Attributable Mortality and Costs of Health Care-Associated Infections in the US

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CDDEP THE CENTER FOR Disease Dynamics, Economics & Policy

Background on HAIs in the US

- 1.7 million health care-associated infections (HAIs) occur in US hospitals yearly
- Many HAIs are preventable
- Hospitals do not bear the full costs of HAIs
  - Insurers bear some financial costs
  - Patient suffer morbidity and mortality

Klevens et al. 2007. *Public Health Reports* 122: 160-166.

Attributable burden of HAIs in the US is unclear

- Single-center studies
- Poor controls for severity of illness and confounding factors
  - Unclear whether bad outcomes are the result of HAIs or the product of already sick patients
  - Lack of controls for length of stay before infection

Graves et al. 2007. *Infect Control Hosp Epidemiol*. 28: 280-292

Barriers to using US national databases

- Not all infections accurately identified
  - SOLUTION: Focus on two conditions that are identifiable
    - Sepsis
    - Pneumonia

- HAIs not distinguished from other infections
  - SOLUTION: Focus on infections after routine surgery
- Time to infection not available
  - SOLUTION: Use estimates based on preoperative stay and data from prior studies

Stevenson et al. 2008. *AJIC* 36: 155-164.

Assessing attributable costs

- Match patients with HAIs to similar control patients
  - Diagnoses
  - Procedures
  - Severity of illness
  - Demographics
  - Time before infection

- Estimate statistically attributable difference in outcomes
- Analyze length of stay, hospital costs, and mortality

Zhan and Miller. 2003. *JAMA* 290: 1868-1874.

Results for surgical patients

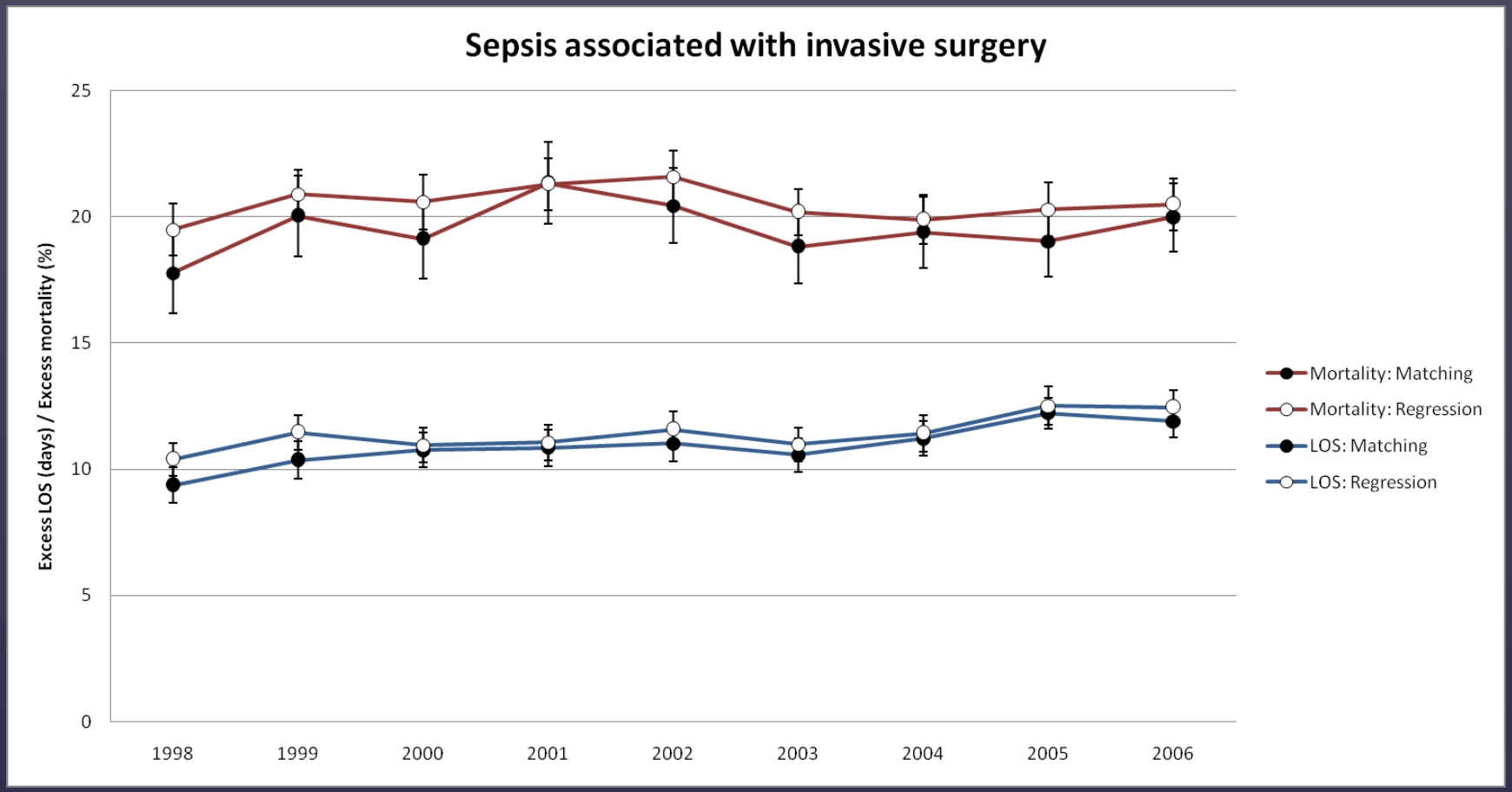
Table 3. Attributable Outcomes of Health Care–Associated Sepsis and Pneumonia Associated With Invasive Surgery for Different Surgical Patient Groups, 1998-2006[a]

Infection Type and Outcome	Invasive Surgical Procedures						
	All	Abdominal	Orthopedic	Thoracic (Noncardiac)	Cardiac	Neurologic	Other
Sepsis							
Mean LOS, d	10.9	10.7	8.9	16.3	19.0	19.5	9.3
Median LOS, d	6.1	5.6	5.4	10.0	14.4	15.0	6.0
Mean costs, $	32 900	32 500	23 200	64 000	66 800	51 600	22 200
Median costs, $	16 100	15 100	11 700	38 200	48 100	36 800	12 500
Mortality, %	19.5	17.3	21.0	26.2	32.1	14.2	19.6
No. of cases	108 610	63 082	21 500	4853	9628	4573	9282
Incidence, %	1.2	1.9	0.7	4.4	1.5	2.5	0.8
Pneumonia							
Mean LOS, d	14.0	14.8	12.1	22.2	15.3	18.0	9.7
Median LOS, d	9.3	9.0	8.3	15.7	10.9	14.0	7.0
Mean costs, $	46 400	48 000	36 600	88 900	56 800	55 500	27 800
Median costs, $	29 200	28 200	22 000	65 900	39 200	44 700	18 700
Mortality, %	11.4	9.9	18.0	19.2	11.5	2.8	12.4
No. of cases	28 469	11 765	5835	1096	5693	4120	1800
Incidence, %	0.3	0.3	0.2	1.0	0.9	2.2	0.1

Abbreviation: LOS, hospital length of stay.
[a] $P < .001$ for all differences between outcome and zero by means of the Wilcoxon rank sum test.

- Eber et al. *Archives of Internal Medicine*. Forthcoming.

Little change in costs over time



- Eber et al. *Archives of Internal Medicine*. Forthcoming.

Aggregate US burden estimates

- 48,000 deaths
- $8.1 in hospital costs
- 2.3 million patient hospitalization days

Eber et al. *Archives of Internal Medicine*. Forthcoming.

Implications of high costs of HAIs

- Effective hospital regulations needed
  - Hospitals do not bear full costs of HAIs
  - High HAI rates may persist despite high costs
  - Regulation to date has not been effective
- More cost-effectiveness analyses needed
- Effective antibiotics need to be preserved or costs could be much higher

McNair et al. 2009. *Health Affairs* 8(5): 1485-1493.