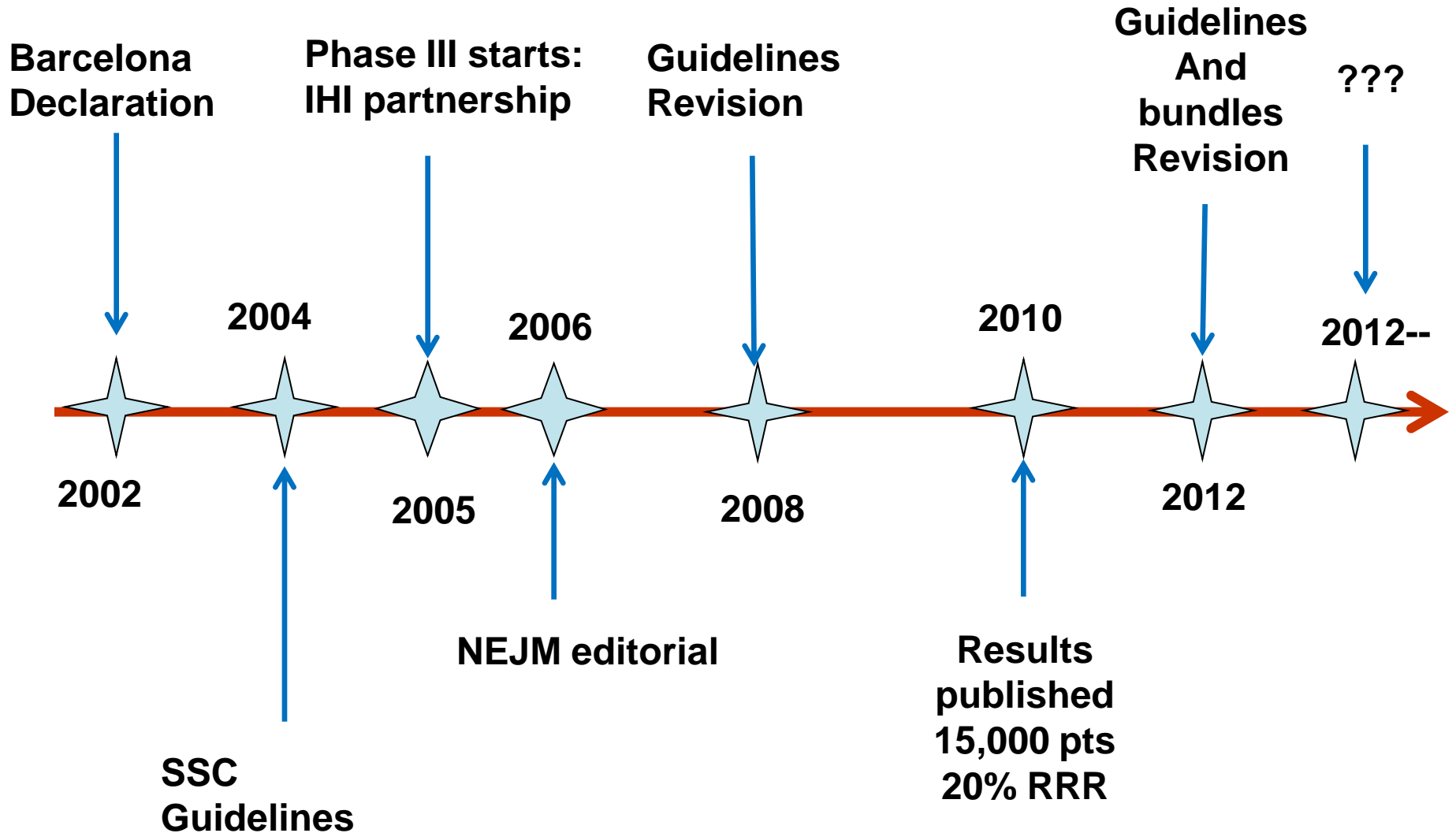


# **IMPROVING OUTCOMES WITH THE SURVIVING SEPSIS CAMPAIGN PERFORMANCE BUNDLES**

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# Surviving Sepsis Campaign: Timeline

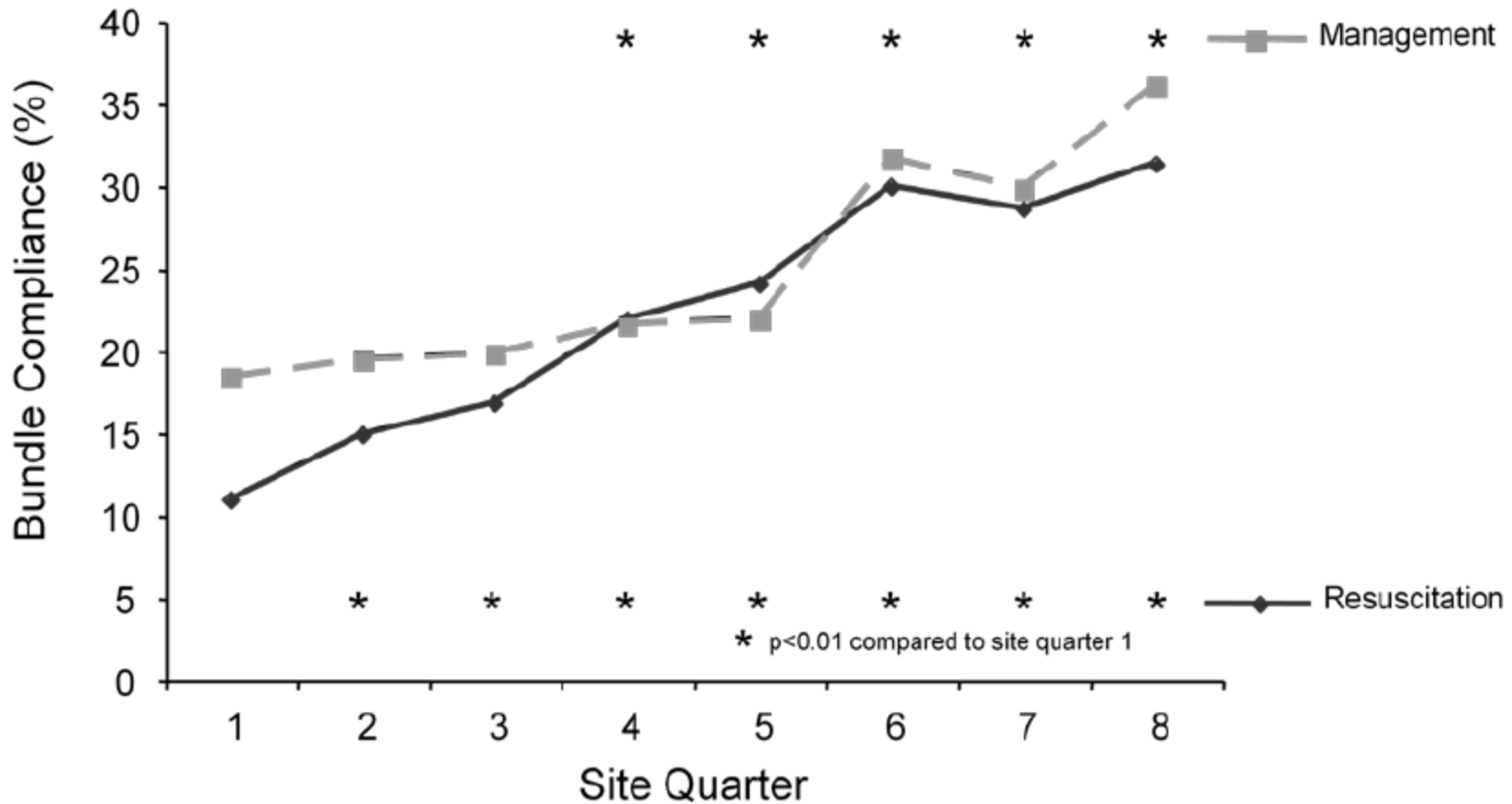


# **SSC Methodology: Multifaceted Intervention**

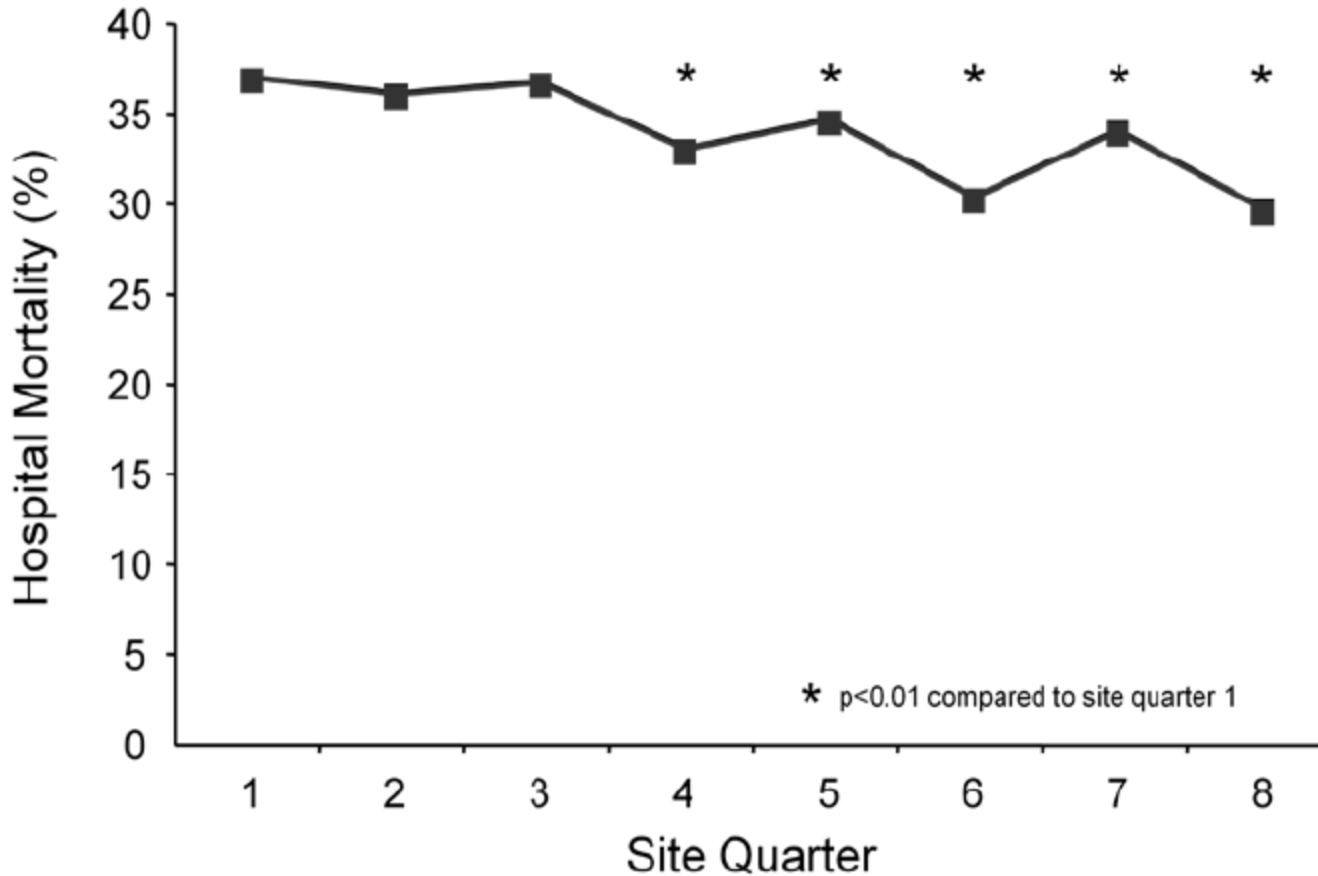


- **National/regional/network “launch meetings”**
  - Identify local champions
  - Introduce sepsis bundles
  - Educational tools
    - **SSC manual**
    - **SSC slides**
  - Staff support for coordinating sites
  - Regular conference calls
- **Website**
  - **SSC and IHI website**
  - **Sepsis list-serve**
- **Interactive database**
  - **Automated uploading to SSC server**
  - **Technical support**
  - **Local audit and feedback capabilities**

# Change in Compliance Over Time



# Change in Mortality Over Time



# Cost Effectiveness of the Guidelines/bundles

	Control group (n = 854)	Treatment group (n = 1,465)	Difference (95% CI)
Length of stay (days)			
ICU	12.5 (15.9)	13.5 (17.7)	1.0 (– 0.4; 2.4)
Ward	10.8 (16.7)	12.6 (18.2)	1.8 (0.4; 3.3)
Total	23.3 (25.1)	26.1 (27.5)	2.8 (0.7; 5.0)
Costs (2006 euros)	16,935 (18,525)	18,671 (20,792)	1,736 (114; 3,358)
LYG <sup>a</sup>	5.44 (6.05)	5.98 (6.11)	0.54 (0.02; 1.05)
QALYs <sup>a</sup>	3.75 (4.18)	4.12 (4.22)	0.37 (0.02; 0.73)
Adjusted ICER	<div style="border: 2px solid red; border-radius: 50%; padding: 10px; display: inline-block;">           4,435 euros per LYG            6,428 euros per QALY         </div>		
Adjusted ICUR			

Suarez et al. ICM 2010.

# Surviving Sepsis Campaign: Data Analysis January 2005-December 2008

- First analysis:
  - 2 years
  - 15,000 pts
  - January 2005-December 2006
- Current analysis:
  - 4 years
  - 28,150 pts
  - January 2005-December 2008

# SSC: Demographics

Site Characteristic	Subjects, %	Sites, %
N	27,836	1,553
Number of ICU beds		
< 25	57.7	73.1
25 to 50	29.9	20.6
> 50	12.4	6.3
Region		
Europe	23.7	31.3
North America	66.3	54.2
South America	10.0	14.6
Patient Characteristics	Subjects, %	Hospital Mortality, %
All	100.0	33.6
Source		
ED	54.3	27.0
ICU	33.2	40.5
Ward	12.5	44.3



# SSC: Demographics

Patient Characteristics	Subjects, %	Hospital Mortality, %
Number of acute organ dysfunction		
1	43.5	26.5
2	34.0	34.0
3	16.2	43.5
4	5.1	53.1
5	1.2	66.7
Cardiovascular		
No cardiovascular dysfunction	10.6	28.0
Cardiovascular dysfunction no hypotension	19.7	23.7
Shock		
Lactate > 4	5.7	30.9
Vasopressors only	47.6	35.0
Lactate > 4 and vasopressors	16.5	46.1
Total shock	69.8	37.3

# Patients and Sites over Time

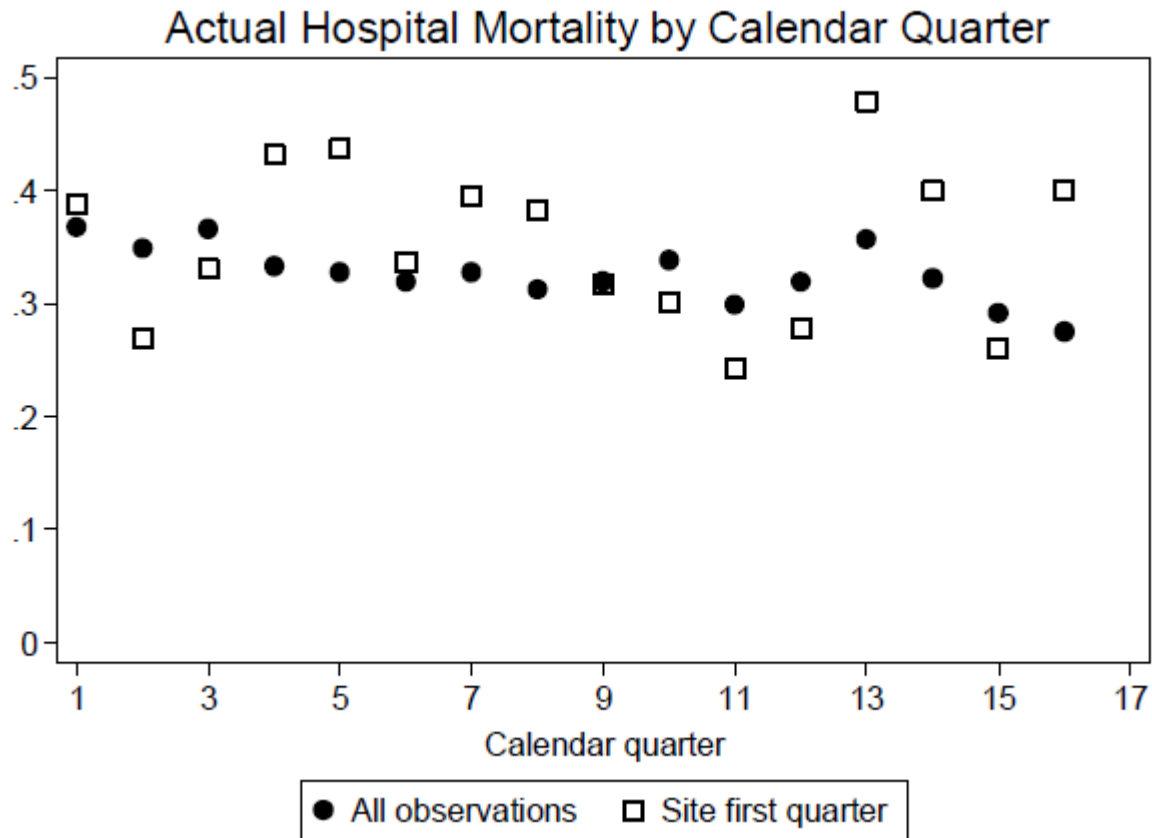
**Table 1: Inclusion in database by site quarter**

Site quarter	Patients	Sites
1	2,610	218
2	3,241	201
3	3,787	203
4	3,007	182
5	2,684	145
6	2,588	126
7	2,187	120
8	1,709	88
9	1,613	72
10	1,273	59
11	970	47
12	775	34
13	530	22
14	354	16
15	319	12
16	189	8

# Model Adjusted for Sepsis Severity Score

- Sepsis origin (ED, ward, ICU)
- Geographic region (Europe, North America, South America)
- CV failure
- Lactate  $> 4$  mmol/L
- No hypotension
- Hypotension
- Fluid resuscitation
- Vasopressors
- Source of infection
- Organ failure (type and number)
- Mechanical ventilation

# Actual Hospital Mortality by Site/Calendar Quarter (January 2005-December 2008)



# Initial Mortality rates in 1<sup>st</sup> Quarter of entering sites

Calendar quarter	1 <sup>st</sup> site quarter observations	
	N	Unadjusted mortality
1	103	38.8
2	41	26.8
3	106	33.0
4	820	43.2
5	222	43.7
6	119	33.6
7	109	39.4
8	94	38.3
9	386	31.6
10	166	30.1
11	70	24.3
12	151	27.8
13	46	47.8
14	25	40.0
15	119	26.1
16	15	40.0

No significant change in mortality in the 1<sup>st</sup> quarter of all sites entering over the 4 year study period

# Mortality: Calender Quarter

Calendar quarter	All observations	
	N	Unadjusted mortality
1	103	38.8
2	152	32.9
3	336	34.2
4	1,279	42.8
5	1,191	40.0
6	1,923	40.1
7	1,363	36.3
8	1,322	33.0
9	2,241	32.2
10	2,376	31.9
11	2,152	33.5
12	2,442	31.4
13	2,506	34.0
14	1,992	34.0
15	1,713	30.7
16	1,426	31.0

- Only sites with >3months of data entry
- Mortality (Unadjusted) over 4 year study period
  - 38.8% to 31.0%
  - ARR: 7.8%
  - RRR: 20.1%
  - P=0.005

# Mortality: Site Quarter

Site quarter	All observations		
	N	Unadjusted mortality	Adjusted mortality
1	2,610	36.7	36.8
2	3,241	34.9	34.4
3	3,787	36.6	36.3
4	3,007	33.3	33.5
5	2,684	32.7	32.5
6	2,588	31.9	32.3
7	2,187	32.8	33.4
8	1,709	31.2	32.6
9	1,613	32.0	32.0
10	1,273	33.9	32.2
11	970	29.9	31.4
12	775	31.9	32.1
13	530	35.7	32.3
14	354	32.2	30.8
15	319	29.2	28.0
16	189	27.5	28.2

- Mortality over 4 year study period
  - 36.7% to 27.5%
  - ARR: 9.2%
  - **RRR: 25.0%**
    - P=0.005

# Mortality Change over time

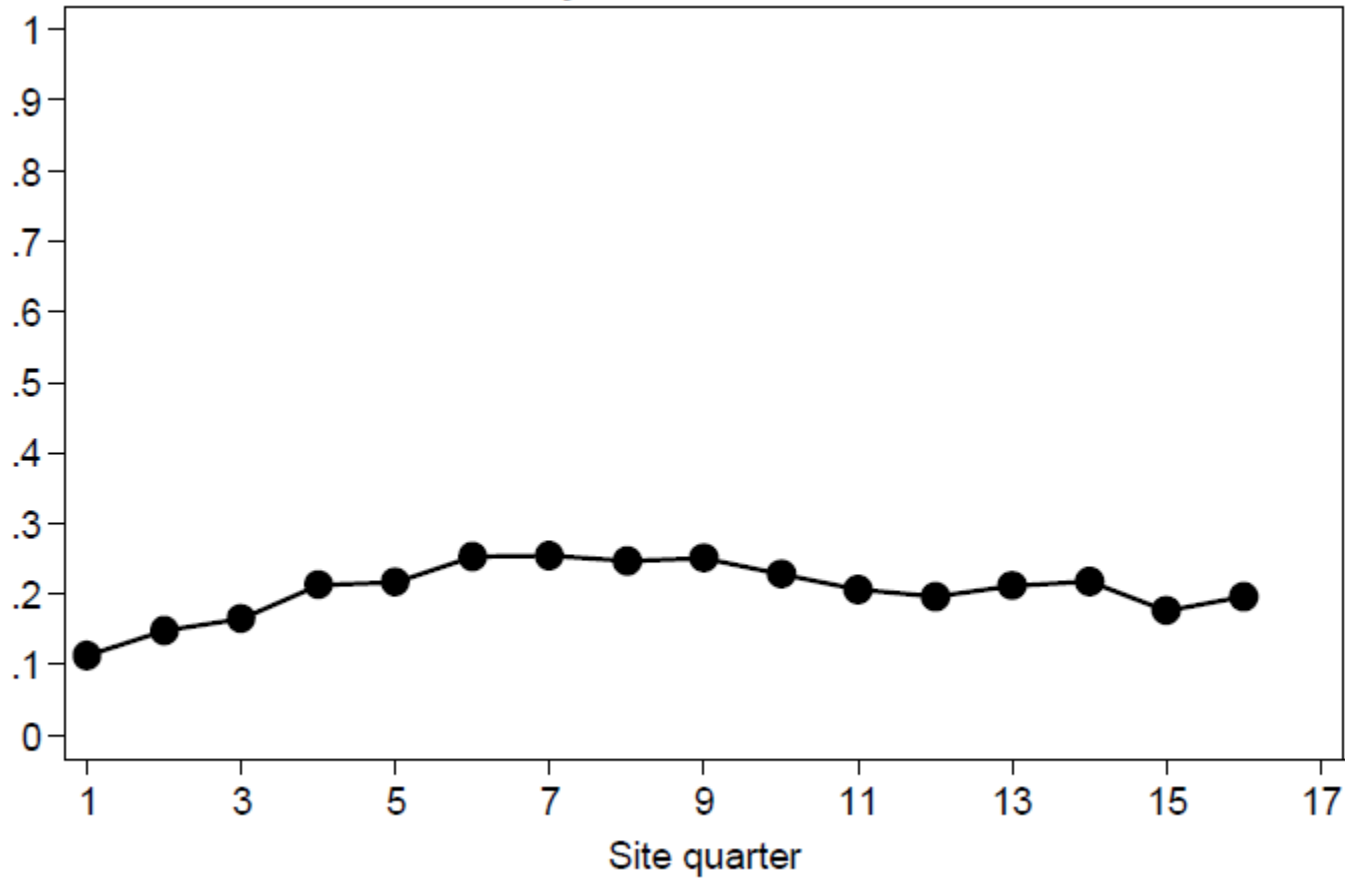
**Table 1: Adjusted generalized estimating equation (GEE) population-averaged logistic regression model for the odds of hospital mortality over calendar quarter**

<b>Model</b>	<b>N</b>	<b>Adjusted OR<sup>1</sup></b>	<b>95% CI</b>	<b>p-value</b>
All observations	28,150	0.99	0.983 – 0.997	0.005
Only first quarter observations	2,593	1.00	0.973 – 1.021	0.809

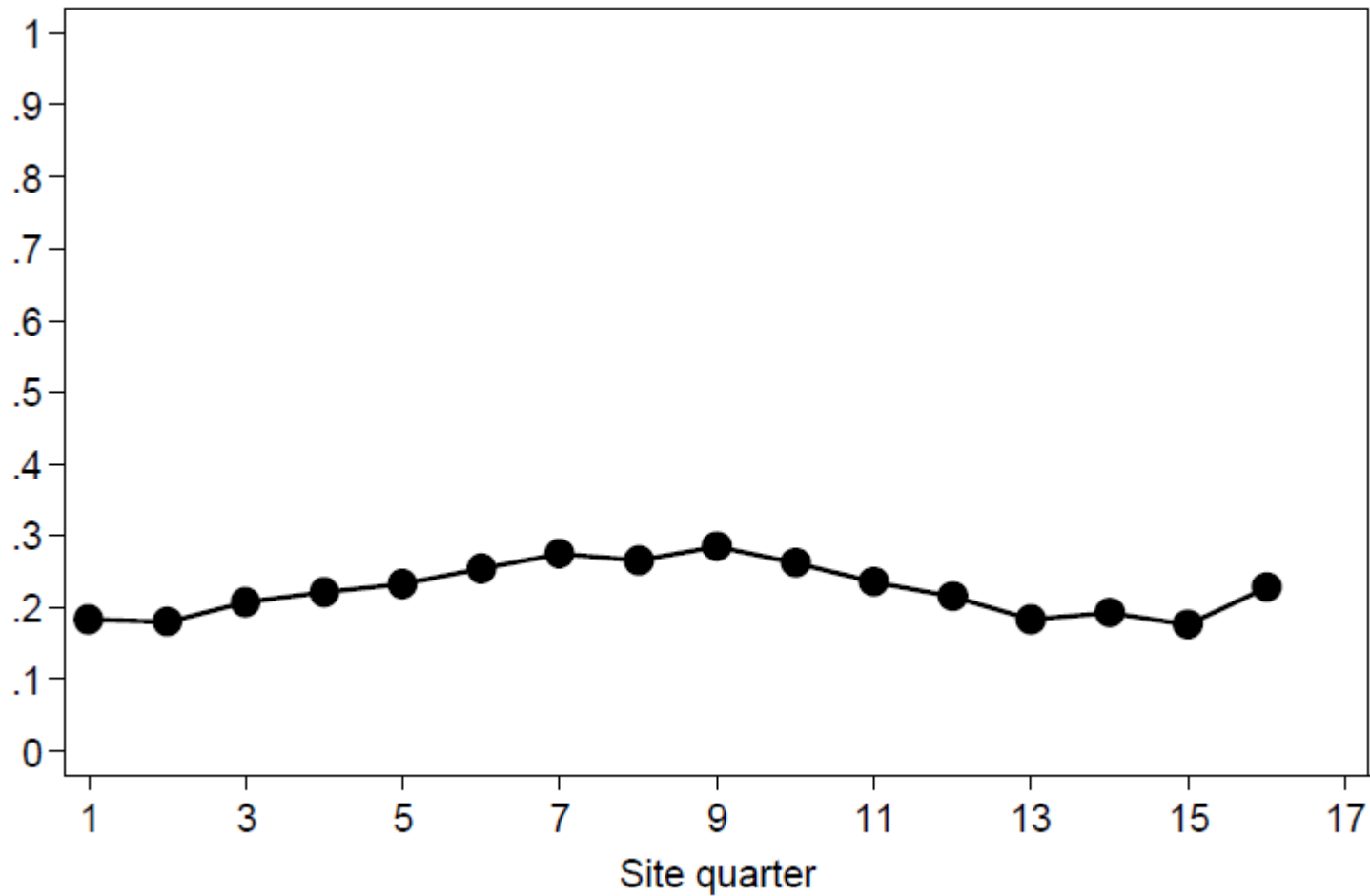
**The adjusted odds of hospital mortality is decreasing 1% per site quarter (p = 0.005)**



# Resuscitation Bundle Compliance by Site Quarter



# Management Bundle Compliance by Site Quarter



# Multivariable mortality prediction Model: population-averaged panel logistic regression

Variables in the model <sup>1,2</sup>	OR	95% CI	<i>p</i> -value	
Admission source				
Ward compared to ED	1.44	1.35	1.54	< 0.001
ICU compared to ED	1.42	1.30	1.55	< 0.001
Broad spectrum antibiotics quality indicator	0.92	0.87	0.98	0.006
≥ 20 ml/kg of crystalloid				
No compared to yes	0.75	0.68	0.82	< 0.001
Steroid administration				
Yes compared to no	1.13	1.05	1.21	0.001
rhAPC administration				
Yes compared to no	0.71	0.62	0.82	< 0.001

# Compliance in High vs Low Performing Centers

Compliance indicator	Overall	Resuscitation		Management		Both	
		Low	High	Low	High	Low	High
1. Serum lactate within 6 hours	70.9	54.6	82.1	60.8	79.8	56.9	77.9
2. Blood cultures before antibiotics	76.5	67.4	82.7	75.2	77.6	77.3	76.1
3. Broad spectrum antibiotics	67.0	61.0	71.0	66.5	67.3	69.8	65.5
4. Fluids and vasopressors	69.9	54.0	81.9	57.3	81.2	53.0	78.6
5. CVP $\geq$ 8 mm Hg within 6 hours	31.2	21.1	39.6	20.0	41.5	15.2	39.7
6. ScvO <sub>2</sub> $\geq$ 70% within 6 hours	20.0	11.3	27.3	11.8	27.6	9.2	25.8
7. Resuscitation bundle	20.1	8.1	28.5	14.5	25.1	13.4	23.5

# Compliance in High vs Low Performing Centers

Compliance indicator	Overall	Resuscitation		Management		Both	
		Low	High	Low	High	Low	High
8. Low-dose steroids policy	63.9	53.8	71.3	44.4	79.1	39.1	74.7
9. Drotrecogin alfa policy	48.4	37.7	55.8	19.2	74.1	9.7	67.7
10. Glucose control maintained	53.9	48.7	57.5	49.3	57.9	48.5	56.6
11. IPP < 30 cm H <sub>2</sub> O	84.4	82.1	86.2	82.2	86.2	80.1	86.2
12. Management bundle	22.6	14.2	28.3	6.3	36.9	3.2	32.2

# The Surviving Sepsis Campaign: A Global Effort at Knowledge Translation

- What is it:
  - A model for knowledge translation
  - International guidelines for sepsis
  - An attempt to standardize care
    - Provide guidance for bedside ICU clinicians
    - Variations are expected and necessary
      - Regional, cultural
      - Individual patient
  - Provide user-friendly tools for audit and feedback
    - To be used locally to drive improvement
  - Bundles, not protocols or checklists

# Revised SSC Bundles

- Based on 2012 SSC guideline Revision
  - Utilizing analysis of 28,000 pt SSC database
- New software to be developed
- No industry funding utilized in revising guidelines or bundles

# Revised SSC Bundles

- Management bundle dropped
  - IPP: High compliance at outset of study
    - No significant change in compliance
  - Glucose
    - Clouded by controversy
  - Steroids
    - OR > 1.0 in SSC analysis
  - rhAPC
    - Significant OR for survival
    - PROWESS-SHOCK will dictate use



# Draft Sepsis Resuscitation Bundle

(To be started immediately and completed within 3 hours)

- **Serum lactate measured in 3 hours.**
- **Blood cultures obtained prior to antibiotic administration.**
- **Minimize time to administration of broad-spectrum antibiotics with a maximum of 3 hours.**
- **In the event of hypotension and/or lactate  $> 3\text{mmol/L}$ , deliver a minimum bolus of 30 ml/kg of crystalloid (or colloid equivalent) within 1 hour.**

# Draft Septic Shock Bundle

(To be started immediately and completed within 6 hours)

- **Apply vasopressors for hypotension not responding to initial fluid resuscitation to maintain mean arterial pressure (MAP)  $\geq$  65 mm Hg.**
- **In the event of persistent arterial hypotension despite volume resuscitation (septic shock) and/or initial lactate  $>$  4 mmol/L (36 mg/dl):**
  - **Insert central line**
  - **Achieve central venous pressure (CVP) of  $\geq$  8 mm Hg.**
  - **Achieve central venous oxygen saturation (ScvO<sub>2</sub>) of  $\geq$  70%.\***

# Conclusions

- **Surviving Sepsis Campaign achieved targeted goal of 25% mortality reduction**
  - Performance metrics can change clinical practice
- Decreased compliance over last 2 years of study period
  - Continued mortality decline
  - protocol fatigue
  - Bundle elements or general awareness and care
- Remaining challenge: Facilitating compliance