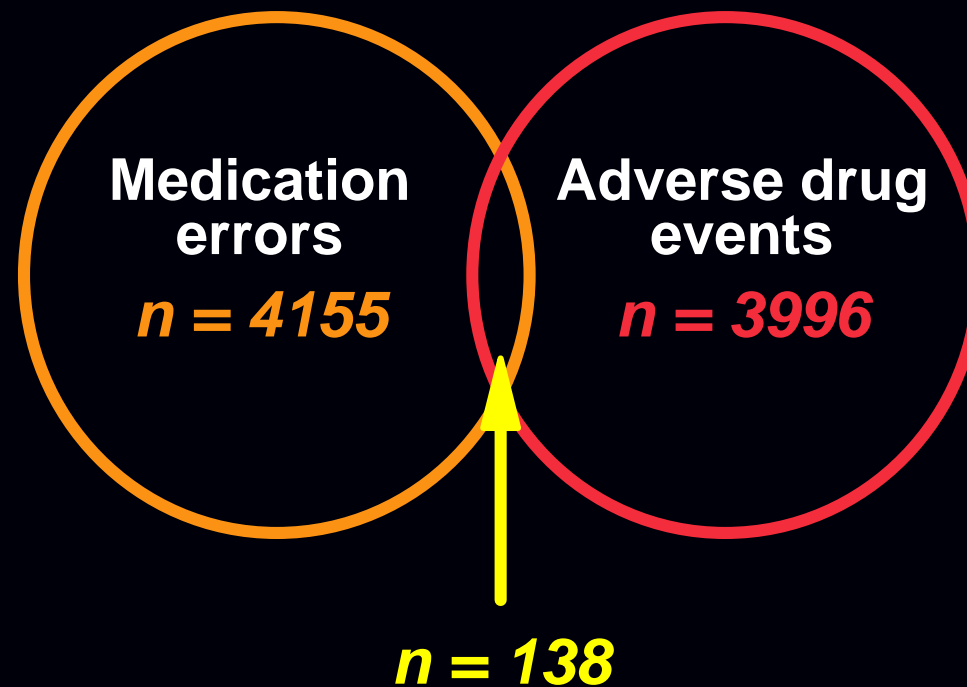


Class	%	Description	Avoidable?
Pharm Expected	28.0	Known drug reactions	?
Physio Renal	23.0	Failure to adjust for decreased renal function	Yes
Physio Age	14.2	Failure to adjust for patient age	Yes
Physio Weight	5.7	Failure to adjust for patient body mass	Yes
Order Dosage	5.0	Error in dosage on order	Yes
Physio Hemal	4.6	Failure to adjust for known hematologic factors	Yes
Total preventable	66.2		

Medication errors vs. ADEs



Prospective daily surveillance of 202,222 inpatients for the occurrence of medication errors and adverse drug events



Definition of medication errors: Assumes that the physician orders correctly, but that the pharmacist then prepares the medication incorrectly, or that the nurse delivers it incorrectly. Specifically, (1) wrong preparation, (2) wrong dose, (3) wrong route of delivery, (4) wrong rate of delivery, and/or (5) wrong patient.

Attack injuries, not errors



What is classified as an "error" derives from what is judged to be "preventable;"

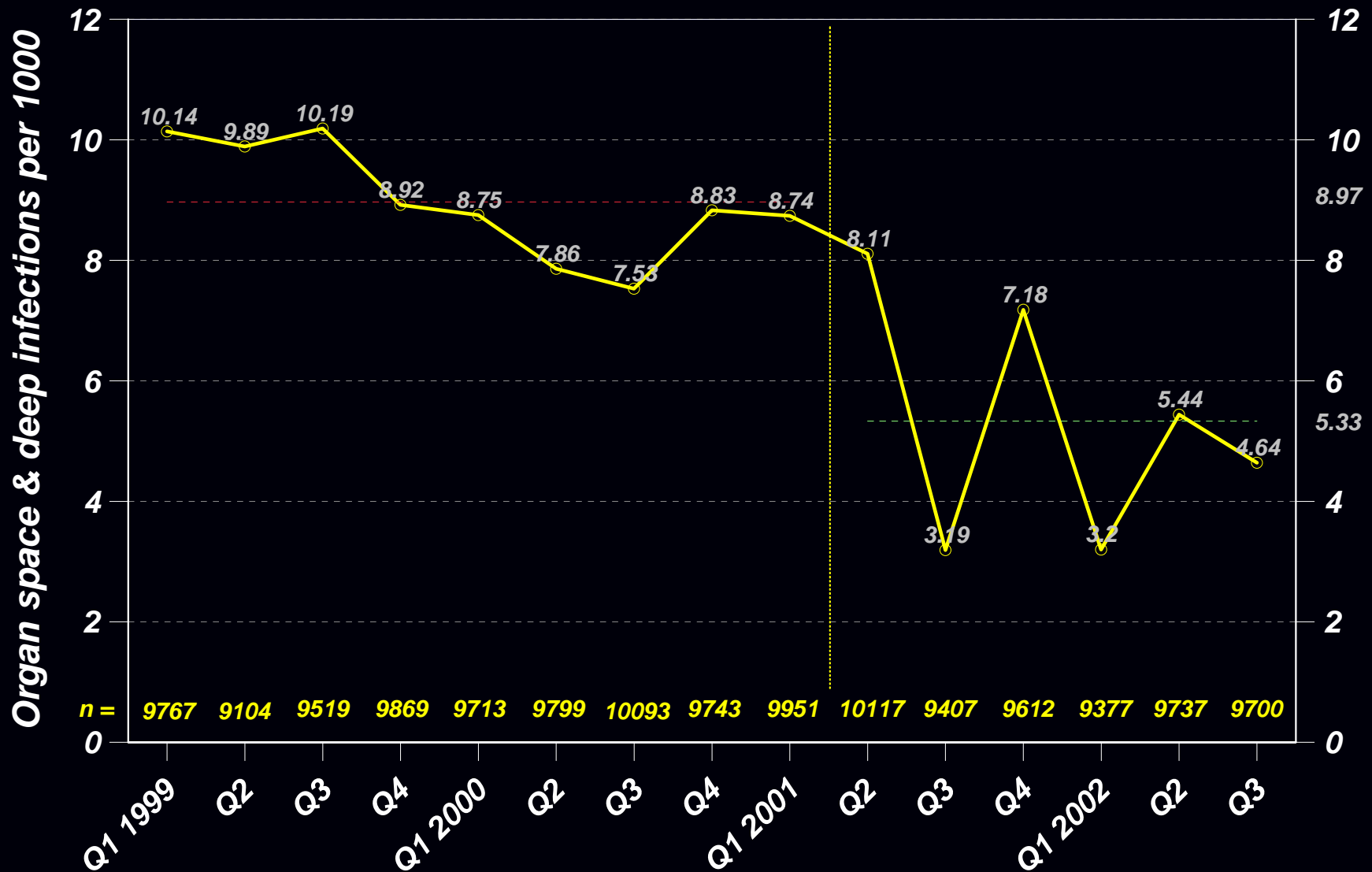
but, at this stage, those (subjective) judgments may be perverted by the "name, shame, and blame game," and seriously misinformed .

It is more useful to think in terms of "medical injuries" rather than "errors."

ADEs at LDS Hospital



Prophylactic antibiotics on time



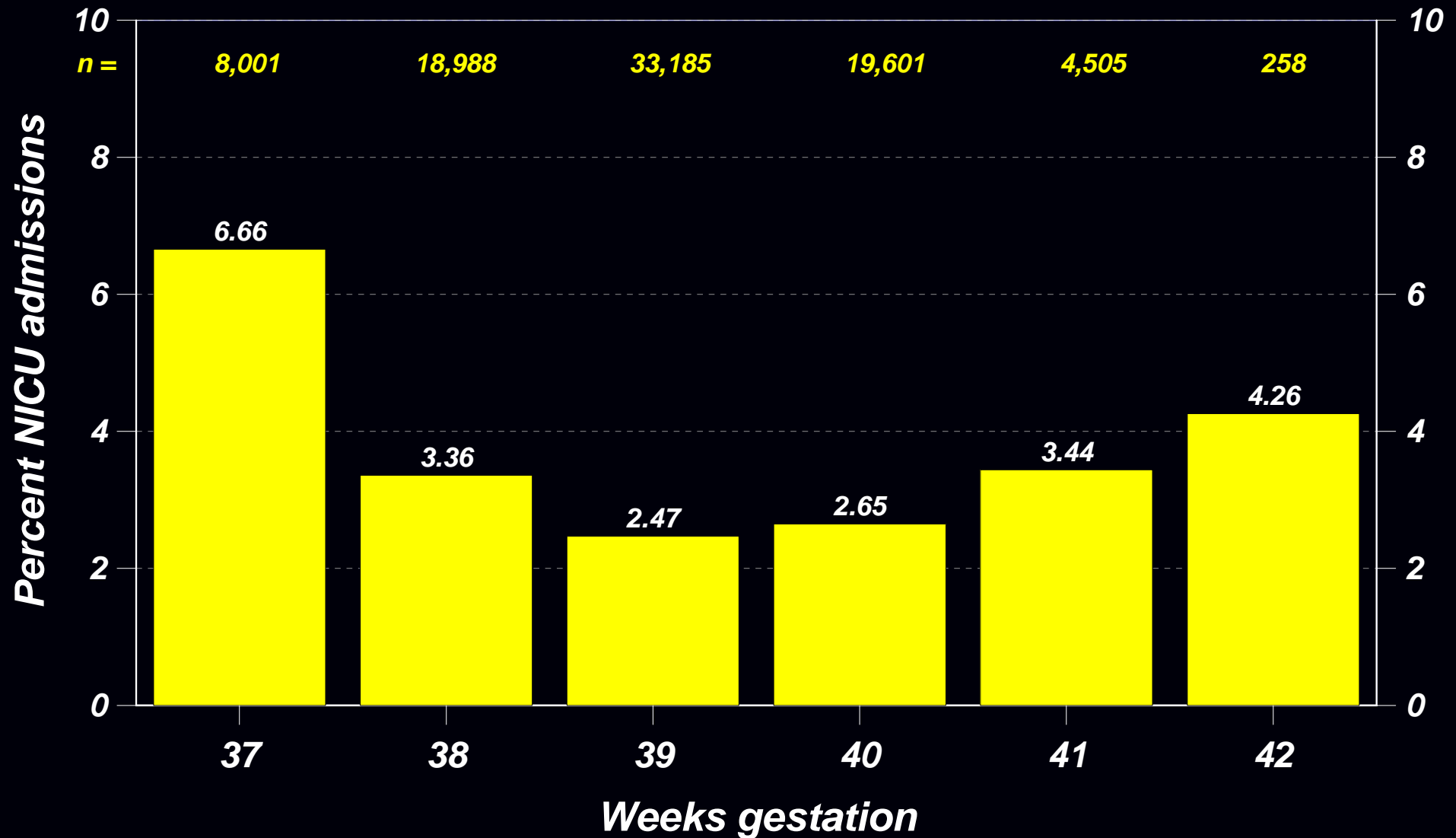
An expanded national focus on patient safety

- ◆ *standardized data systems*
- ◆ *independent, external audit*
- ◆ *detected injury rates much higher than today*
- ◆ *drive for substantial systems-level change*

ICU admissions by weeks gestation



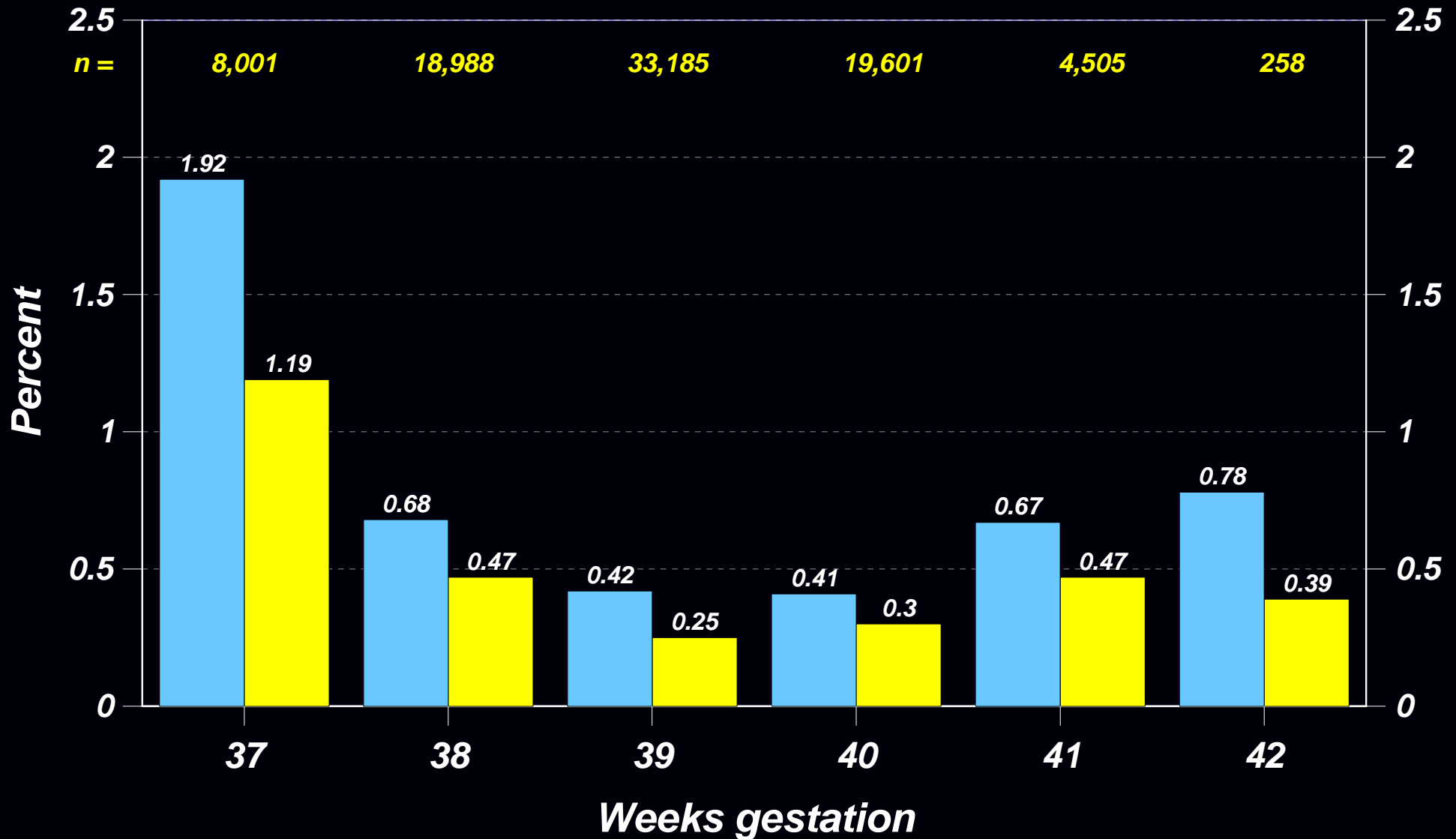
Deliveries w/o Complications, 2002 - 2003



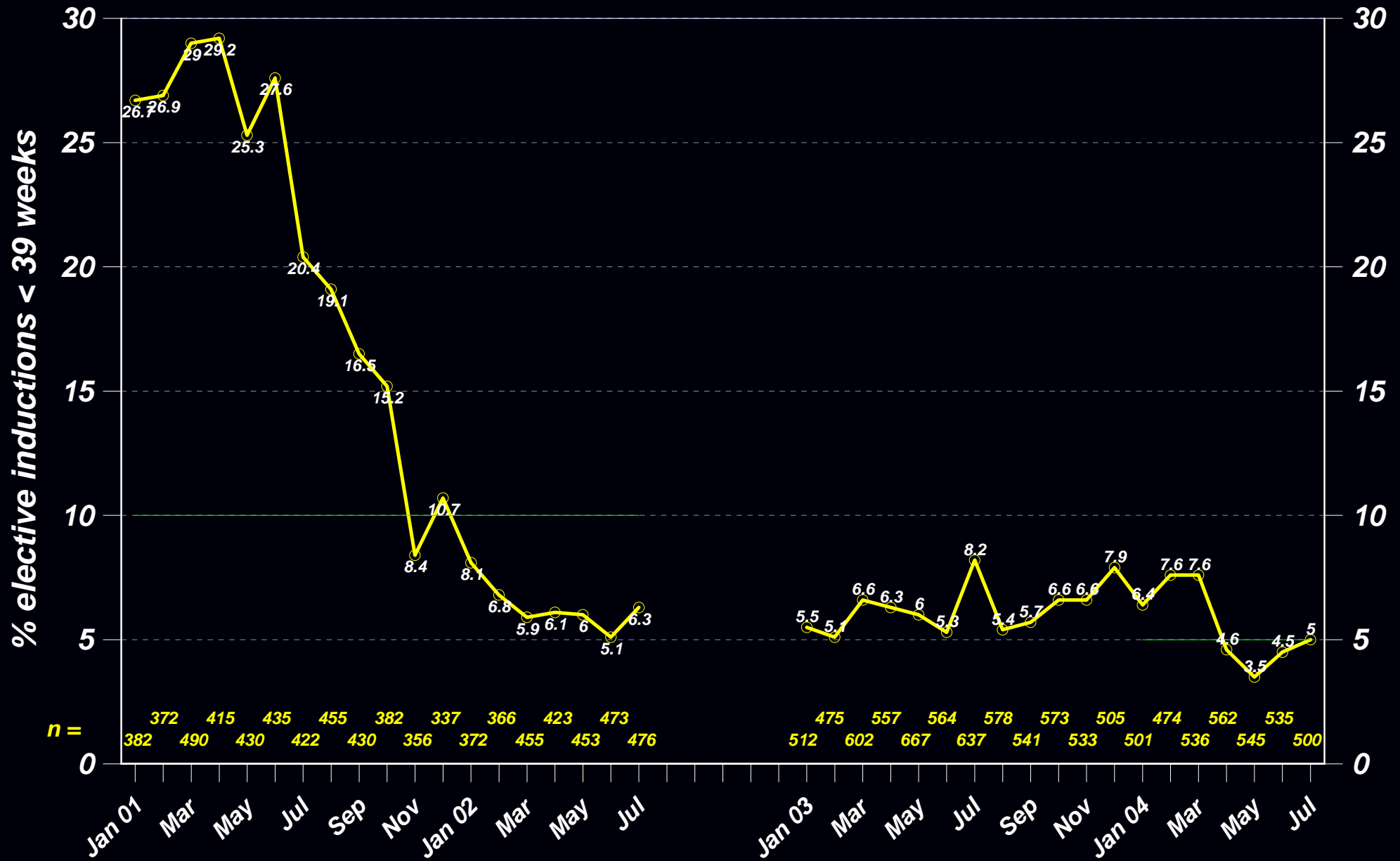
RDS by weeks gestation



Deliveries w/o Complications, 2002 - 2003



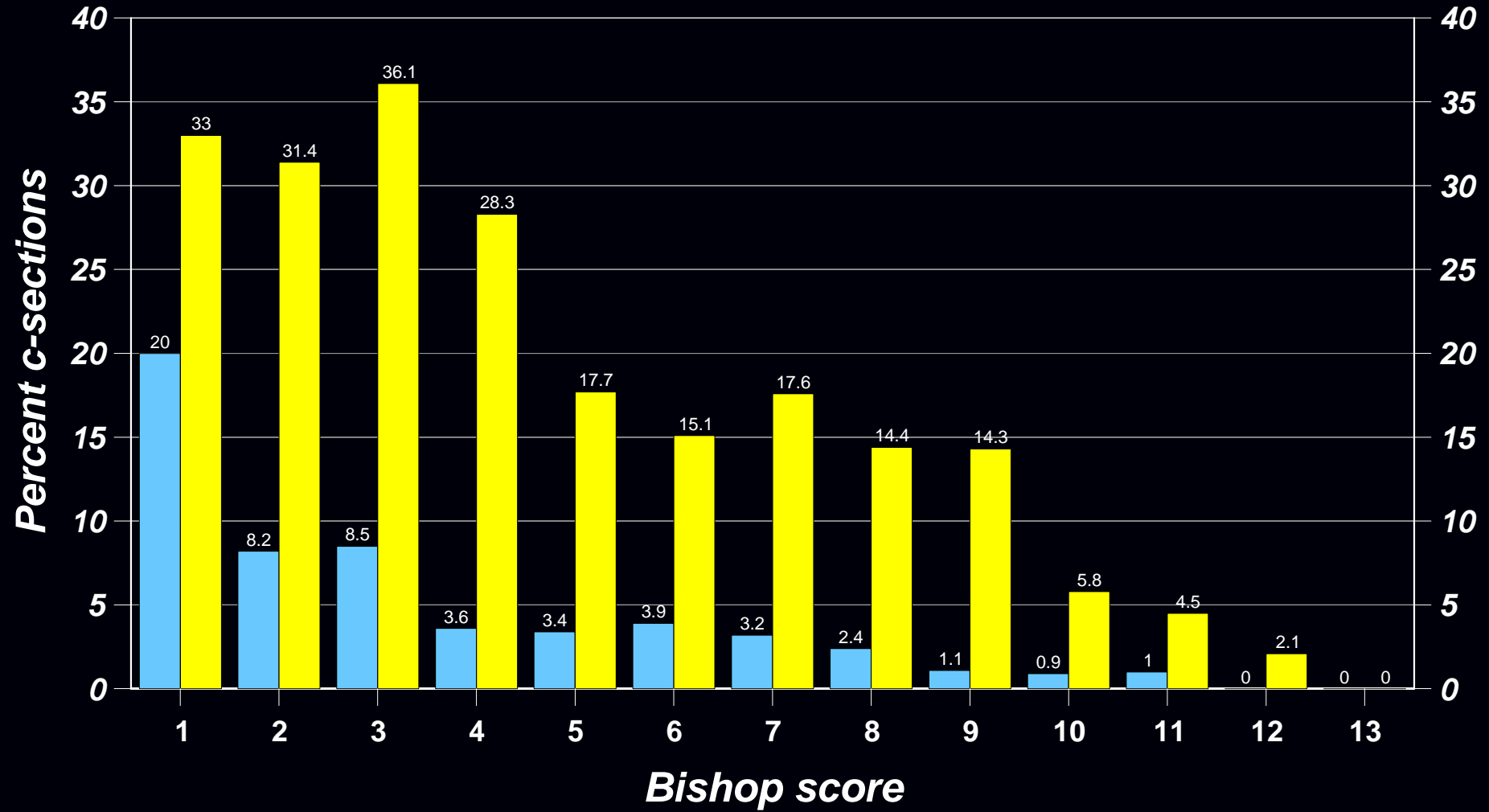
Elective inductions <39 weeks



Unplanned c-section rates



Electively induced patients by Bishop score, Jan 2002 - Aug 2003

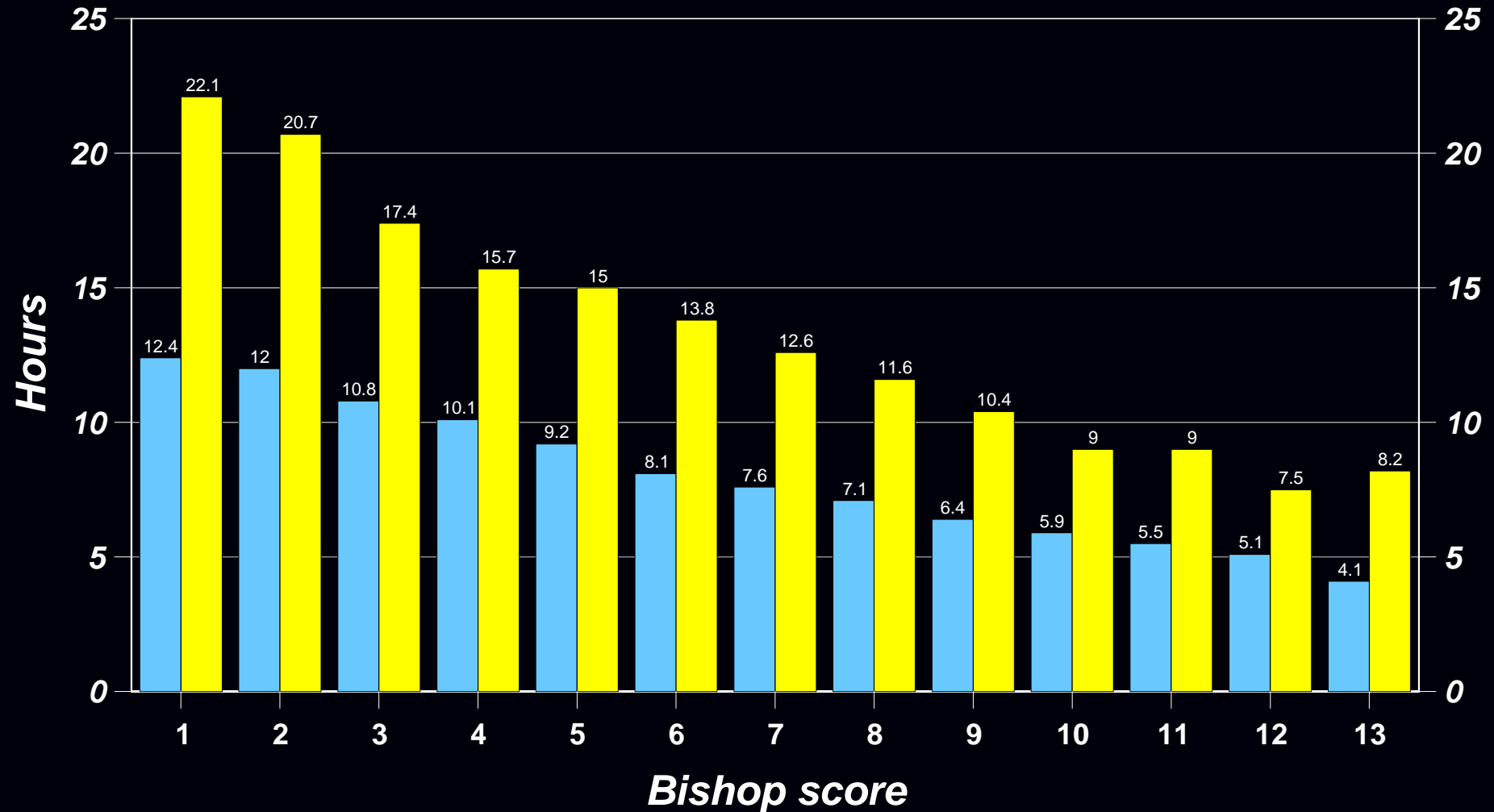


<u>n</u>													
<i>Multips</i>	10	49	130	274	567	856	1114	1266	1062	737	415	86	19
<i>Primips</i>	18	35	61	99	164	278	375	487	453	346	179	47	7

Average hours in labor & delivery

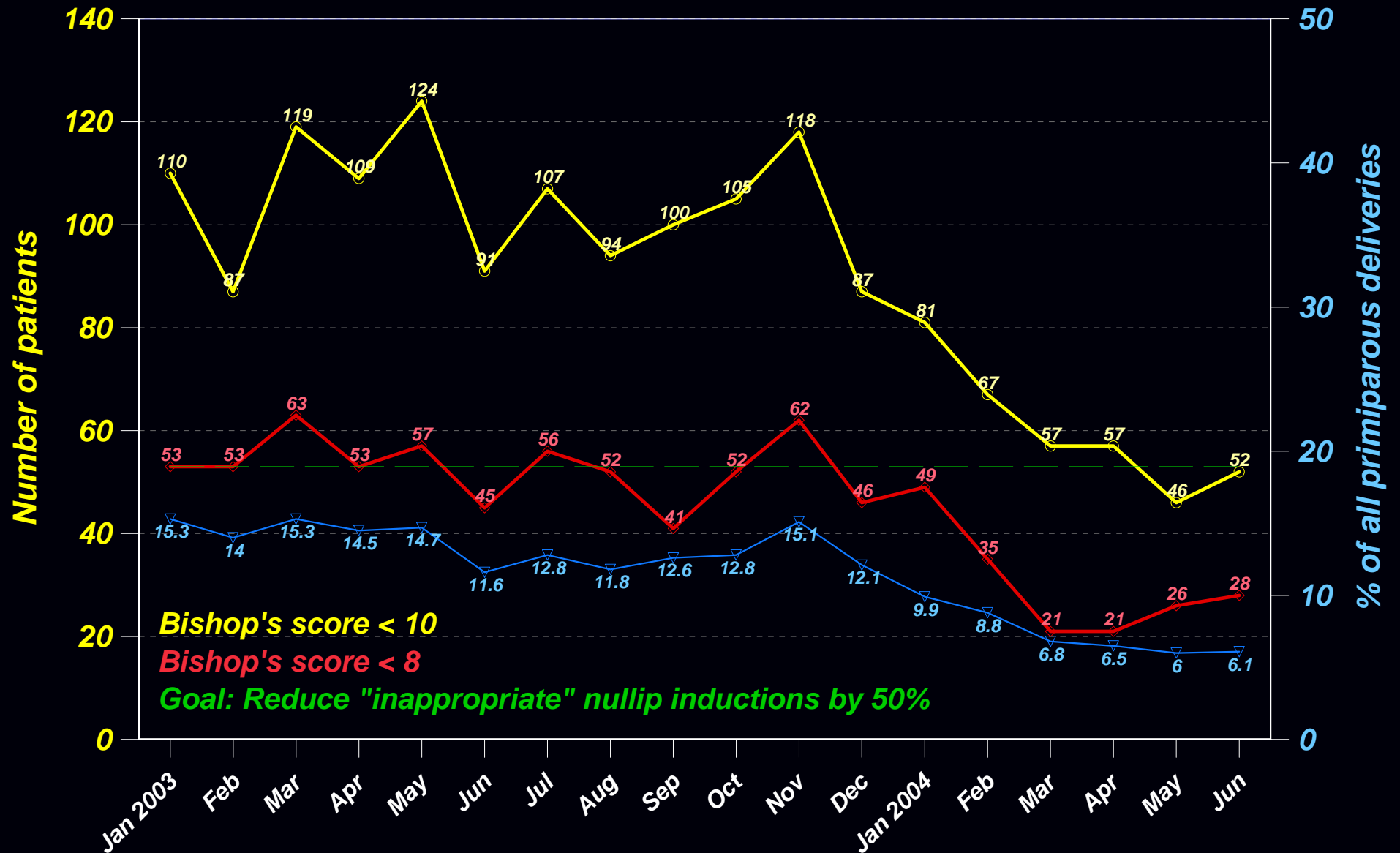


Electively induced patients by Bishop score, Jan 2002 - Aug 2003

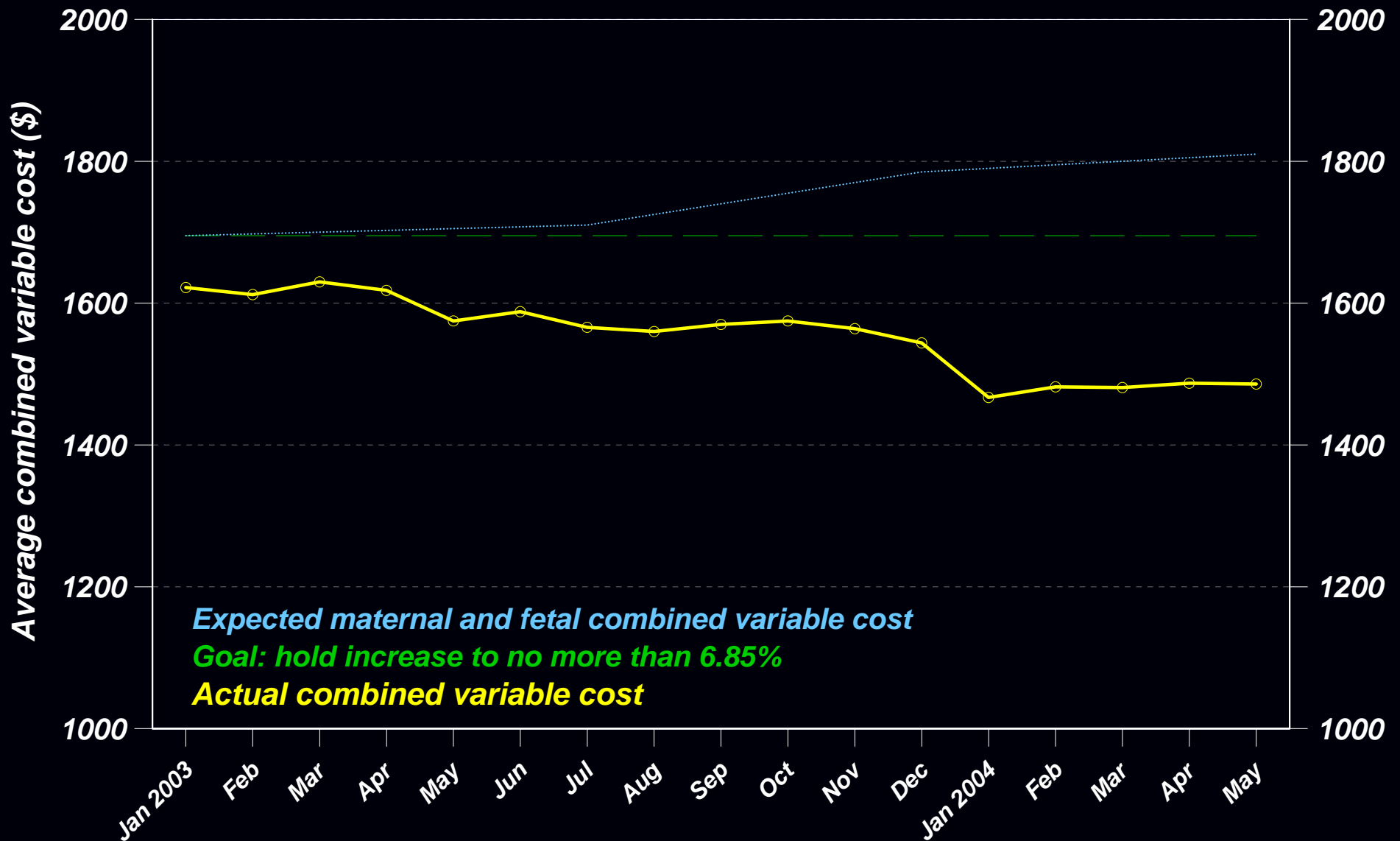


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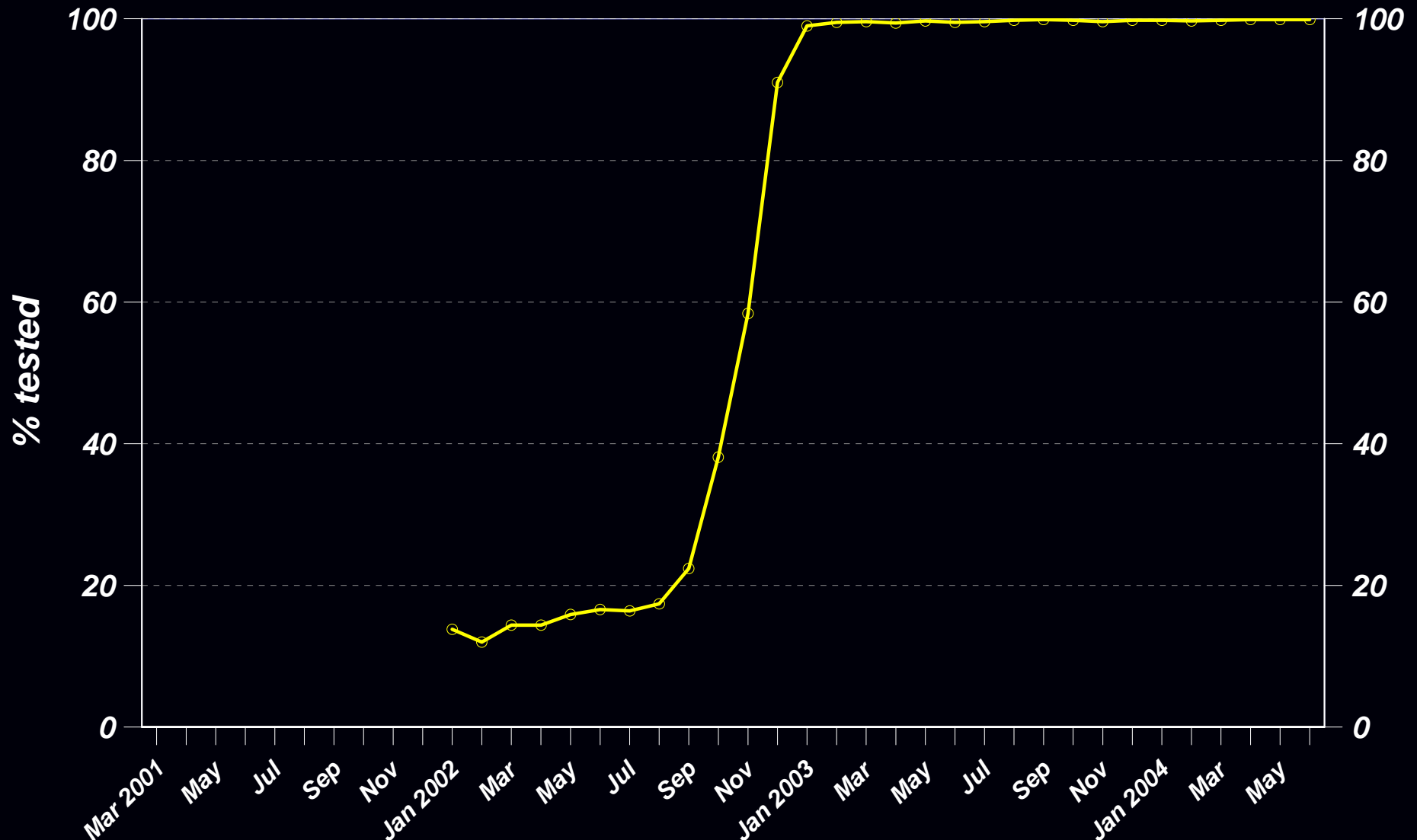
Primiparous elective inductions



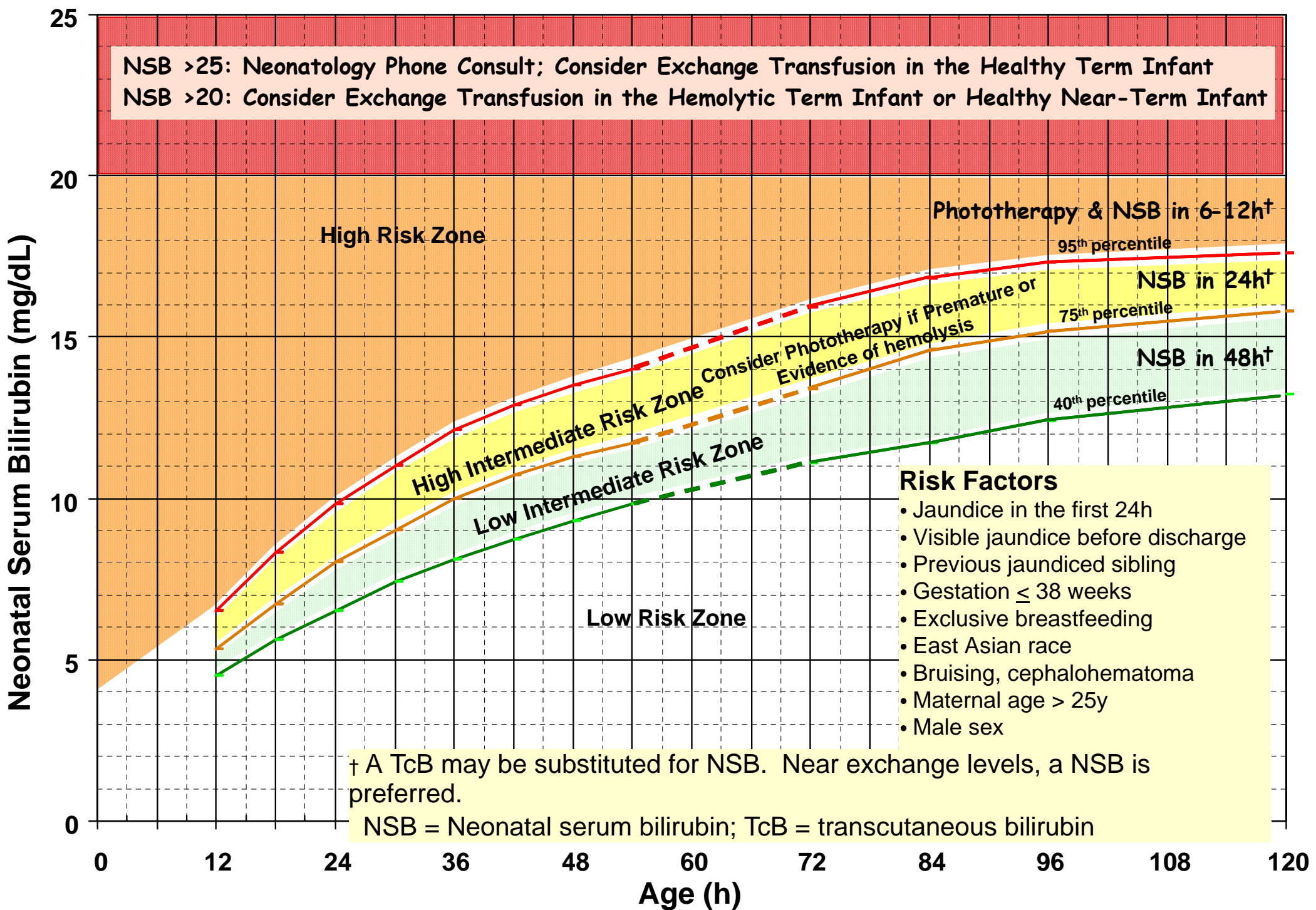
Labor & delivery variable cost



Well newborn bilirubin testing



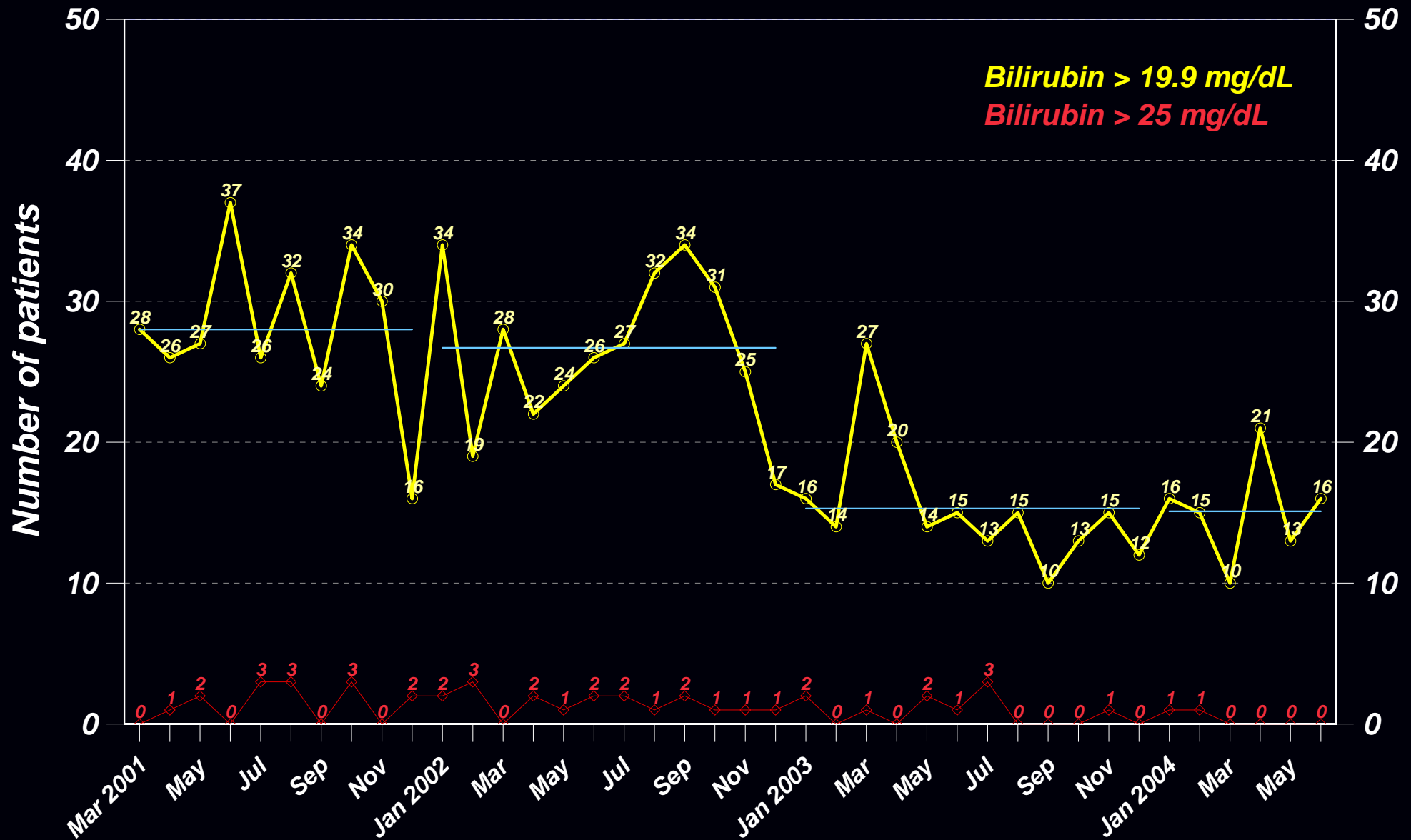
Newborns \geq 35 weeks gestation seen in Well Newborn Nursery (excluding hospitals using Bilicheck testing)



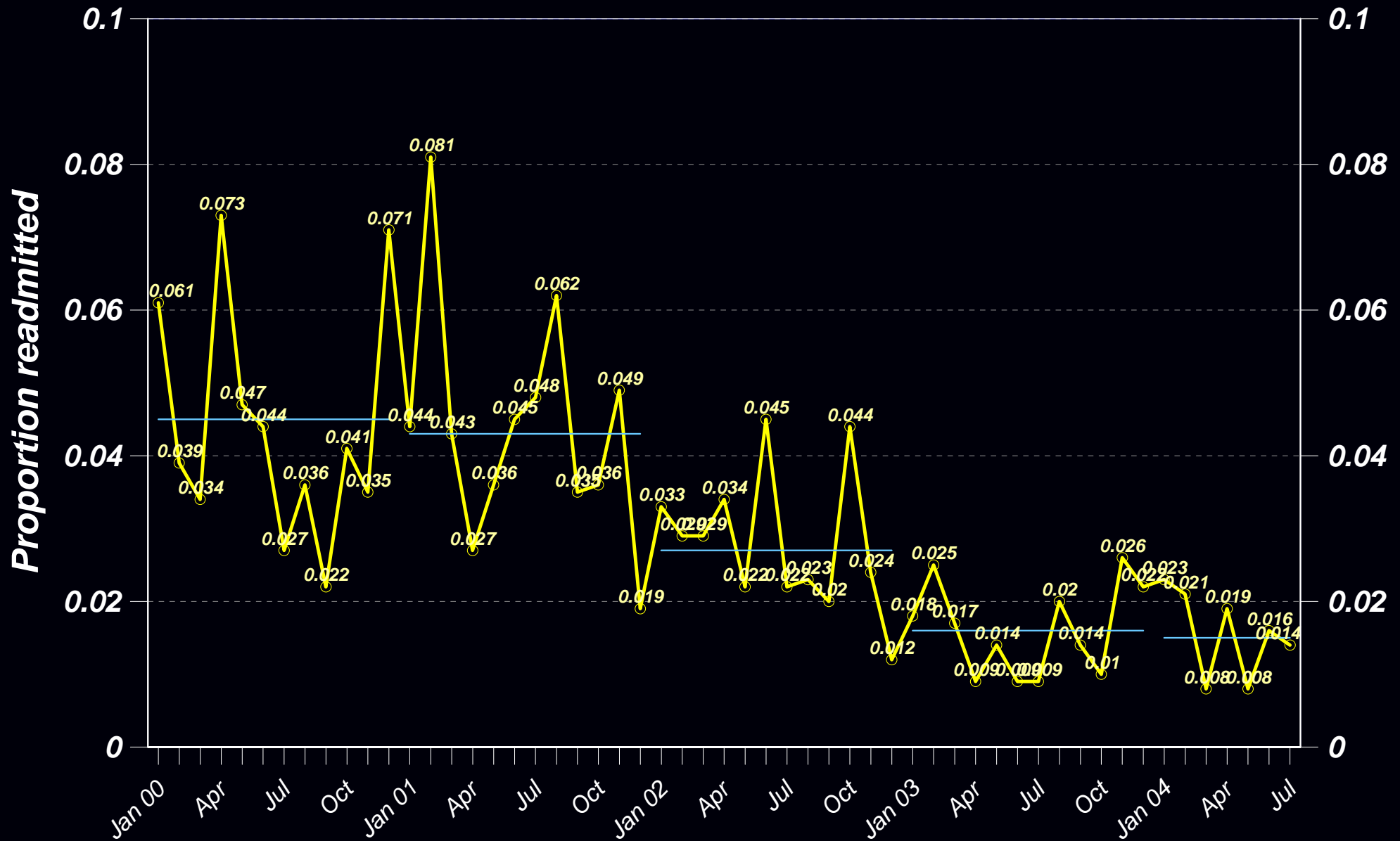
Hour-Specific Bilirubin Risk Chart for Term & Near-Term Infants

Adapted and revised [April 2003] based on IHC data (12-54h) & from Bhutani VK et al. *Pediatr* 1999; 103:6-14 & *J Perinat* 2001; 21:S76-S82 (72-120h)

Newborns w/ hyperbilirubinemia



Hyperbilirubinemia readmissions





"I am sorry for you, young men (and women) of this generation. You will do great things. You will have great victories, and standing on our shoulders, you will see far, but you can never have our sensations. To have lived through a revolution, to have seen a new birth of science, a new dispensation of health, reorganized medical schools, remodeled hospitals, a new outlook for humanity, is not given to every generation."

-- Sir William Osler

At the opening of the Phipps Clinic in England, near the end of his career. Cited in

Reid, Edith Gittings. The Great Physician: A Life of Sir William Osler. New York, NY: Oxford University Press, 1931 (p. 241).