Baby-MONITOR

Composite Measure of NICU Quality

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By The Numbers

Working across the continuum of care

500K

BIRTHS

17K

NICU ADMITS

140

MEMBER HOSPITALS

7K

ACUTE NEONATAL TRANSPORTS

9K

HIGH-RISK INFANTS REGISTERED

CMQCC

CPQCC

Our Programs

1. NICU Database
2. High Risk Infant Follow-up (HRIF) Reporting System
3. Quality Improvement
4. QI Research

By The Numbers

NICU level improvements between 2006-2015

Between 2006-2015 member hospitals reduced mortality rates for VLBW infants by

21%

An additional

16.6%

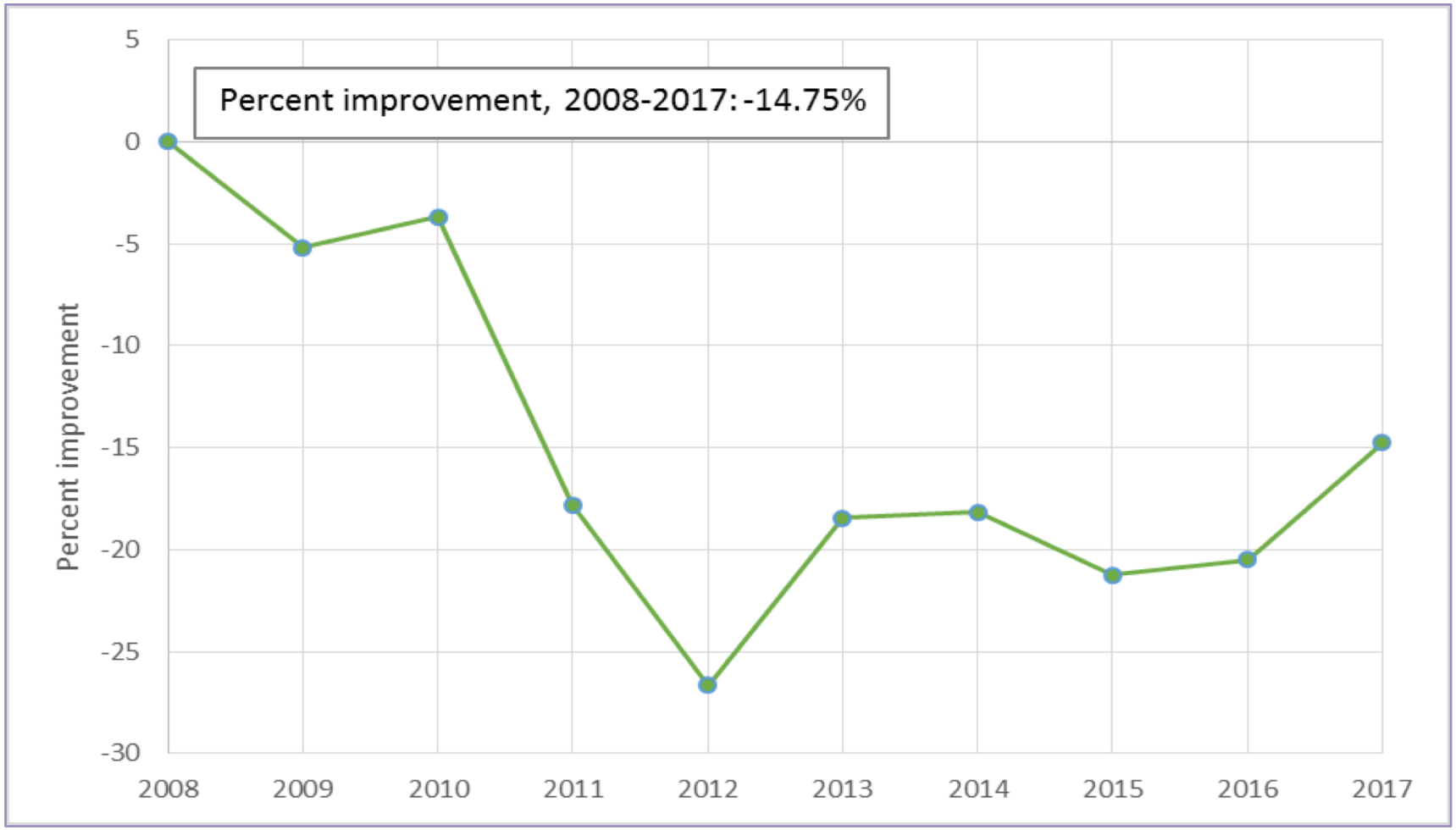
of babies were discharged without major morbidities like severe ROP, NEC, CLD, and severe IVH

And the rate of healthcare-associated infections decreased by

49%

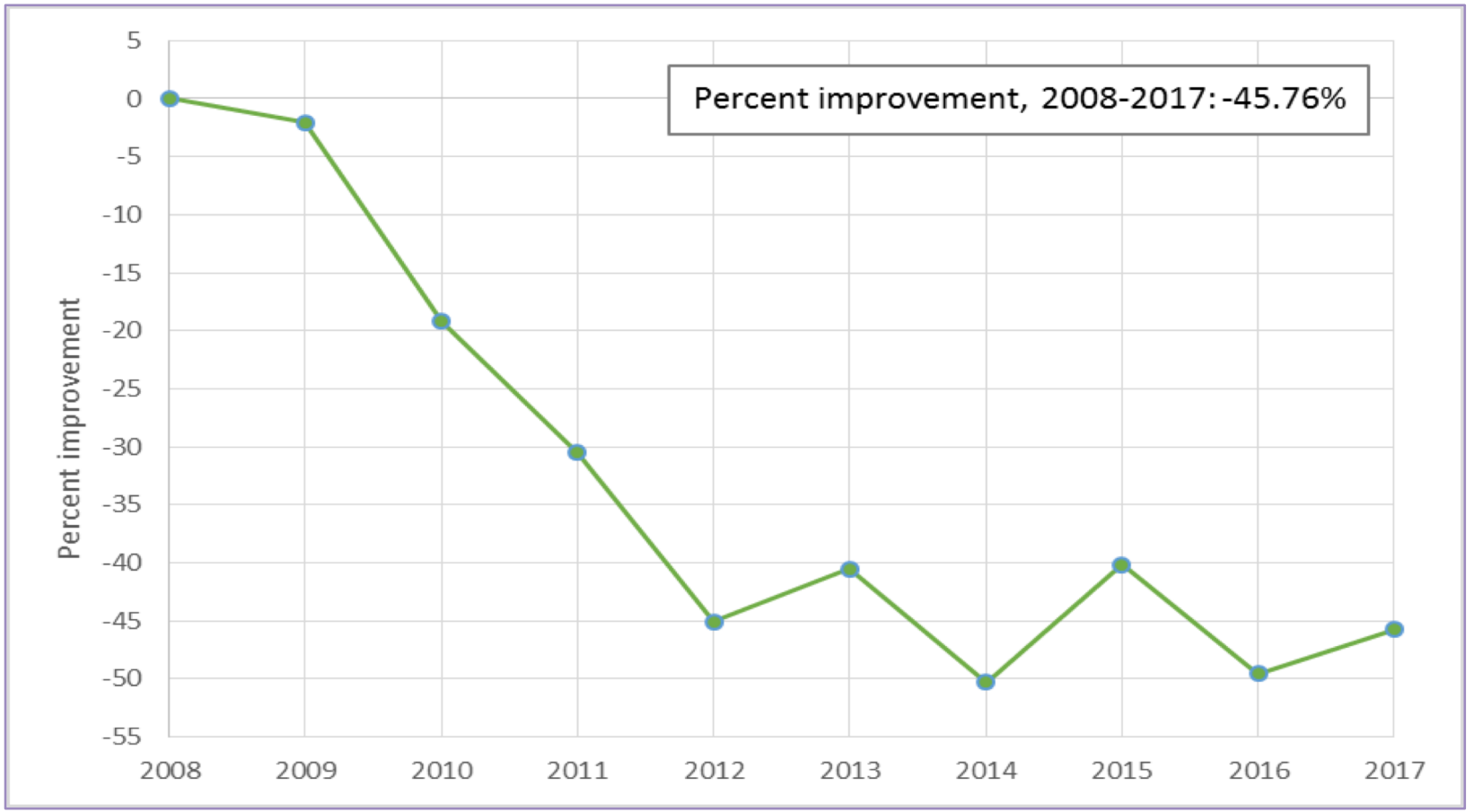
Improvement driven by our members

Reduction in infant death between 2008 - 2017



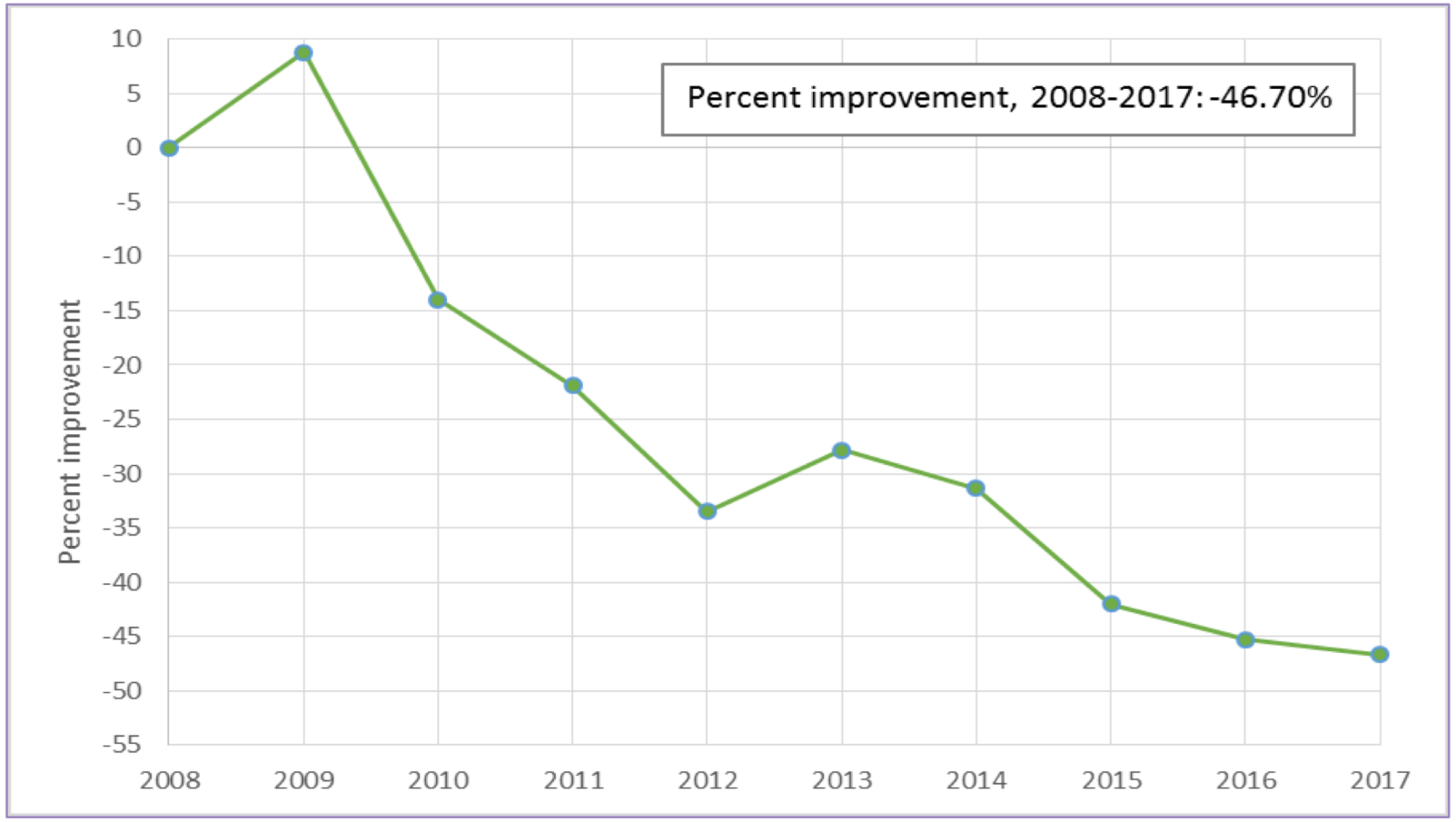
Improvement driven by our members

Reduction in infection rates between 2008 - 2017



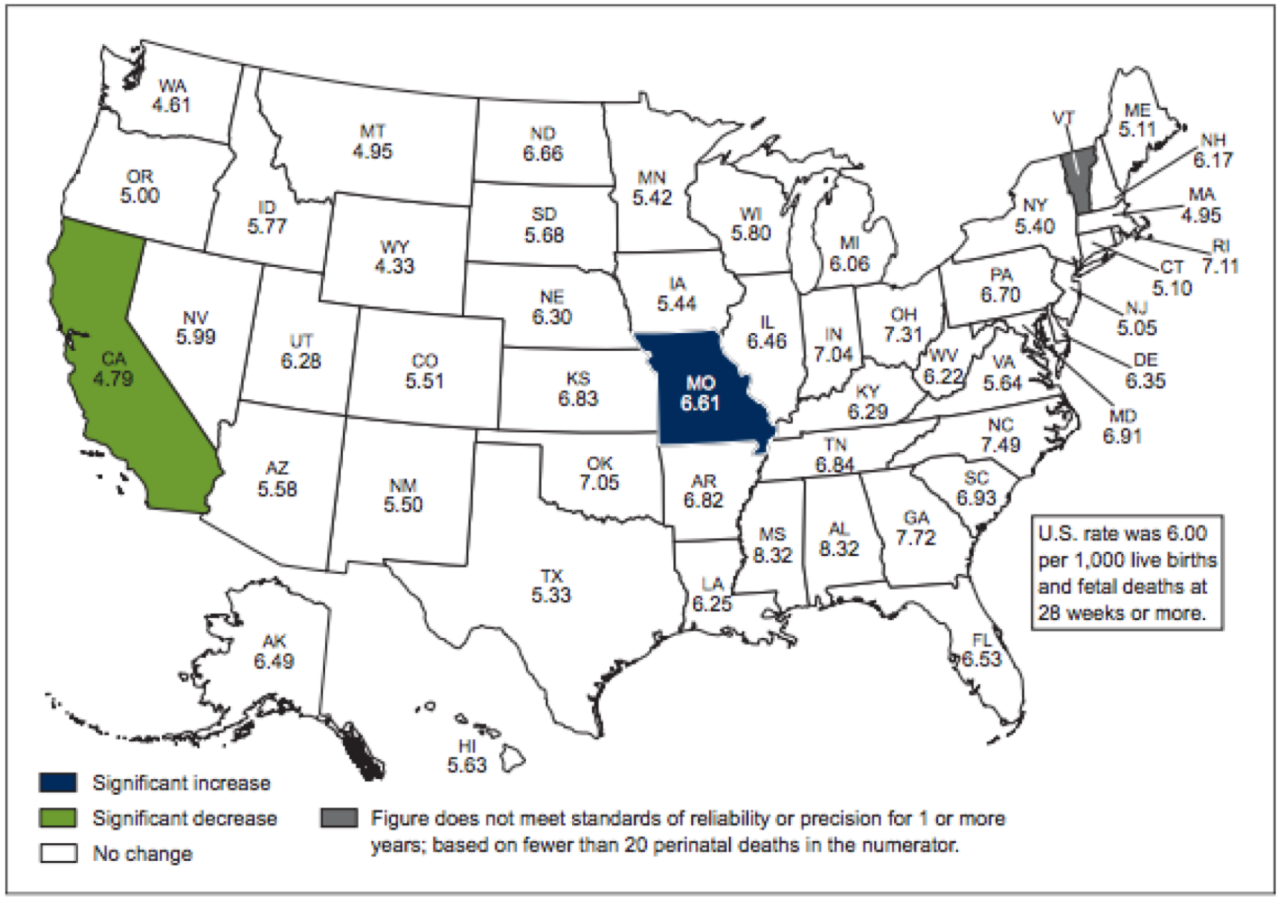
Improvement driven by our members

Reduction in necrotizing enterocolitis (NEC) between 2008 - 2017



California vs. the United States

Figure 4. Perinatal mortality rates by state for 2016 and change in 2016 compared with 2014



NOTES: Rate per 1,000 live births and fetal deaths at 28 weeks or more. Significant increase or decrease at $p < 0.05$. Access data table for Figure 4 at: https://www.cdc.gov/nchs/data/databriefs/db316_table.pdf#4.
SOURCE: NCHS, National Vital Statistics System.

CDC NCHS Data Brief published in August 2018 found that California was the **only state to have lowered perinatal mortality between 2014 and 2016.**

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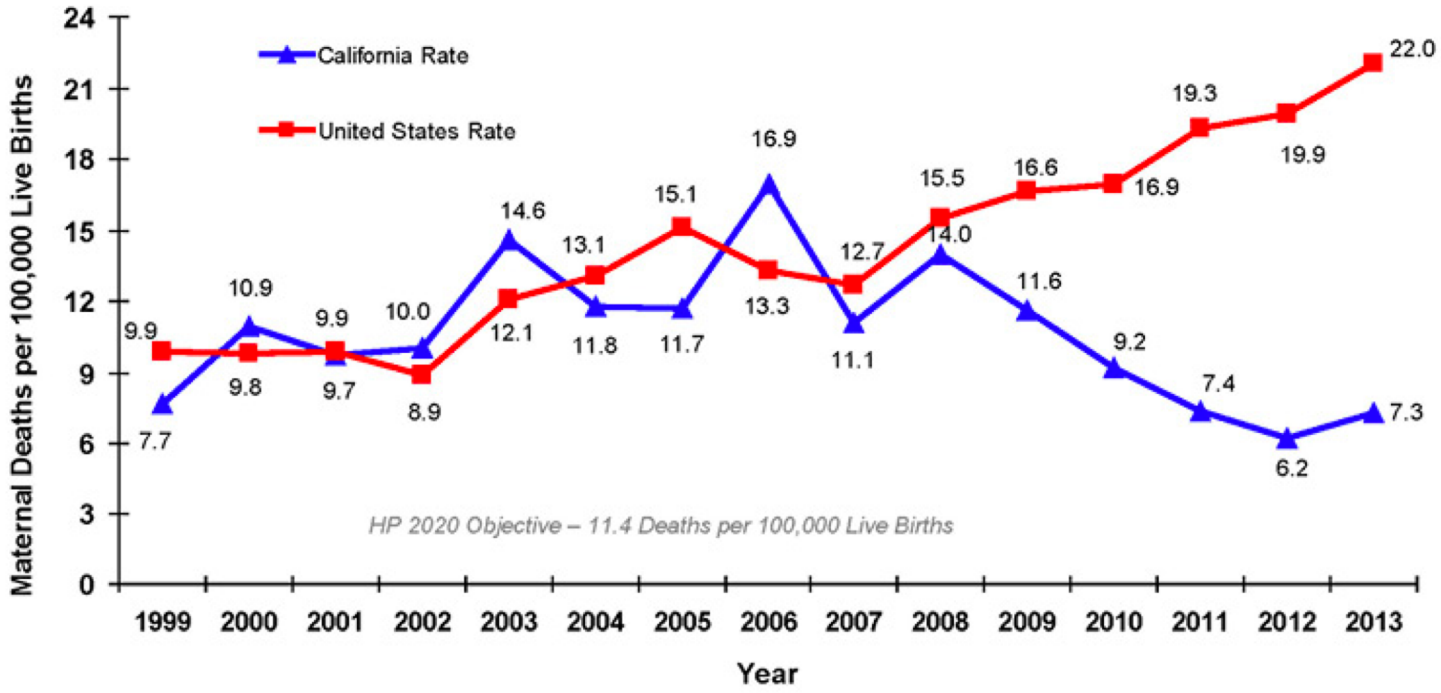
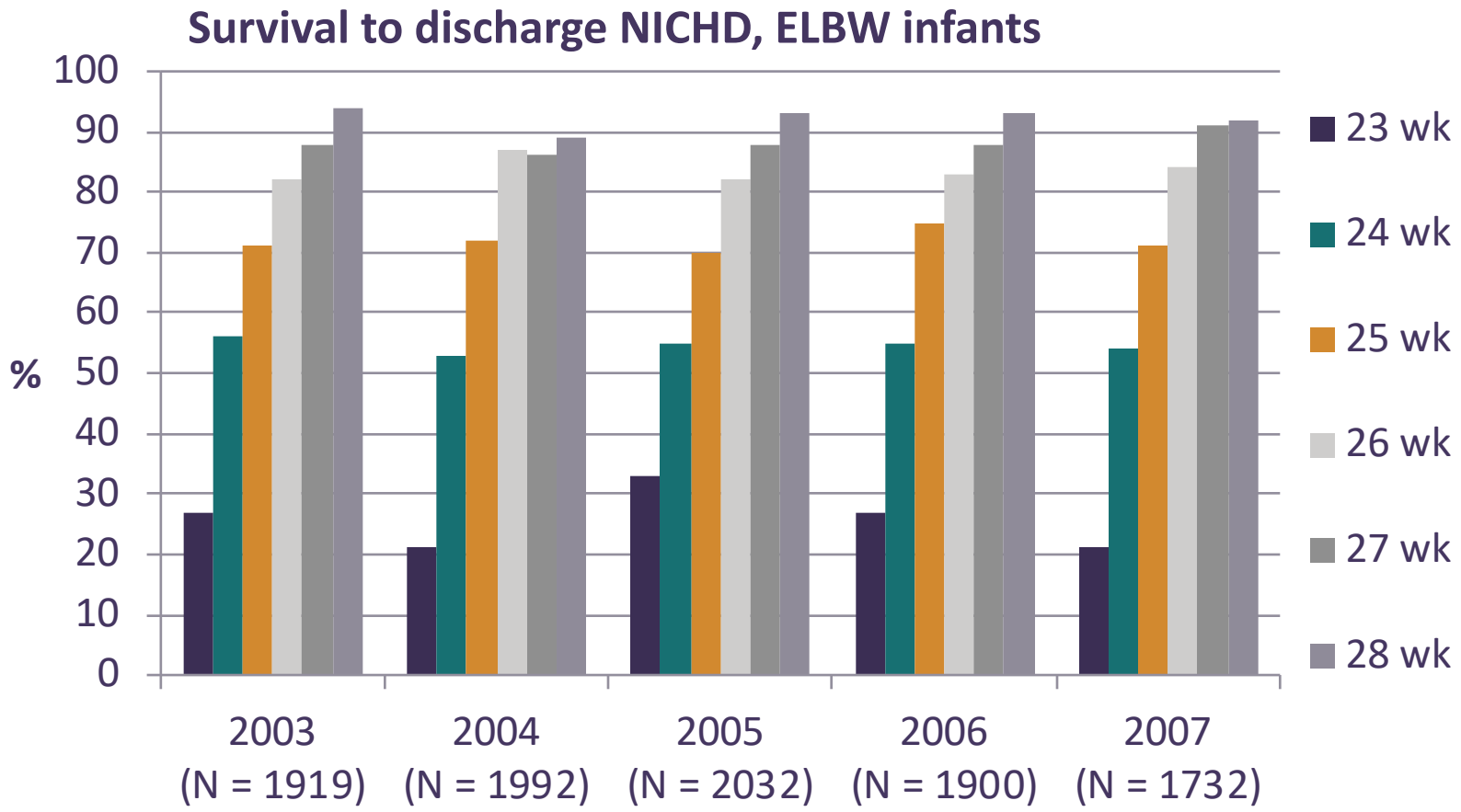
California vs. the United States

Maternal Mortality Rate, California and United States; 1999-2013



Similar trend for maternal mortality thanks to the work of our sister organization, CMQCC.

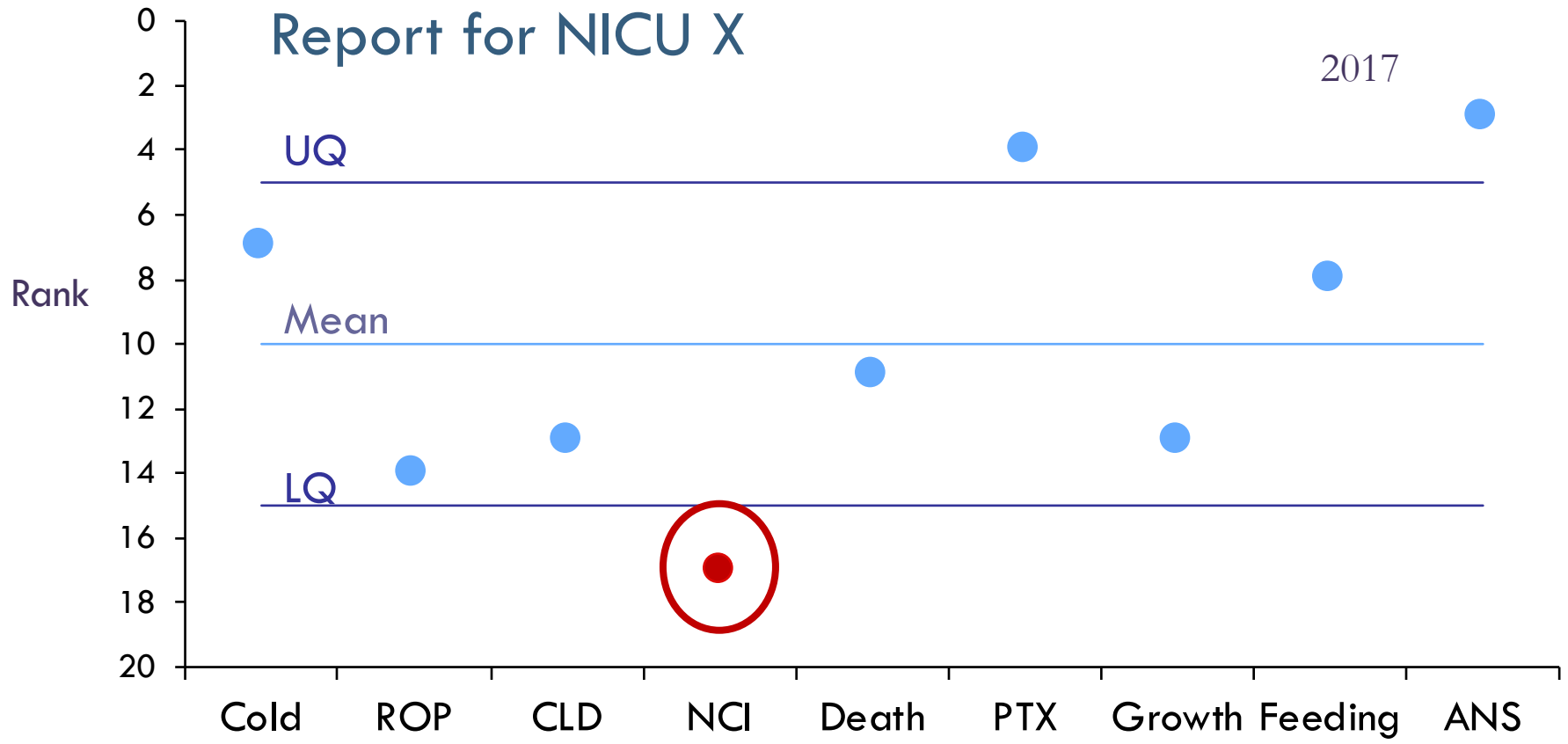
10 Years after "To Err is Human" there has been little progress – Wachter, Haff 2010

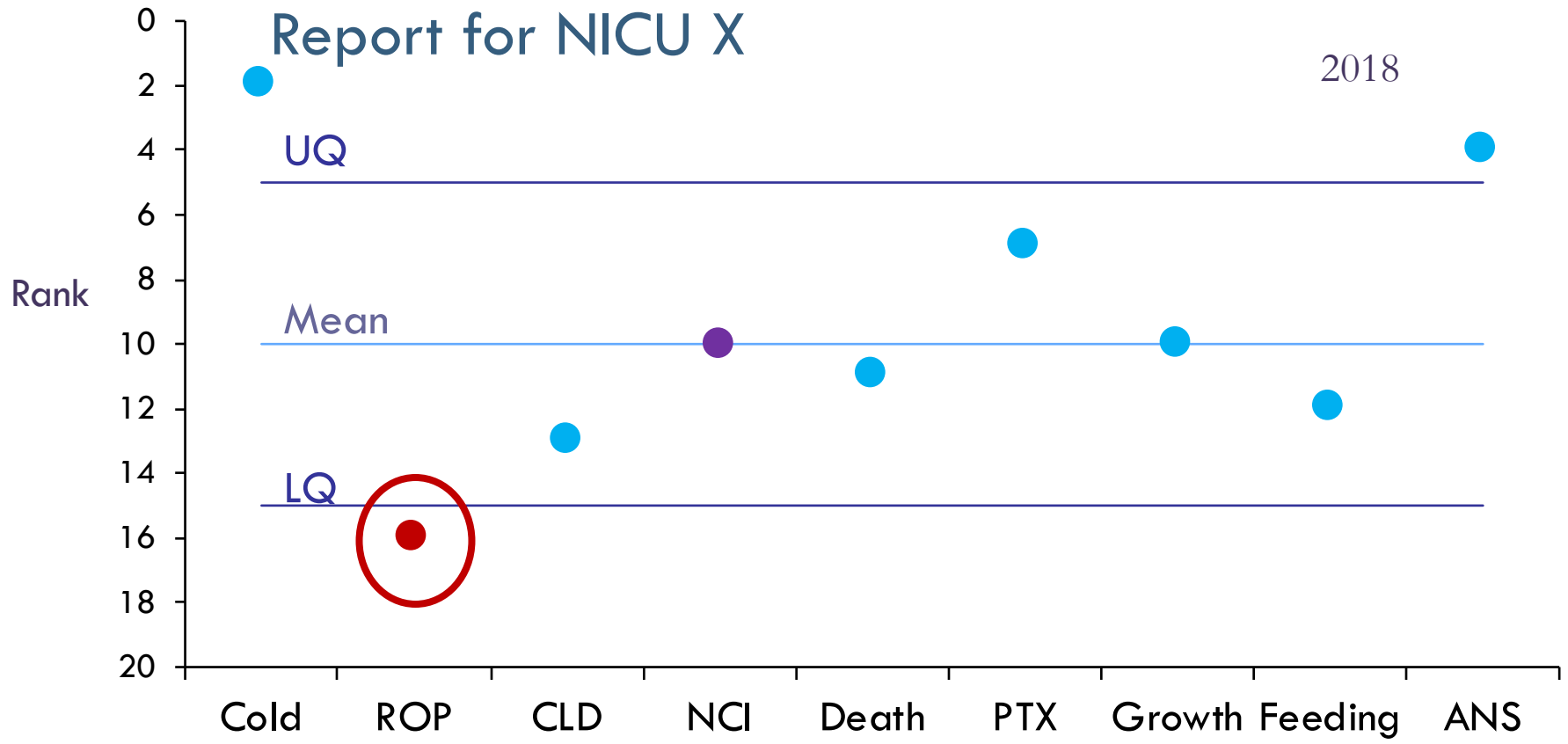


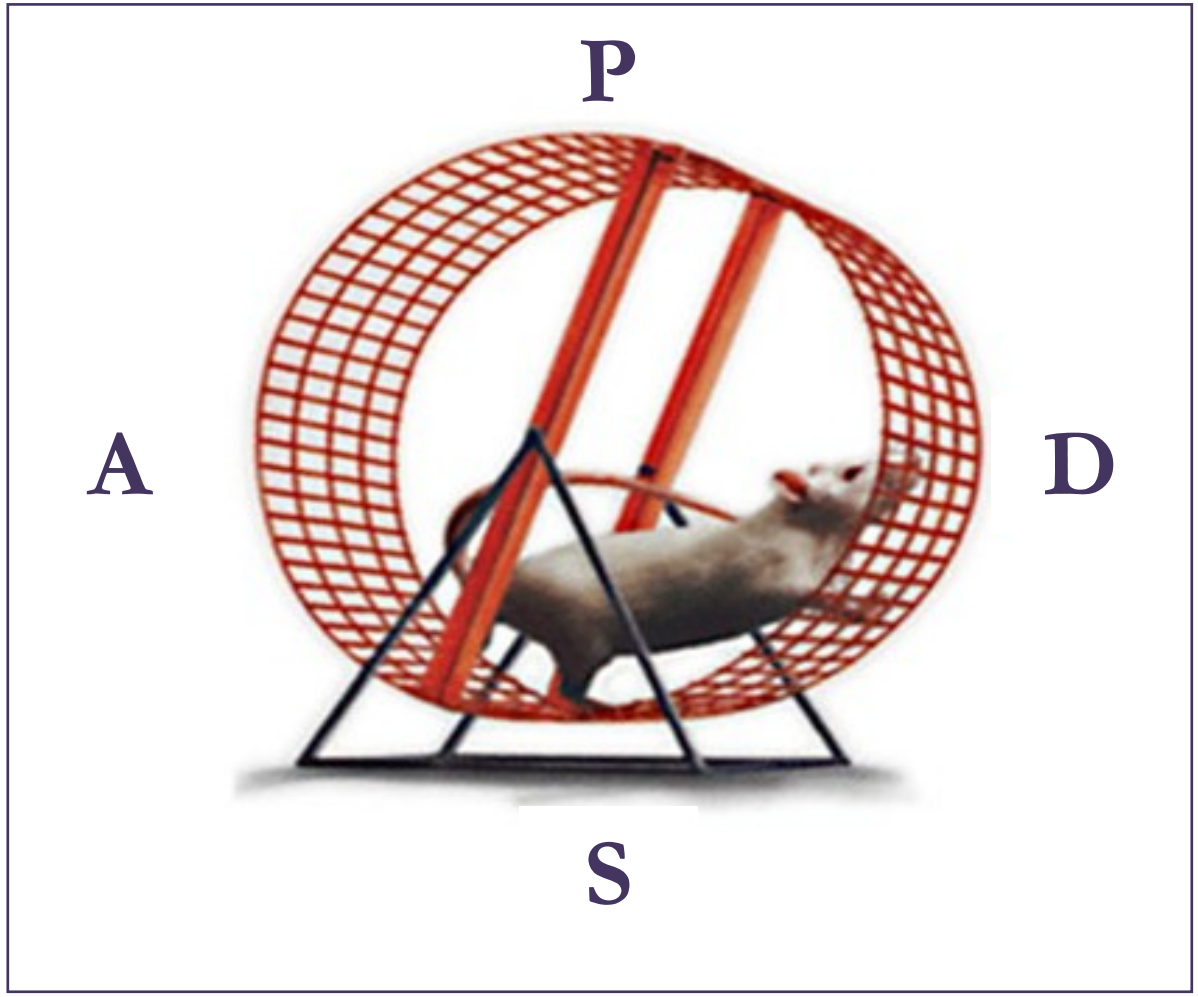
Stoll et al. Pediatrics, 2010

Why no improvement?

Current approach to QI is necessary but NOT sufficient




Report for NICU X
2018
Rank
0
2
4
6
8
10
12
14
16
18
20
UQ
Mean
LQ
Cold
ROP
CLD
NCI
Death
PTX
Growth
Feeding
ANS


P
A
D
S

Cooking a perfectly boiled egg
Simple - Process driven

- Egg factors (Case mix)
  - Age of egg
  - Size of egg
- Cooking factors (Quality)
  - pH of water
  - Temperature of water
  - Time of cooking
  - Altitude

Providing a perfect dinner experience
Complex – Systems-based approach

Food

Décor

Service

Cost

French Laundry – "Best Food" in SF area

Context matters

Why a Composite Indicator?

Individual measures say little about overall quality

Correlation Among Quality Measures

	Surv	ANS	Not Cold	No PTX	No HAI	High GV	No CLD	BM
Survival	1							
ANS	.42*	1						
Not Cold	-.06	.01	1					
No PTX	.38*	.43*	.02	1				
No HAI	.05	.09	.01	-.01	1			
High GV	.08	-.07	.03	.05	.61*	1		
No CLD	.23	.46*	-.33	-.04	-.07	-.41*	1	
BM at dc	-.23	-.05	-.16	-.18	.11	-.44*	.35	1

* Only 6/28 correlations were significant

CPQCC 22 regional NICUs 2004-07, n = 5445 VLBW

Based on standardization and risk adjustment

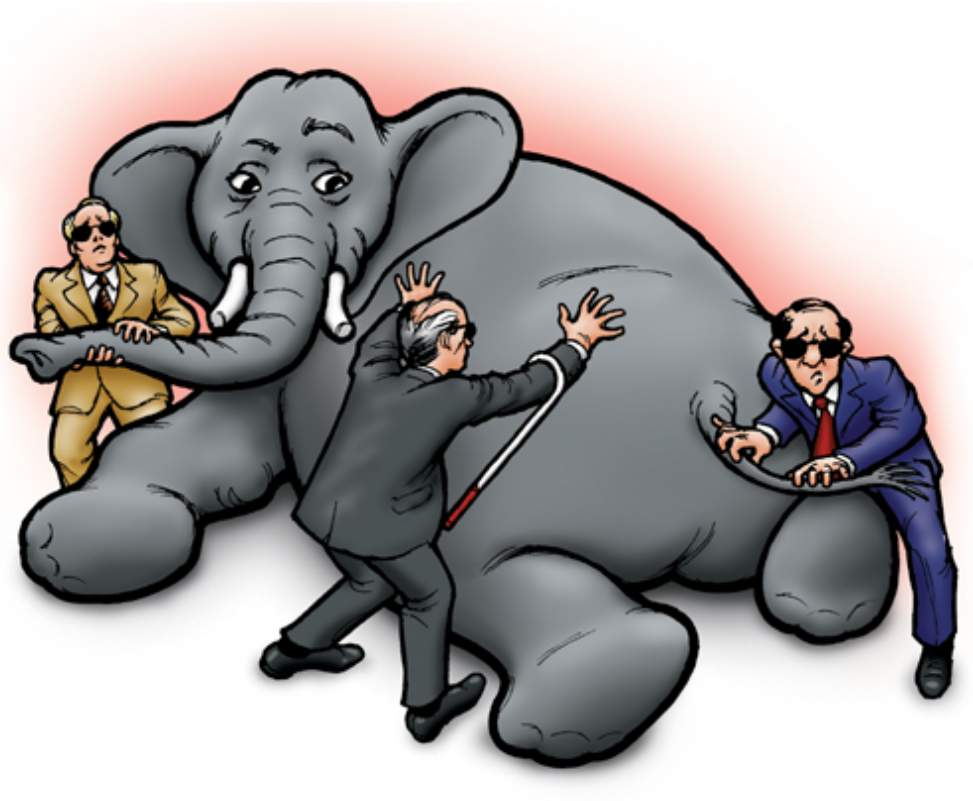
Each measure has its own risk model

Profit, Gould, et al., Arch Peds & Adol Med, 2012

Implications for Performance Measurement

- Cannot infer overall NICU performance based on one or a few metrics of quality

- Composite may better measure **overall** performance



Composites

Composite Indicators

- Aggregate multiple measures into a single score
- National priority for quality assurance
- Multi-dimensional measurement may drive multi-dimensional systems-based improvements in quality

Development

- Complex process
- Developers' choice of methods may sway performance ratings
- Imperative to follow a standardized and explicit approach

Profit, et al., Imp Science. 2007

Development of the Baby-MONITOR

Measure Selection

Delphi Experiment (RAND)

- QI/HSR expert panel
- 27 VON/CPQCC measures
  - Importance, reliability, validity, scientific soundness, usability
  - Overall score
- 2 rounds of ratings on 9 point scale (9 is best)
- Ratings interspersed by telephone conferences

Profit, Gould et al., J Perinatol. 2011

Measures Selected by Panelists

METRIC	Panel Median Rating (IQR)
Antenatal steroids	9 (0)
Timely ROP exam	9 (0)
Nosocomial infection	9 (1)
Cold (<36°C) on admit	8 (1)
Pneumothorax	8 (2)
Growth velocity	8 (2)
Oxygen at 36 weeks	7 (2)
Any human milk at dc	7 (2)
In hospital mortality	7 (2)

*Range 1-9, 9 is best.

Profit, Gould et al., J Perinatol, 2011

Clinicians Selected the Same Metrics for Inclusion in the Baby-Monitor as the Research Panel

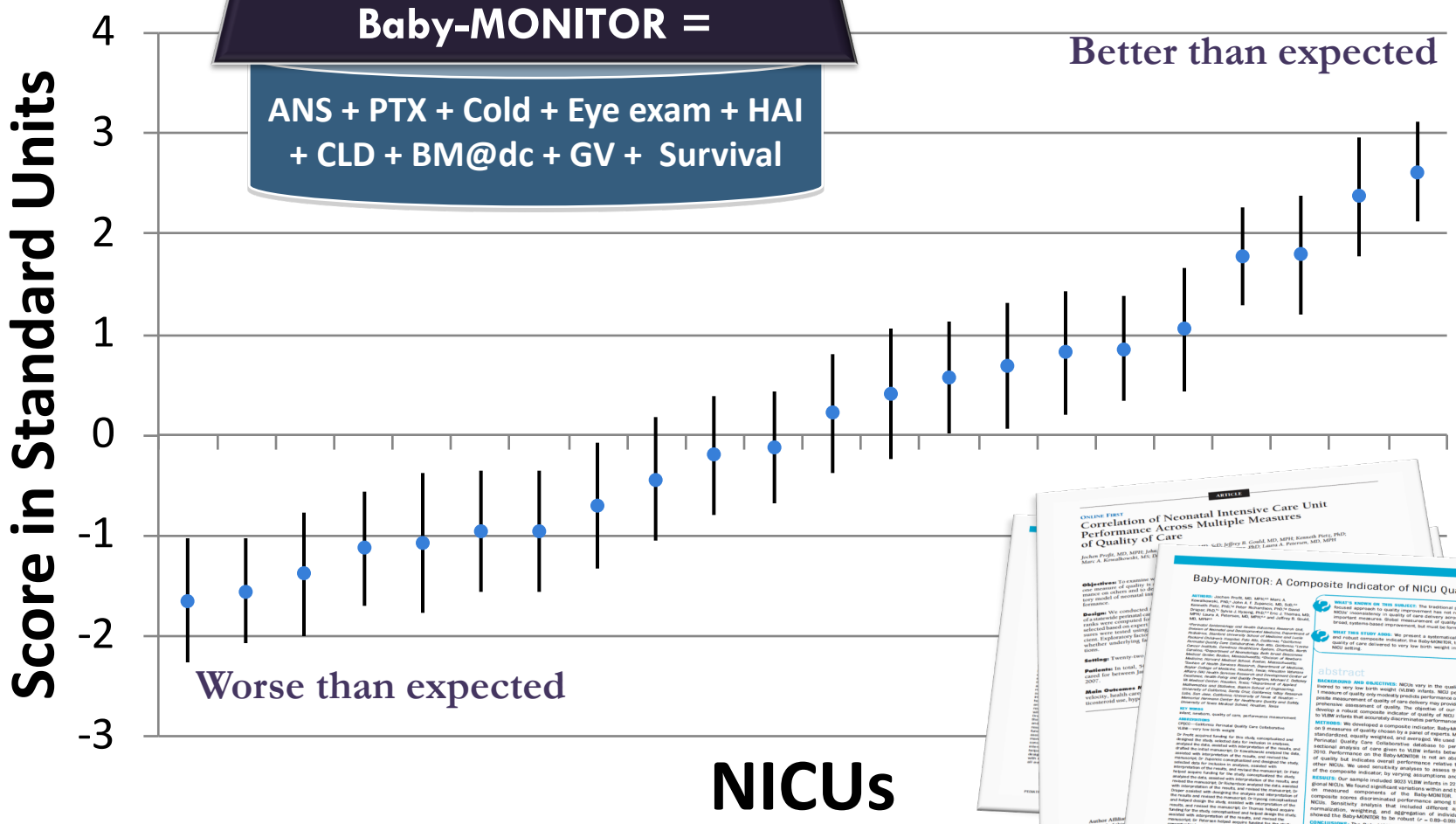
METRIC	Panel Median Rating (IQR)	Clinician Agreement, % (SD)	Clinician Vote, %
Antenatal steroids	9 (0)	78.3 (0.42)	95
Timely ROP exam	9 (0)	95.5 (0.43)	95
Nosocomial infection	9 (1)	77.3 (0.43)	100
Cold (<36°C) on admit	8 (1)	78.3 (0.54)	95
Pneumothorax	8 (2)	56.5 (0.73)	66
Growth velocity	8 (2)	63.6 (0.69)	82
Oxygen at 36 weeks	7 (2)	76.2 (0.66)	77
Any human milk at dc	7 (2)	72.7 (0.54)	82
In hospital mortality	7 (2)	68.2 (0.63)	77

Clinician Agreement – % reporting metric reasonably rated; Clinician Vote – % voting in favor of metric inclusion in composite index (2/3 majority = Include)

Kowalkowski, Profit, et al., J Perinatol 2012

Baby-MONITOR =

ANS + PTX + Cold + Eye exam + HAI + CLD + BM@dc + GV + Survival



Profit et al. Pediatrics 2014 131:74-82

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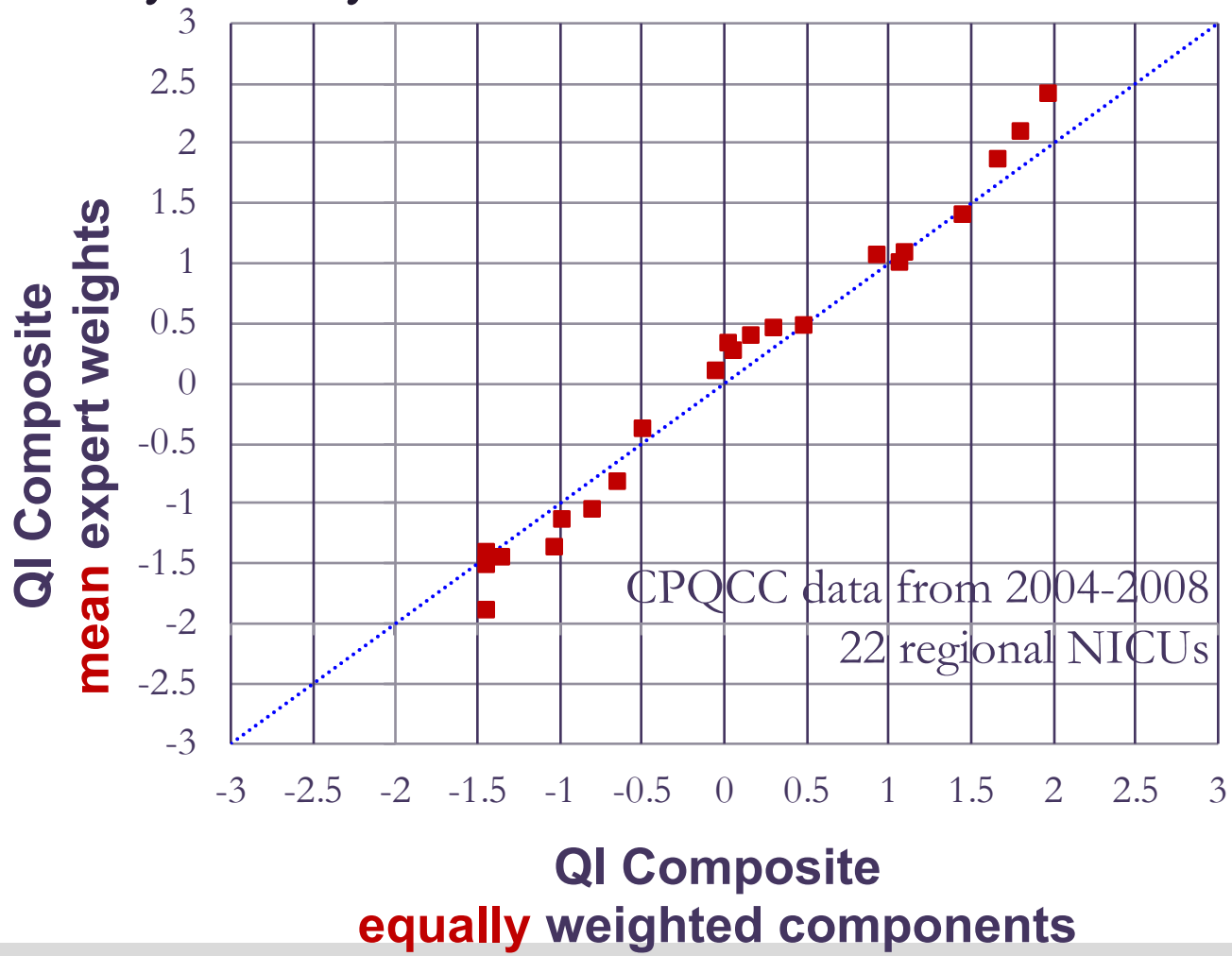
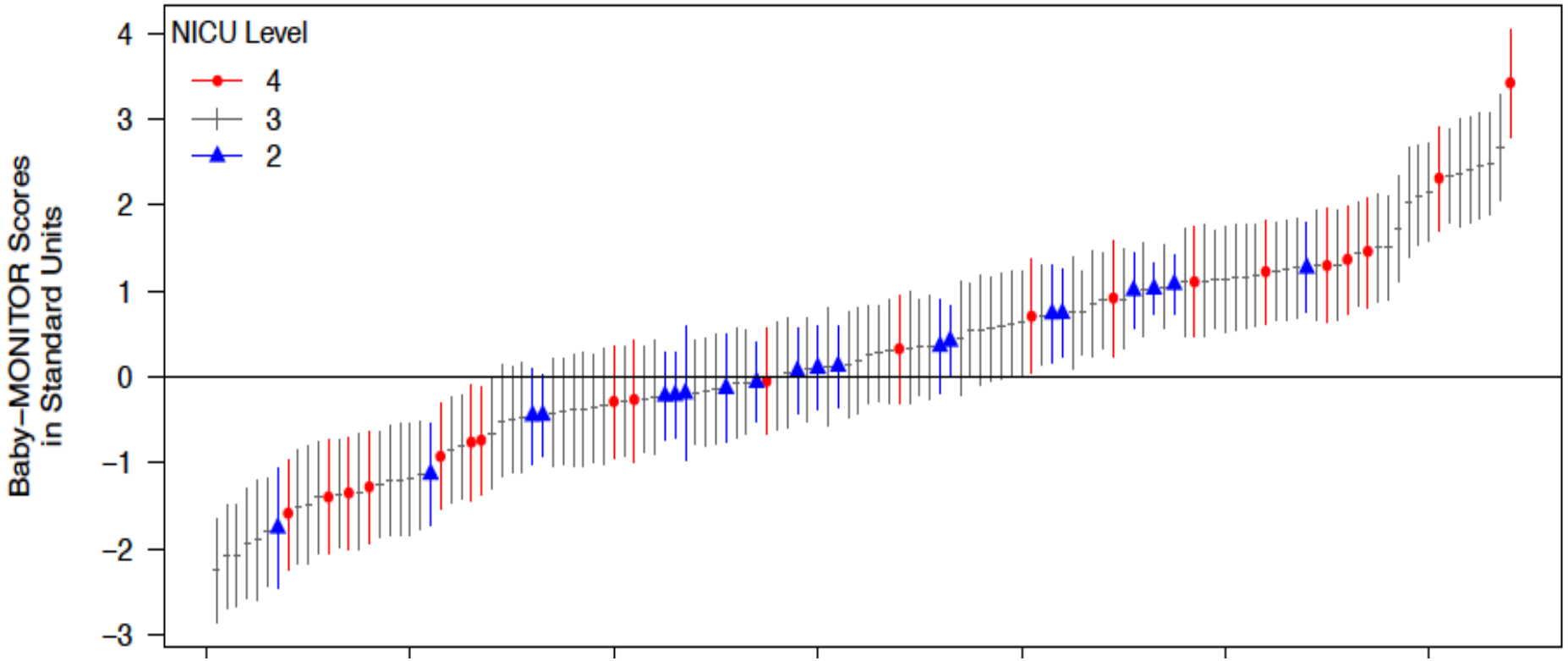
Different approaches to weighting

Sensitivity analysis



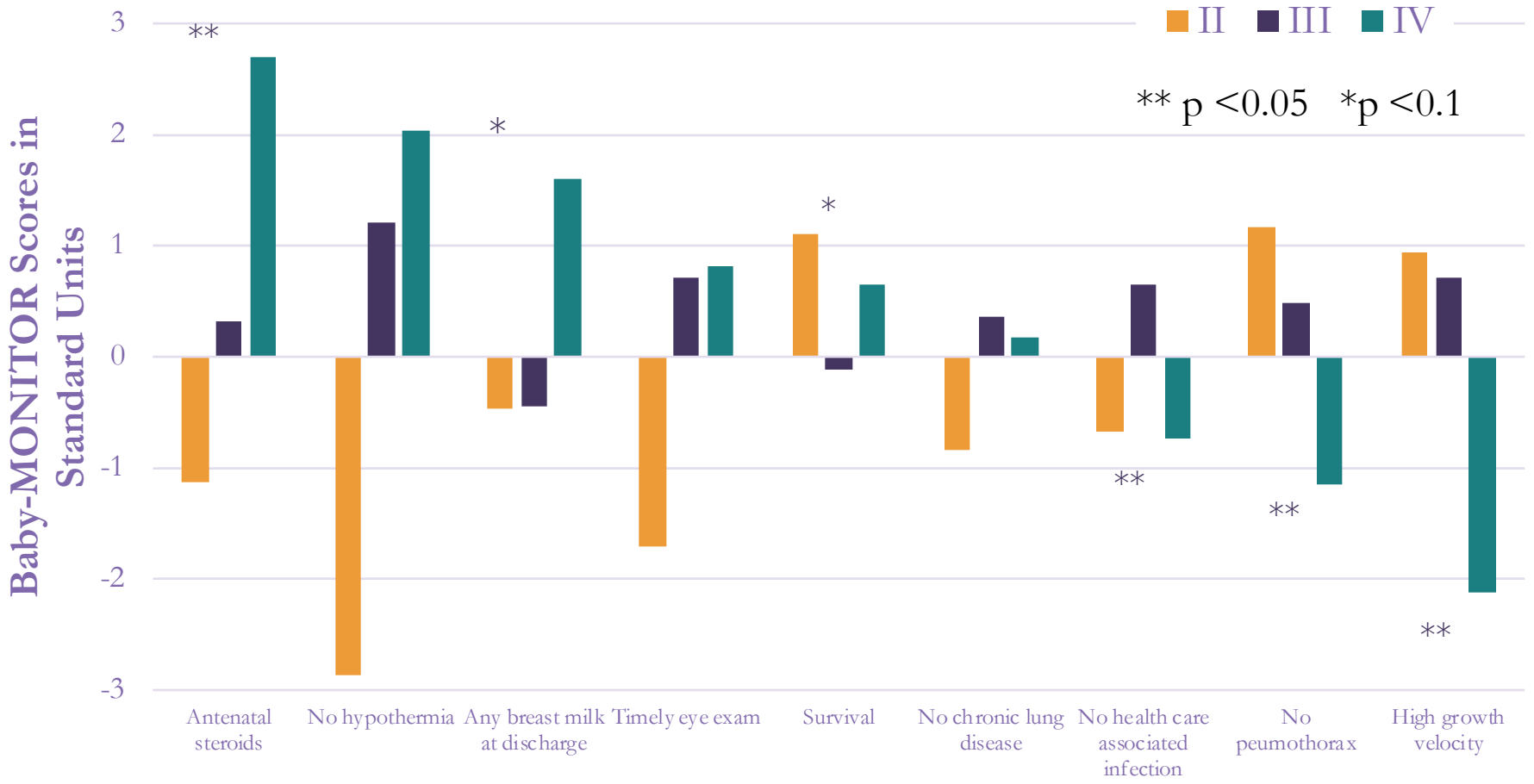
Generalizing the Baby-MONITOR to all NICU levels



CPQCC NICUs

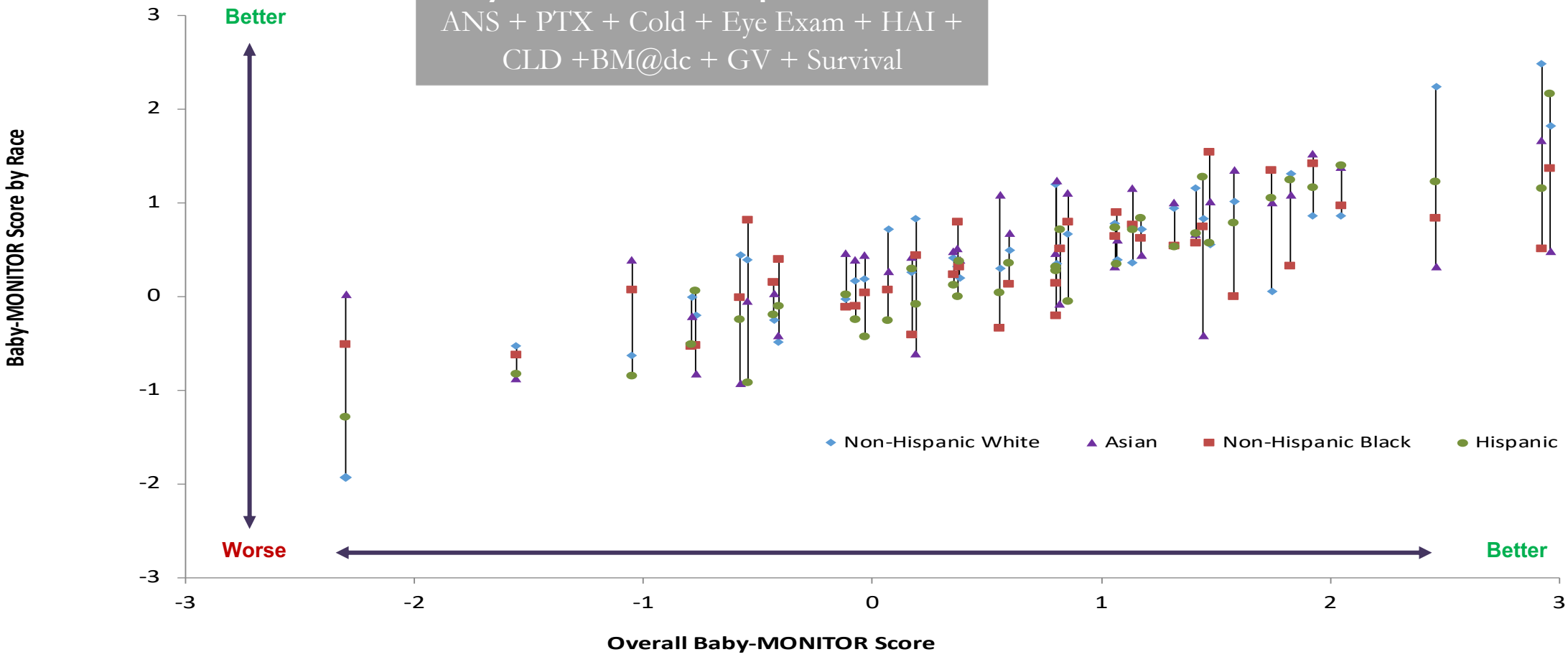
Profit et al. Pediatrics 2016 137(3):e20144210

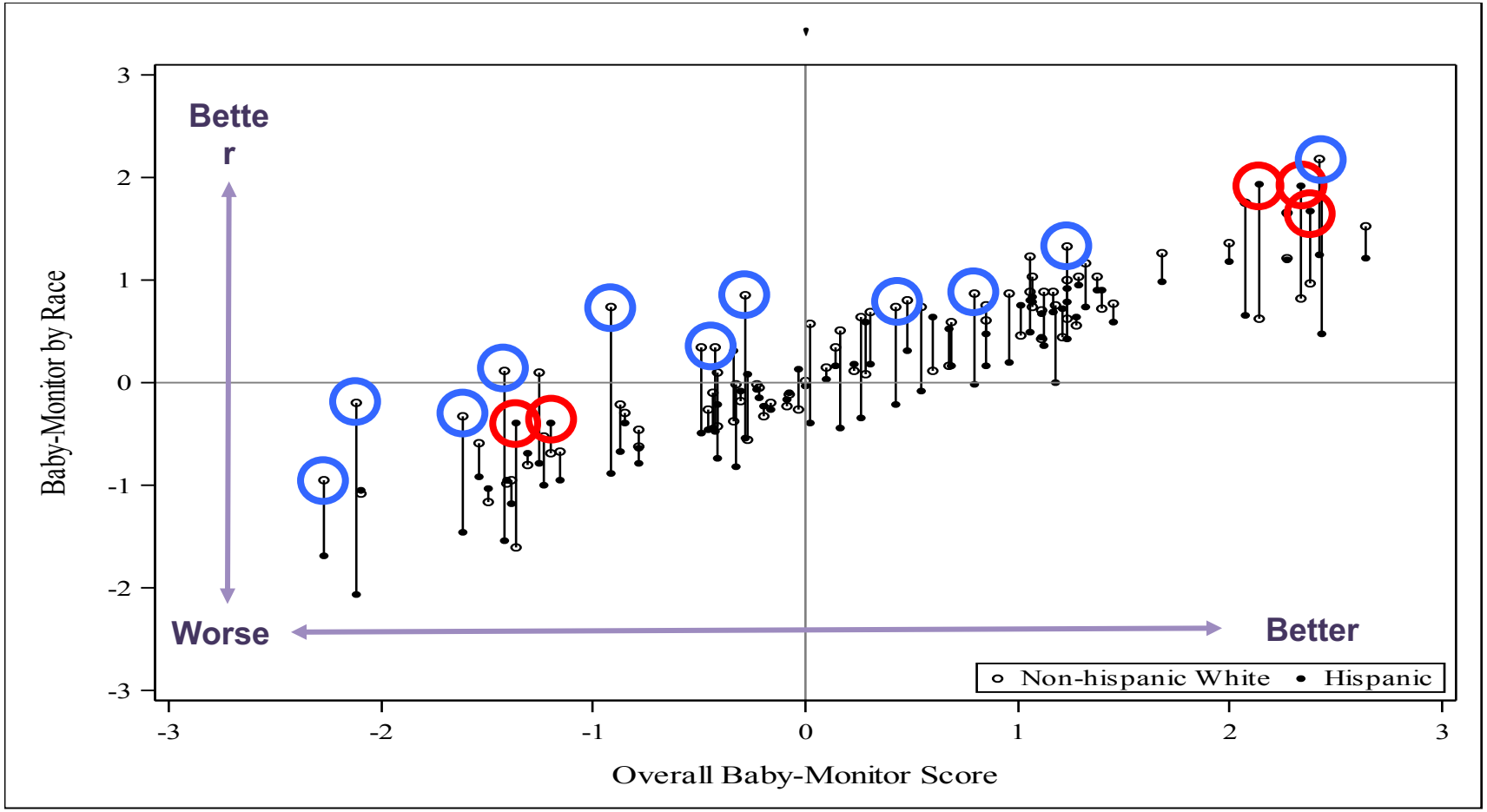
Subcomponents by AAP Level

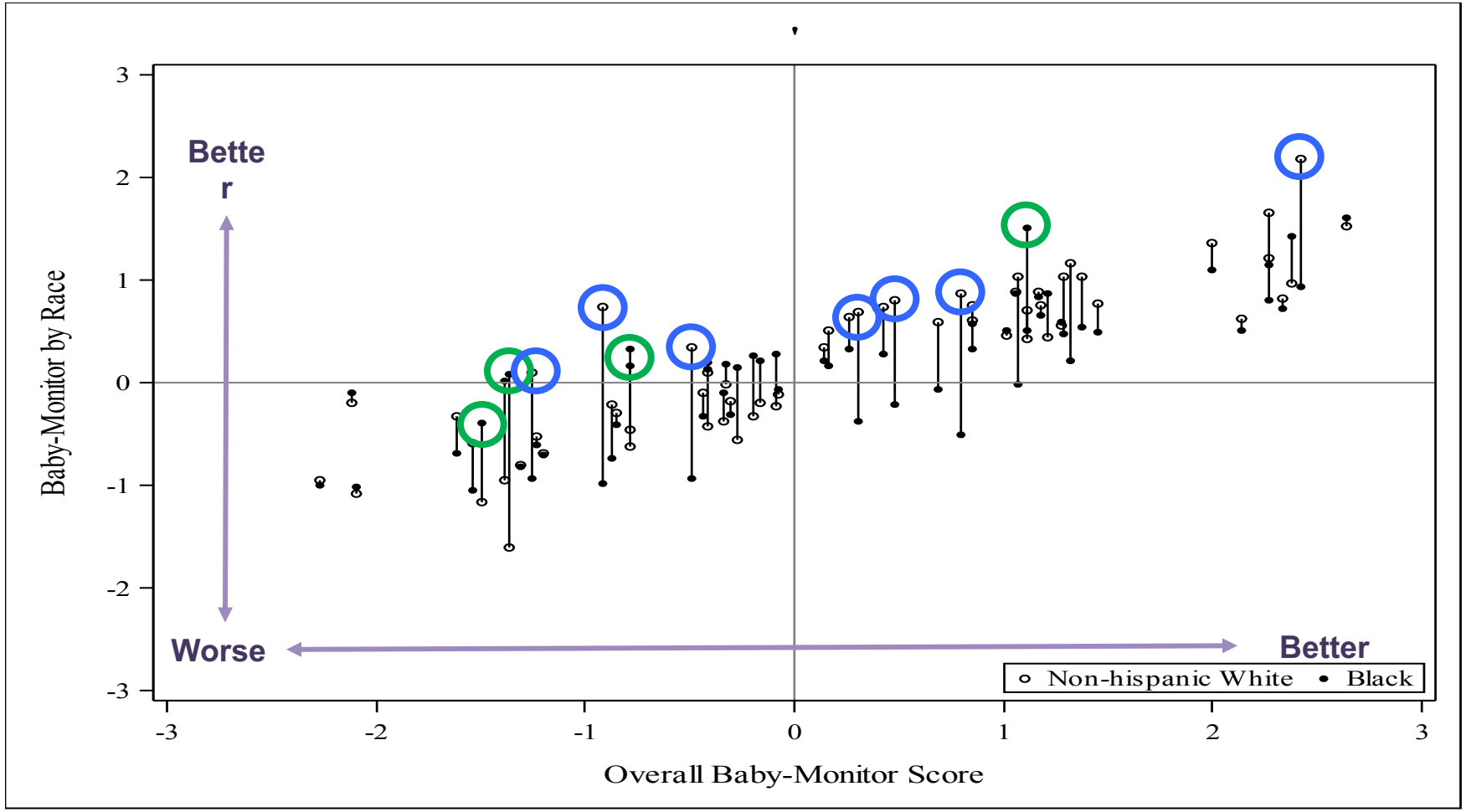


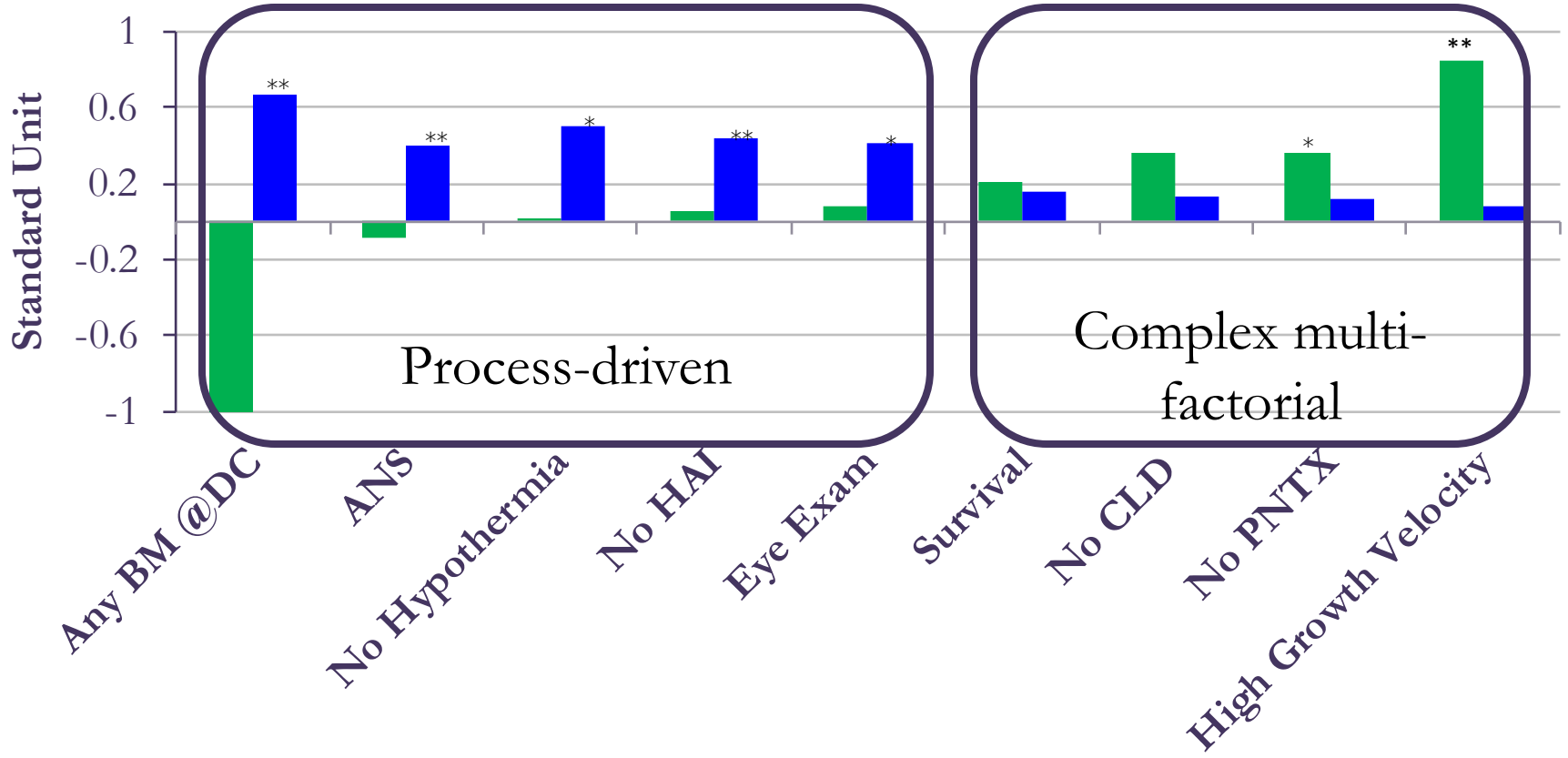
Significant quality differences across R/E within and between NICUs

Baby-MONITOR composite score =
ANS + PTX + Cold + Eye Exam + HAI + CLD +BM@dc + GV + Survival



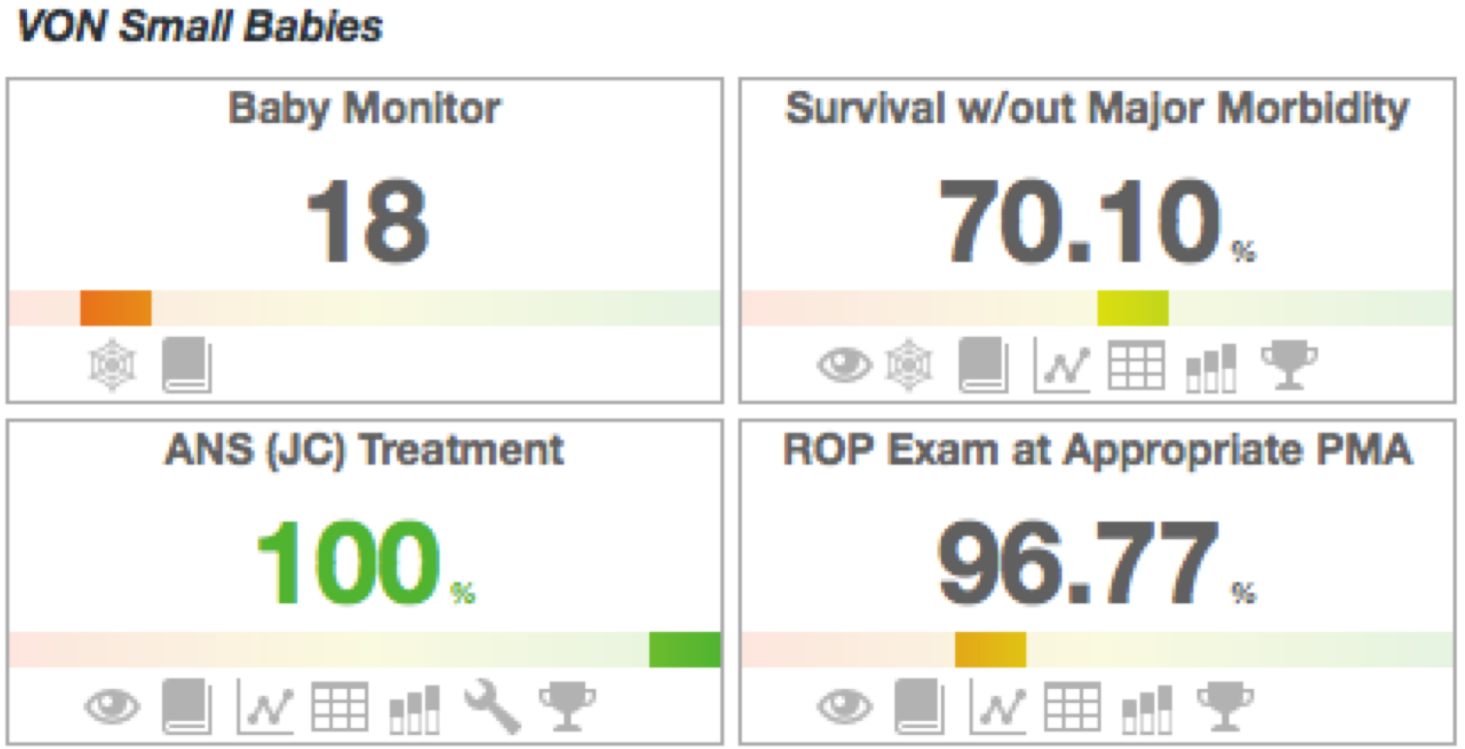

Bette
r
Worse
Better
Baby-Monitor by Race
Overall Baby-Monitor Score
Non-hispanic White
Hispanic
3
2
1
0
-1
-2
-3


Bette
r
Worse
Better
Baby-Monitor by Race
Overall Baby-Monitor Score
Non-hispanic White
Black
3
2
1
0
-1
-2
-3

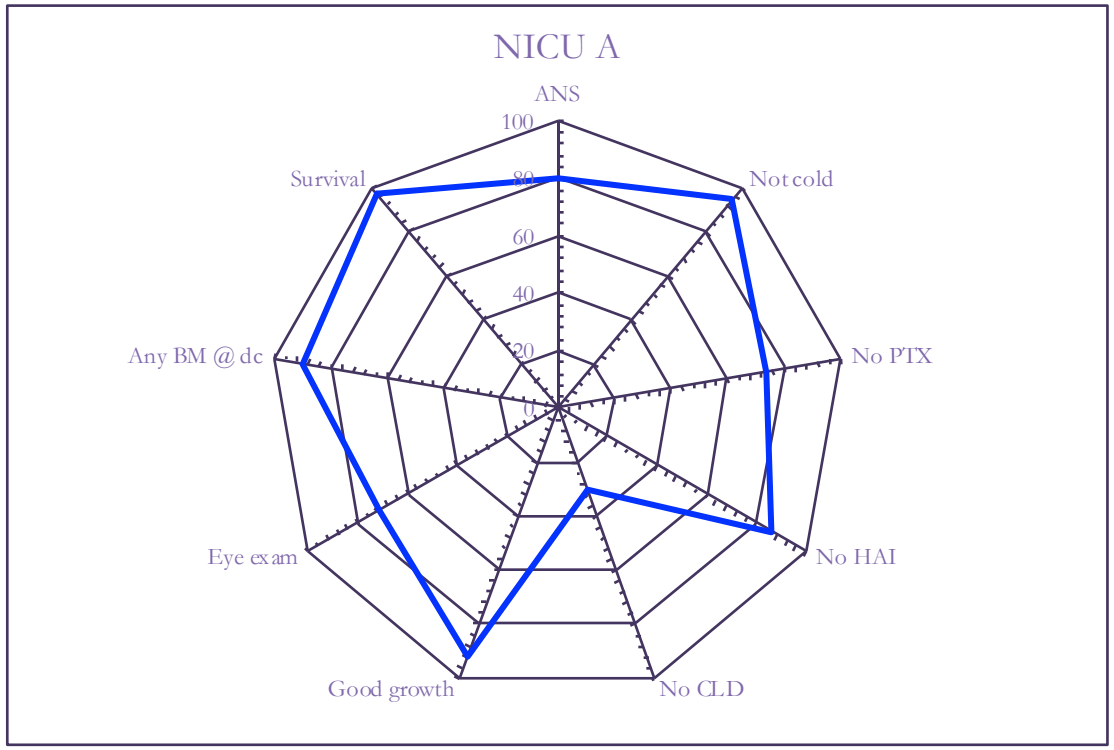

Standard Unit
1
0.6
0.2
-0.2
-0.6
-1
**
**
*
**
*
**
*
Process-driven
Complex multi-factorial
Any BM @DC
ANS
No Hypothermia
No HAI
Eye Exam
Survival
No CLD
No PNTX
High Growth Velocity

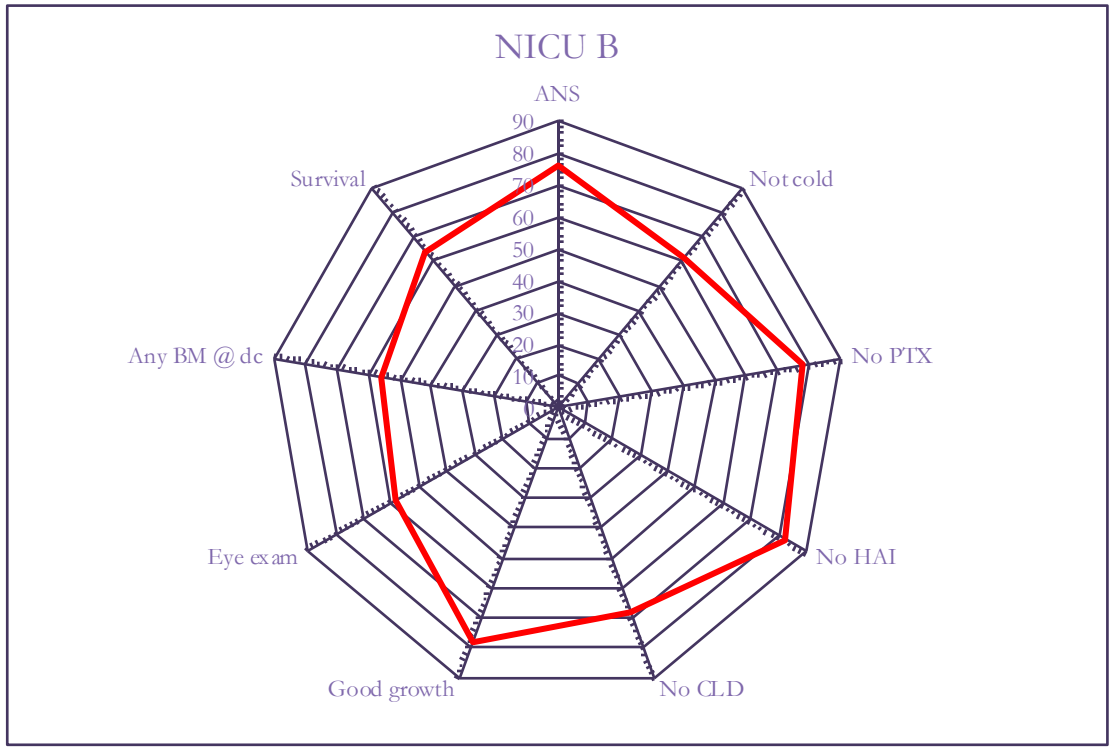
** p <0.05 *p <0.1

Baby-MONITOR Report



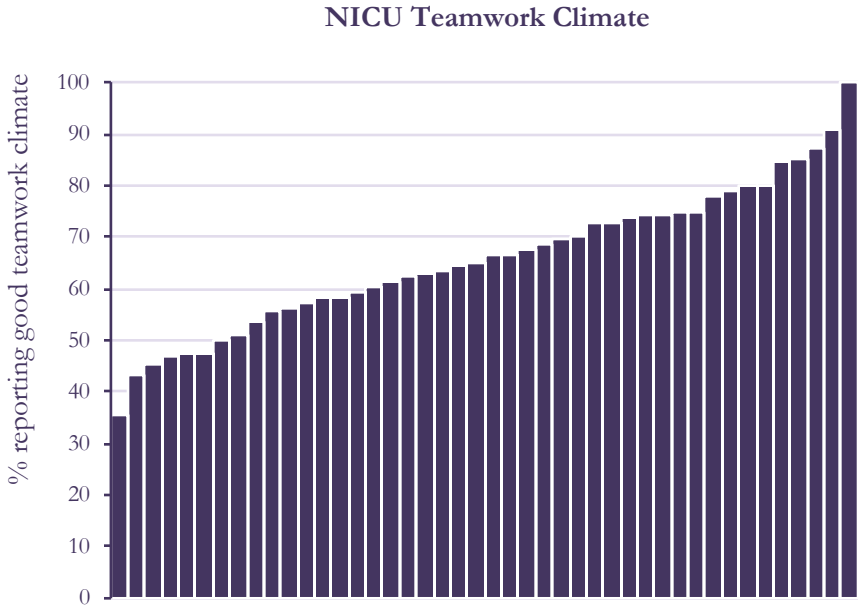
Radar Charts

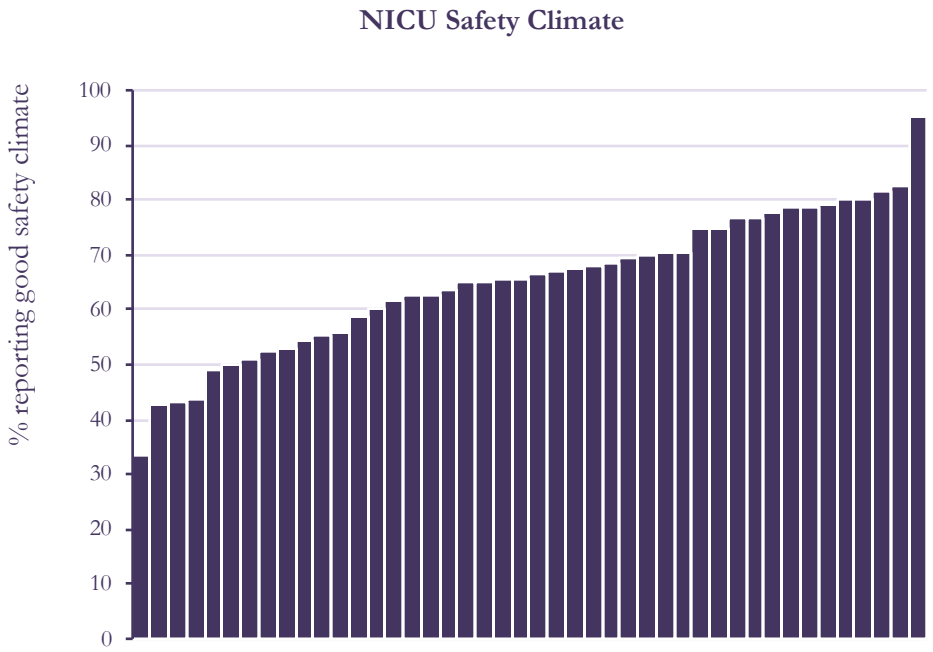


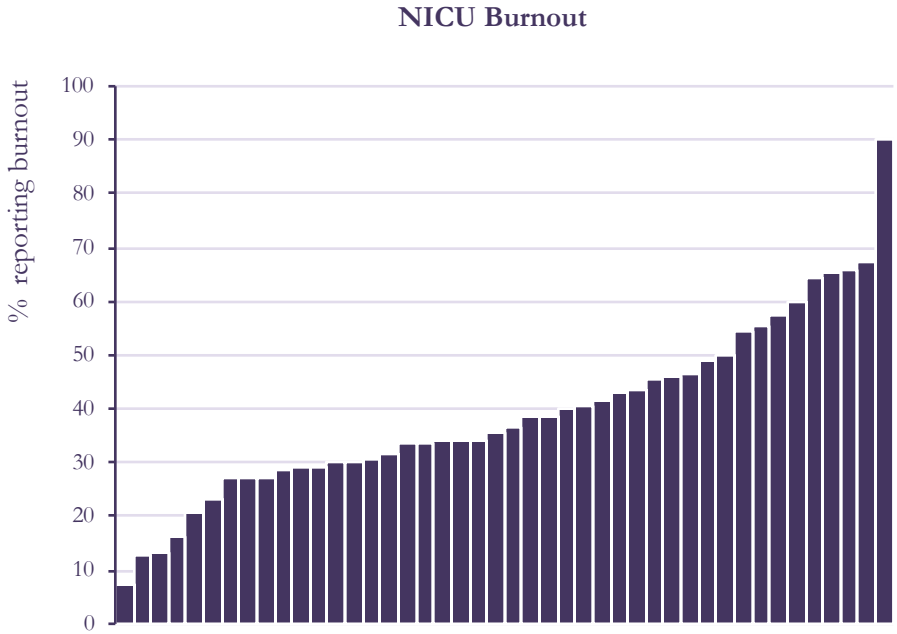


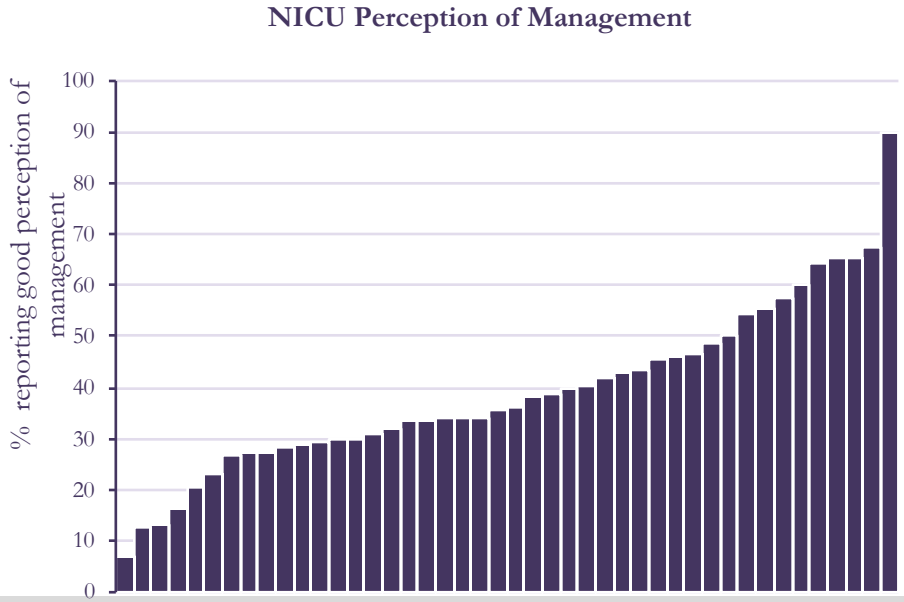
Care Context

Four different dimensions that affect the context of care.



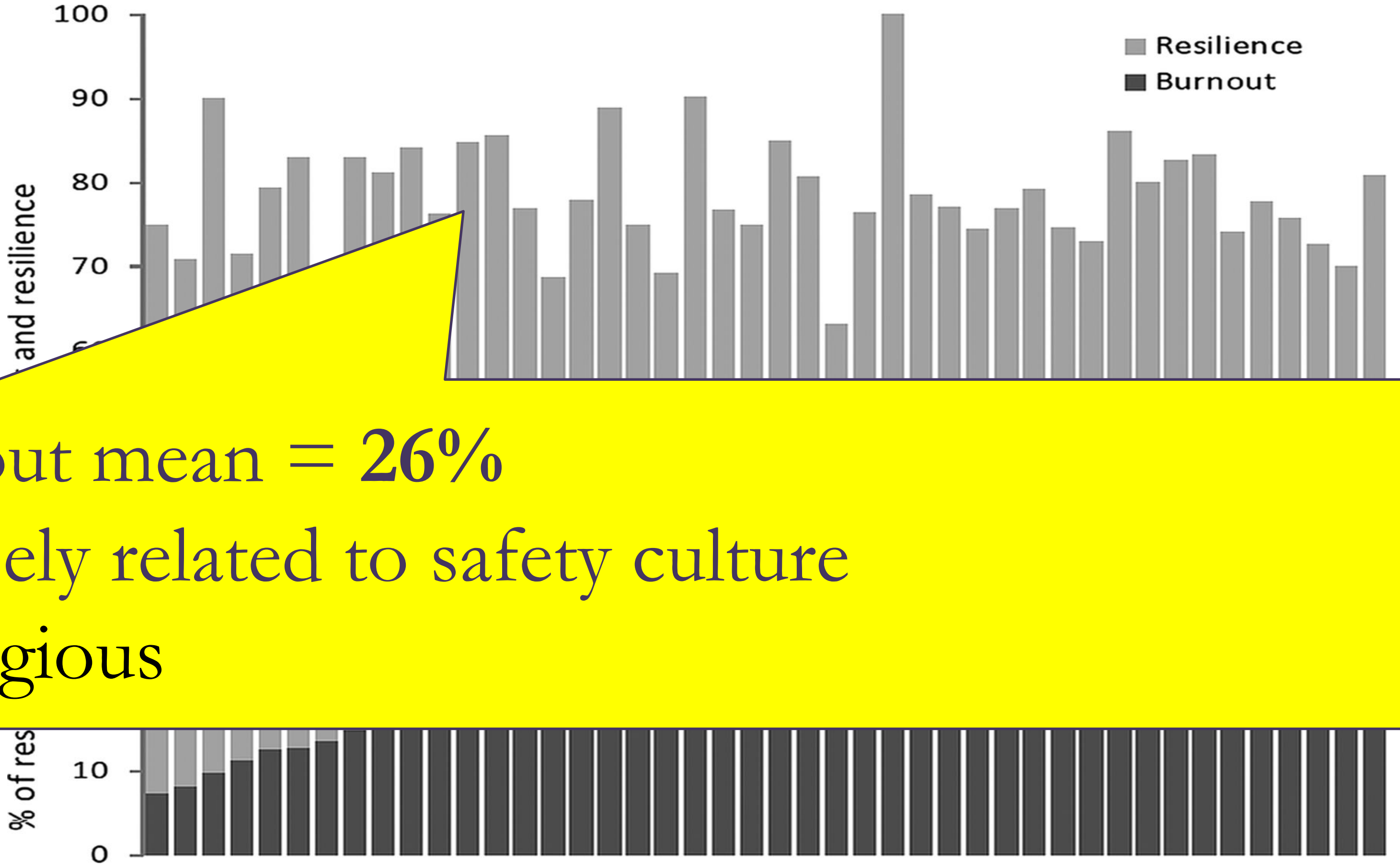






BMJ Quality & Safety Online First, published on 17 April 2014 as 10.1136/bmjqs-2014-002831
ORIGINAL RESEARCH

Burnout in the NICU setting and its relation to safety culture

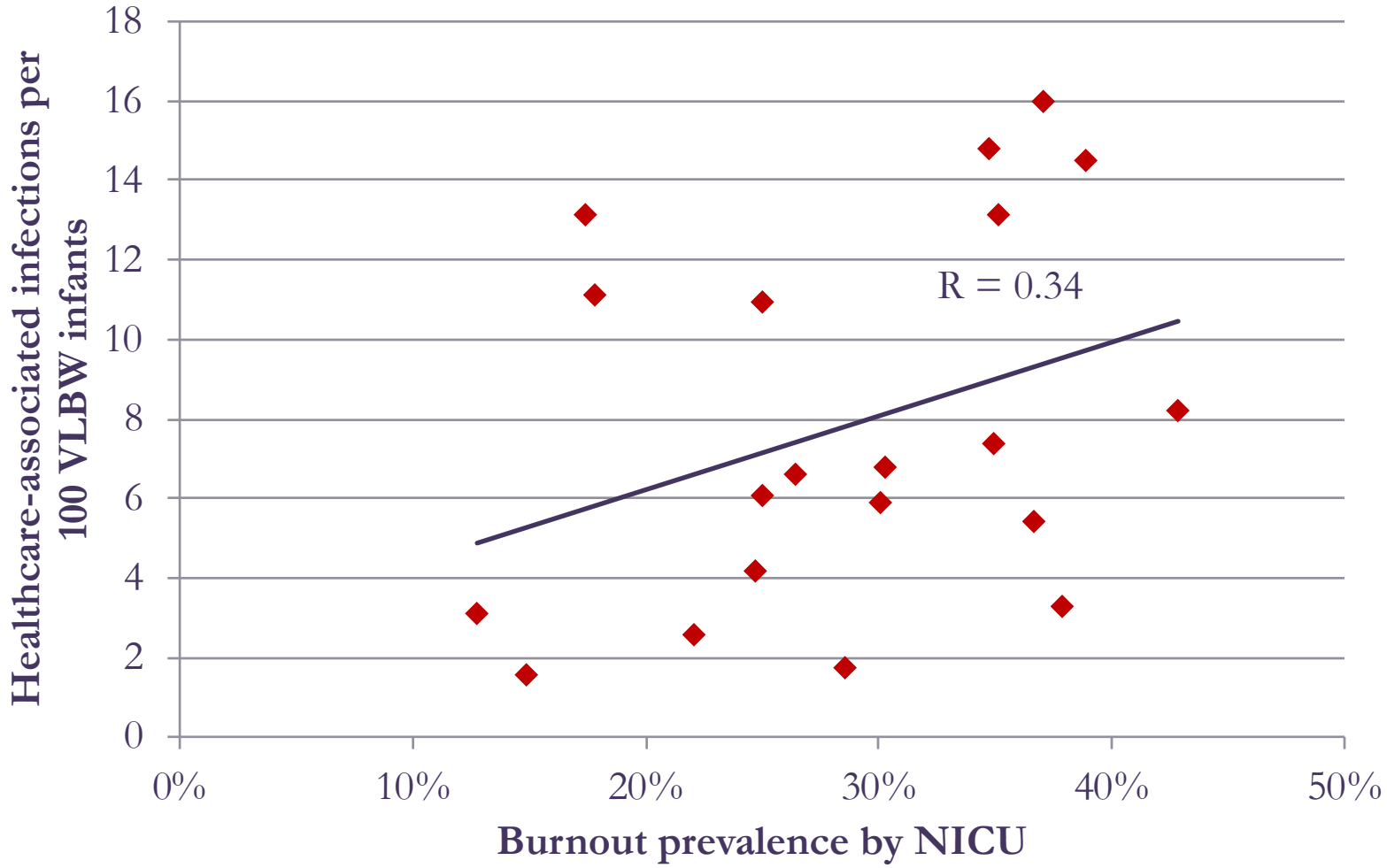


▸ Additional material is published online only. To view please visit the journal online

Division of Neonatal and Developmental Medicine, Department of Pediatrics, Stanford University School of Medicine, MSOB Rm x115, 1265 Welch Road, Stanford, CA 94305, USA;

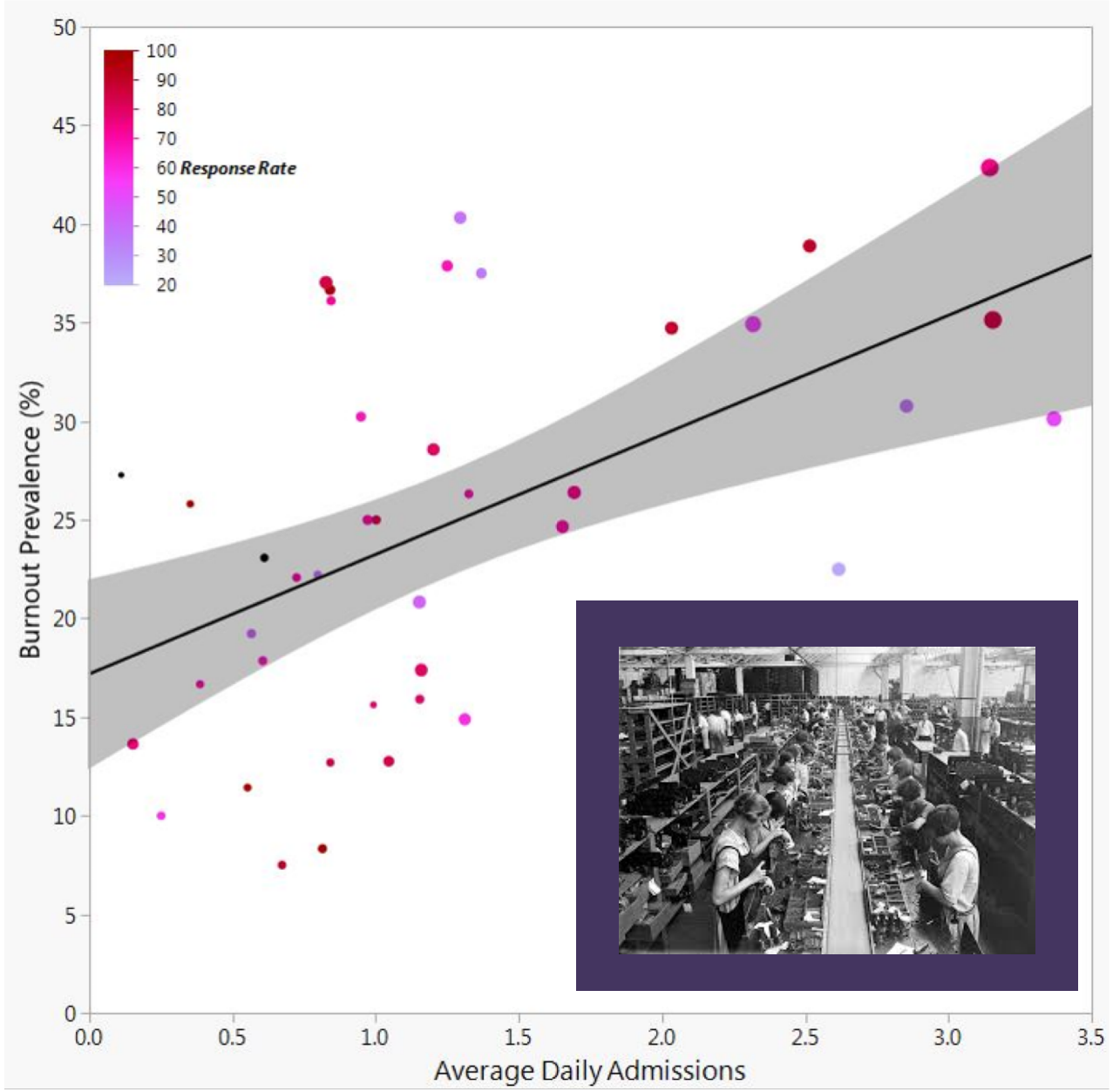
- Burnout mean = **26%**
- Inversely related to safety culture
- Contagious

Burnout: Association with Hospital Infections



Tawfik, Profit. J Perinatol 2017 Mar;37(3):315-320

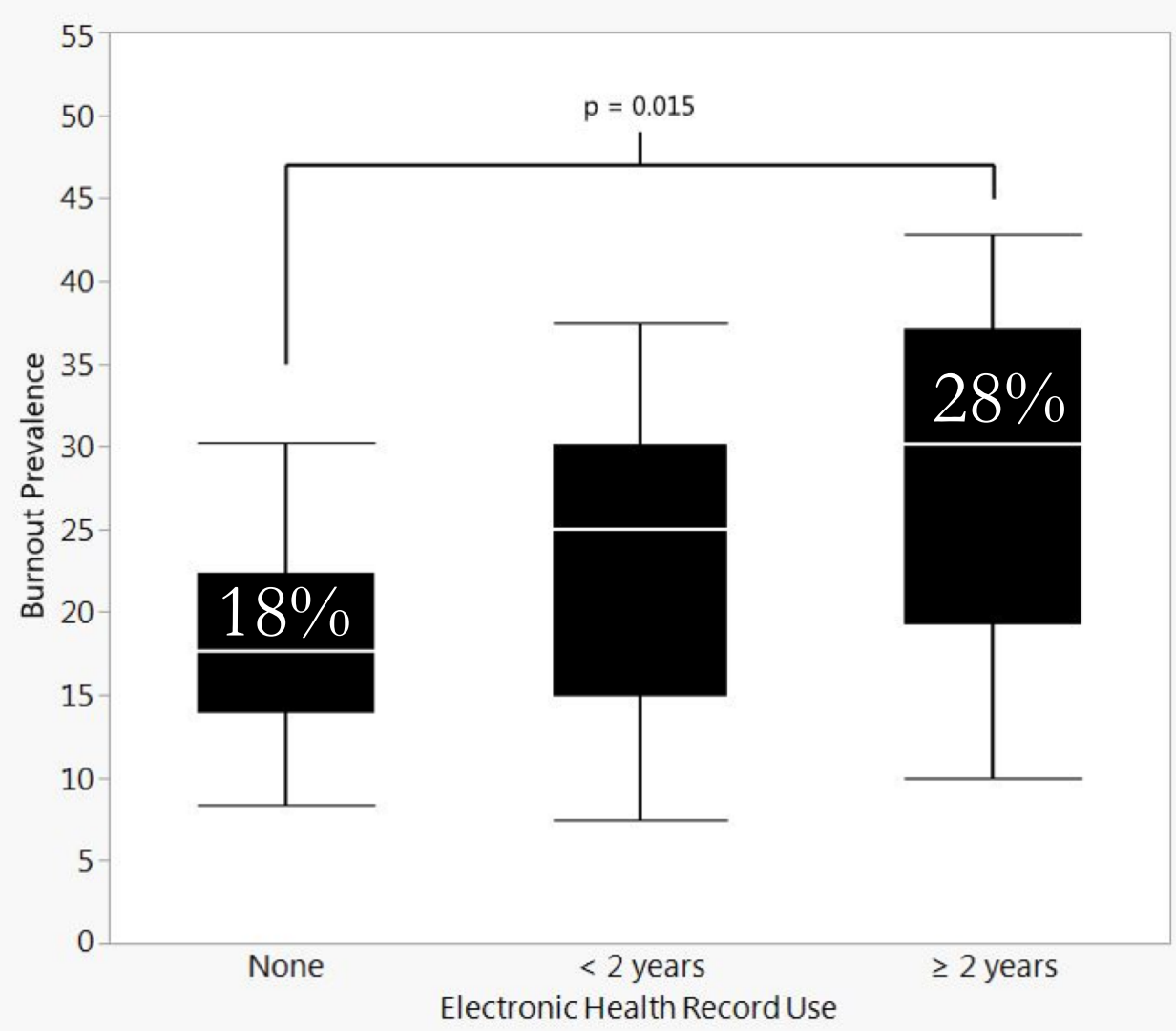
NICU volume associates with burnout



Each daily admission:
6% increase in burnout prevalence

Tawfik, Profit, et al
Pediatrics. 2017 May;139(5).

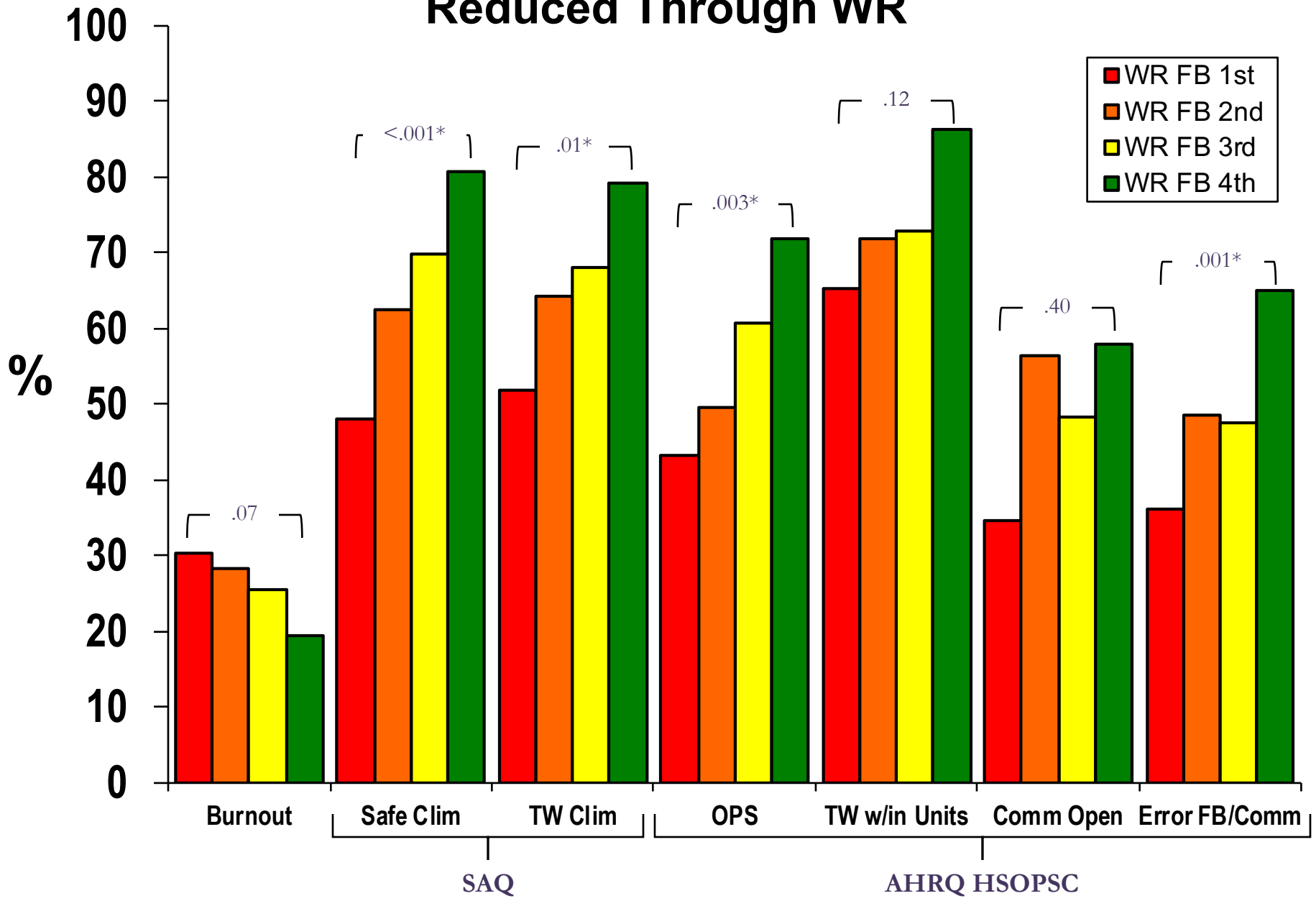
EHR use associates with burnout



Tawfik, Profit, et al
Pediatrics. 2017
May;139(5).

Bohman, et al. NEJM 2017

Quartiles of Receiving FB About Patient Safety Risks Reduced Through WR



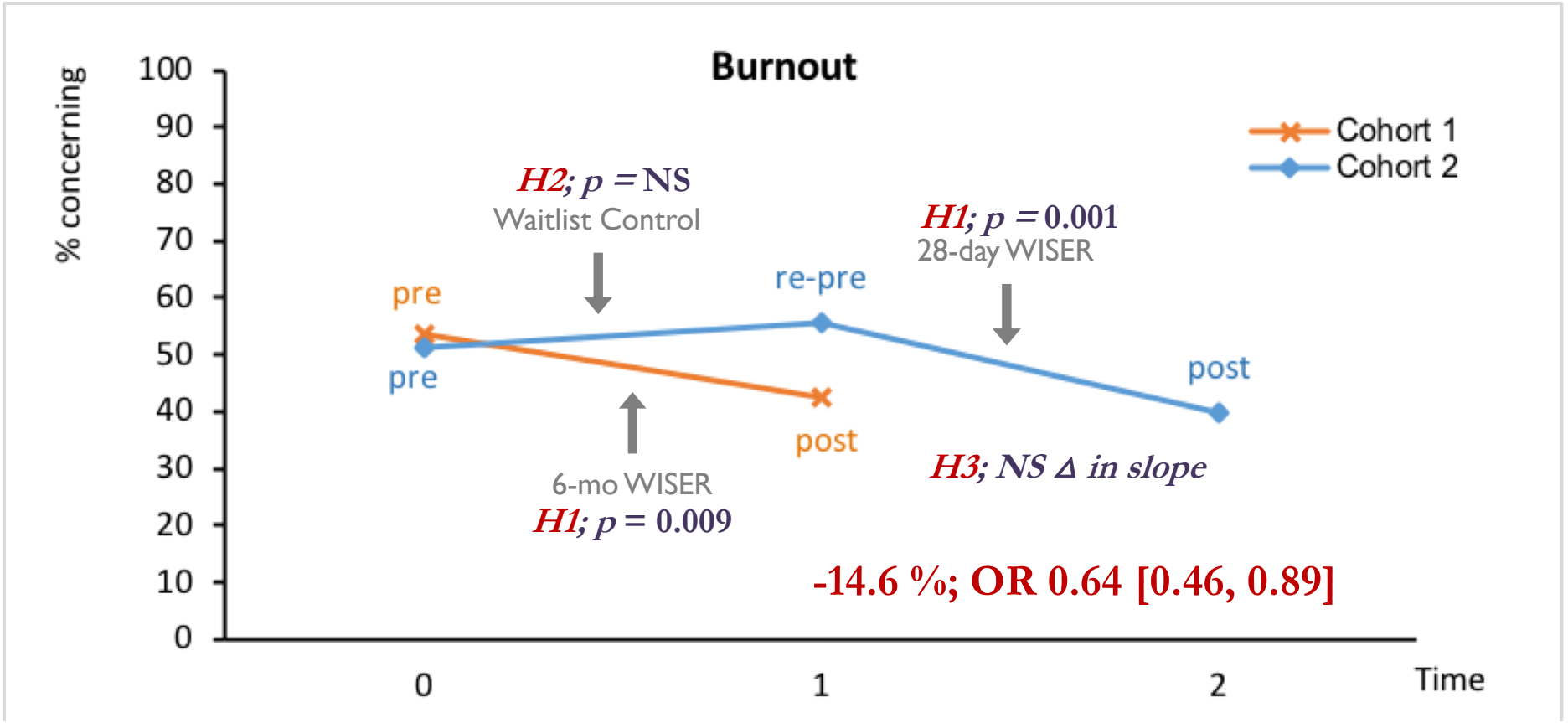
AIM:

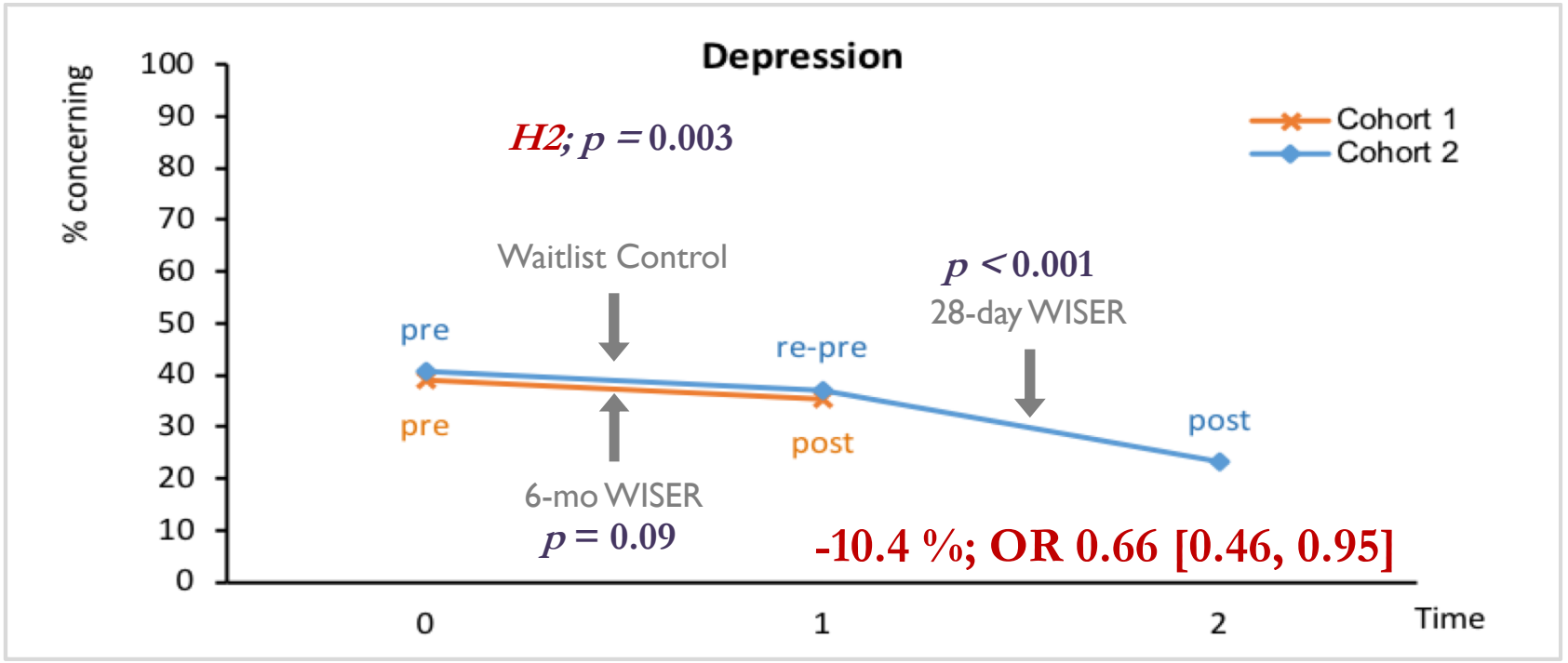
Test the efficacy of a phone-based resilience program among busy NICU providers

- Burnout (primary outcome) – Maslach EE
- Depression – CES-D10
- Work-Life Integration – Sexton/Profit (BMJ Q&S, 2016)
- Happiness – Lyubomirsky/Lepper

INTERVENTION:

Gratitude	Three Good Things	Moment of Awe
Random Acts of Kindness	Signature Strengths	Relationship Resilience


Burnout
% concerning
100
90
80
70
60
50
40
30
20
10
0
0
1
2
Time
Cohort 1
Cohort 2
H2; p = NS
Waitlist Control
H1; p = 0.001
28-day WISER
pre
pre
re-pre
post
post
6-mo WISER
H1; p = 0.009
H3; NS Δ in slope
-14.6 %; OR 0.64 [0.46, 0.89]


Depression
% concerning
100
90
80
70
60
50
40
30
20
10
0
H2; p = 0.003
Cohort 1
Cohort 2
Waitlist Control
p < 0.001
28-day WISER
pre
re-pre
pre
post
post
6-mo WISER
p = 0.09
-10.4 %; OR 0.66 [0.46, 0.95]
0
1
2
Time

- Composite measurement can provide global overview of quality
  - Against other NICUs
  - Over time
- Can be practically applied to QI work
  - If systemic weakness → systemic solution
  - If individual weakness → address that measure

Thank you

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