

The Silver Book®: Healthcare-Associated Infections



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Roberts, RR, B Hota, et al. 2009. Hospital and Societal Costs of Antimicrobial-Resistant Infections in a Chicago Teaching Hospital: Implications for antibiotic stewardship. *Clin Infect Dis* 49(8):1175-84. *Extrapolations in PR Newswire*. 2009. Antibiotic-Resistant Infections Cost the U.S. Healthcare System in Excess of \$20 Billion Annually.

Scott, RD. 2009. *The Direct Medical Costs of Healthcare-Associated Infections in U.S. Hospitals and the Benefits of Prevention*. Atlanta, GA: Centers for Disease Control and Prevention.

Silber, JH, PR Rosenbaum, ME Trudeau, et al. 2005. Preoperative Antibiotics and Mortality in the Elderly. *Ann Surg* 242(1):107-14.

Spellberg, B, R Guidos, D Gilbert, et al. 2008. The Epidemic of Antibiotic-Resistant Infections: A call to action for the medical community from the Infectious Diseases Society of America. *Clin Infect Dis* 46(2):155-64.

Standiford, HC, S Chan, M Tripoli, et al. 2012. Antimicrobial Stewardship at a Large Tertiary Care Academic Medical Center: Cost analysis, before, during, and after a 7-year program. *Infect Control Hosp Epidemiol* 33(4):338-45.

Towse, A and P Sharma. 2011. *Incentives for R&D for New Antimicrobial Drugs: Research paper 11/02*. Office of Health Economics.

Vincent, J-L, J Rello, J Marshall, et al. 2009. International Study of the Prevalence and Outcomes of Infection in Intensive Care Units. *JAMA* 302(21):2323-9.



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References

Agency for Healthcare Research and Quality. 2009. AHRQ's Efforts to Prevent and Reduce Health Care-Associated Infections: Fact sheet. *AHRQ Publication No. 09-P013*. Rockville, MD: Agency for Healthcare Research and Quality.

Braykov, NP, MR Eber, E Klein, et al. 2013. Trends in Resistance to Carbapenems and Third-Generation Cephalosporins Among Clinical Isolates of *Klebsiella Pneumoniae* in the United States, 1999-2010. *Infect Control Hosp Epidemiol* 34(3):259-68.

Centers for Disease Control and Prevention. March 2012. Making Health Care Safer: Stopping *C. difficile* infections. *Vital Signs*. Atlanta, GA: Centers for Disease Control and Prevention.

Centers for Disease Control and Prevention. January 2012. Types of Healthcare-Associated Infections. Last accessed June 18, 2013 at www.cdc.gov/HAI/infectionTypes.html.

Clancy, Carolyn, et al. 2010. Preventing Healthcare-Associated Infections: Initiating Promising Solutions and Expanding Proven Ones: Commentaries by AHRQ Director, Dr. Carolyn Clancy, and other staff members. Last accessed June 18, 2013 at www.ahrq.gov/news/newsroom/commentaries/preventing-healthcare-associated-infections.html.

Ebnother, C, B Tanner, F Schmid, et al. 2008. Impact of an Infection Control Program on the Prevalence of Nosocomial Infections at a Tertiary Care Center in Switzerland. *Infect Control Hosp Epidemiol* 29(1):38-43.

Frieden, TR, RF Khabbaz, SC Redd, et al. 2011. A CDC *Framework for Preventing Infectious Diseases: Sustaining the Essentials and Innovating for the Future*. Atlanta, GA: Centers for Disease Control and Prevention.

Frieden, TR. April 28, 2010. Antibiotic Resistance and Threat to Public Health. *Statement of Thomas Frieden, MD, MPH, Director of the CDC; before the Committee on Energy and Commerce Subcommittee on Health, U.S. House of Representatives*.

Haley, RW, TM Hooton, DH Culver, et al. 1981. Nosocomial Infections in U.S. Hospitals, 1975-1976: Estimated frequency by selected characteristics of patients. *Am J Med* 70(4):947-59.

Hall, MJ, SN Williams, CJ DeFrances, et al. 2011. Inpatient Care for Septicemia or Sepsis: A challenge for patients and hospitals. *NCHS Data Brief No. 62*. Atlanta, GA: Centers for Disease Control and Prevention.

Hersh, AL, JG Newland, SE Beekmann, et al. 2010. Unmet Medical Need in Infectious Diseases. *Clin Infect Dis* 54(11):1677-8.

Hidron, AJ, JR Edwards, J Patel, et al. 2008. Antimicrobial-Resistant Pathogens Associated with Healthcare-Associated Infections: Annual summary of data reported to the National Healthcare Safety Network at the Centers for Disease Control and Prevention, 2006-2007. *Infect Control Hosp Epidemiol* 29(11):996-1011.

Infectious Diseases Society of America. March 2012. Promoting Anti-Infective Development and Antimicrobial Stewardship through the U.S. Food and Drug Administration Prescription Drug User Fee Act (PDUFA). *Statement of the ISDA before the House Committee on Energy and Commerce's Subcommittee on Health*.

Infectious Diseases Society of America. 2011. Combating Antimicrobial Resistance: Policy Recommendations to Save Lives. *Clin Infect Dis* 52(s5):S397-428.

Infectious Diseases Society of America. 2004. *Bad Drugs, No Drugs: As antibiotic discovery stagnates...A public health crisis brews*. Alexandria, VA: Infectious Diseases Society of America.

Kallen, AJ, Y Mu, S Bulens, et al.; for the Active Bacterial Core Surveillance (ABCs) MRSA Investigators of the Emerging Infections Program. 2010. Health Care-Associated Invasive MRSA Infections, 2005-2008. *JAMA* 304(6):641-7.

Klevens RM, JR Edwards, CL Richards, et al. 2007. Estimating Health Care-Associated Infections and Deaths in U.S. Hospitals, 2002. *Public Health Rep* 122(2):160-6.

Laximinaryan, R, A Malani, D Howard, et al. 2007. *Extending the Cure: Policy responses to the growing threat of antibiotic resistance*. Washington, DC: Resources for the Future.

Lucado, J, K Paez, R Andrews, et al. 2010. Adult Hospital Stays with Infections Due to Medical Care, 2007. *HCUP Statistical Brief #94*. Rockville, MD: Agency for Healthcare Research and Quality.

Martone, WJ, WR Jarvis, DH Culver, et al. 1992. Incidence and Nature of Endemic and Epidemic Nosocomial Infections. In: Bennett, JV, PS Brachman, eds. *Hospital Infections*. Boston, MA: Little, Brown, and Co. 577-96.

Mauldin, PD, CD Salgado, IS Hansen, et al. 2010. Attributable Hospital Cost and Length of Stay Associated with Health Care-Associated Infections Caused by Antibiotic-Resistant Gram-Negative Bacteria. *Antimicrob Agents Chemother* 54(1):109-15.

National Nosocomial Infections Surveillance (NNIS) System. 1999. NNIS System Report, Data Summary from January 1990-May 1999. *Am J Infect Control* 27(6):520-32.

Redelings, MD, F Sorvillo, and L Mascola. 2007. Increase in Clostridium Difficile-Related Mortality Rates, 1999-2004. *Emerg Infect Dis* 13(9):1417-9.

Roberts, RR, B Hota, et al. 2009. Hospital and Societal Costs of Antimicrobial-Resistant Infections in a Chicago Teaching Hospital: Implications for antibiotic stewardship. *Clin Infect Dis* 49(8):1175-84. *Extrapolations in PR Newswire*. 2009. Antibiotic-Resistant Infections Cost the U.S. Healthcare System in Excess of \$20 Billion Annually.

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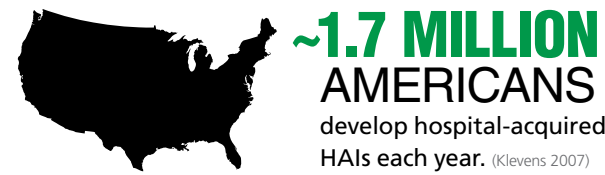
Towse, A and P Sharma. 2011. *Incentives for R&D for New Antimicrobial Drugs: Research paper 11/02*. Office of Health Economics.

Vincent, J-L, J Rello, J Marshall, et al. 2009. International Study of the Prevalence and Outcomes of Infection in Intensive Care Units. *JAMA* 302(21):2323-9.

The Silver Book® Healthcare-Associated Infections

Healthcare-associated infections (HAIs) are acquired while receiving medical or surgical care for other conditions in hospitals, physician offices, long-term care facilities, and other healthcare settings. They are largely preventable, yet often costly and deadly, and rapidly becoming a national crisis as they increasingly develop resistance to drugs.

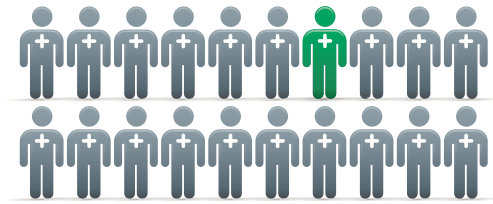
Prevalence & Incidence



THE MOST COMMON COMPLICATION OF HOSPITAL CARE

Around **1 in 20** hospitalized patients will contract a HAI

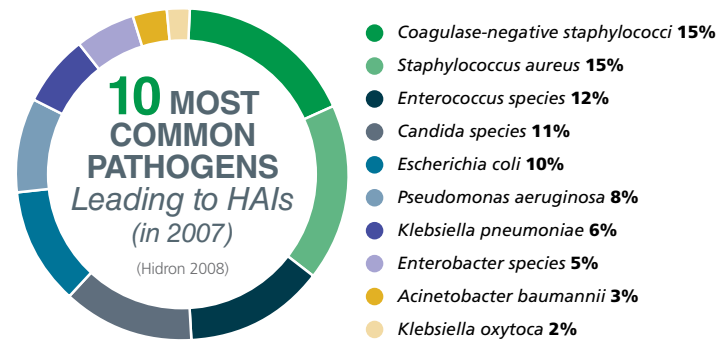
(AHRQ 2009; Martone 1992)



75% of *Clostridium difficile* (*C. difficile*) infections, a common HAI, START IN PLACES LIKE NURSING HOMES AND PHYSICIAN OFFICES (IDSA 2012)

- Around 2/3 of all HAIs are central-line associated bloodstream infections, catheter-associated urinary tract infections, and ventilator-associated pneumonia. Surgical site infections and *Clostridium difficile* (*C. difficile*) are also common HAIs. (CDC 2012)

- Nearly 3/4 of all hospital-acquired HAIs occur outside of the intensive care unit (ICU). (Klevens 2007)



Age – A Major Risk Factor

HOSPITALIZED **ELDERLY PATIENTS** **2-5X** MORE LIKELY to develop a HAI than younger patients (Haley 1981)

- Around 45% of all hospital-acquired HAIs in 2007 were in patients age 65 and older. (Lucado 2010)

H The rate of hospitalization for sepsis/septicemia in 2008 was around **30 times higher for patients age 85+**, than for those under the age of 65. (Hall 2011)

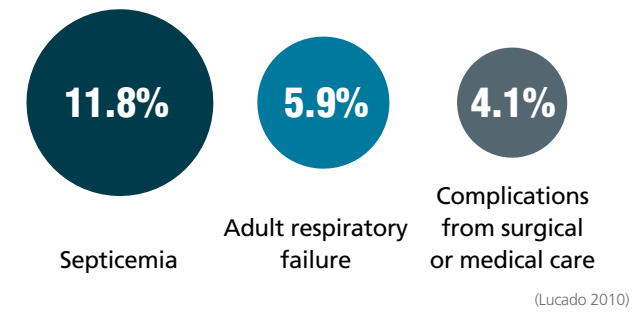
! More than 90% of deaths from *C. difficile* infections occur in people 65 and older. (CDC 2012)

- In 2008, 75% of healthcare-associated invasive *MRSA* infections occurred in patients older than 50, with 46% in patients older than 65. (Kallen 2010)

>20% WERE IN NURSING HOME RESIDENTS. of drug-resistant pneumonias in 2010 (Braykov 2013)

The Human Burden

THE MOST COMMON PRINCIPAL DIAGNOSES FOR HOSPITALIZED PATIENTS WITH HAIs ARE:



19 days longer THE AVERAGE LENGTH OF STAY WITH HAIs THAN STAYS WITHOUT INFECTIONS (24.4 VS. 5.2 DAYS). (Lucado 2010)

- Patients with HAIs have more comorbidities (2.8 vs. 1.9) and in-hospital mortality (9% vs. 1.5%), compared to all other hospitalized patients. (Lucado 2010)
- The majority of the **99,000 patients killed** by hospital-acquired HAIs each year are **due to antibacterial-resistant pathogens**. (IDSA 2011; Klevens Klevens 2007)

The Unique Burden of Sepsis/Septicemia

- 1 in 10 hospital stays with HAIs have a principal diagnosis of septicemia. (Lucado 2010)
- Compared with patients hospitalized with other diagnoses, patients hospitalized for sepsis/septicemia are:
 - 1/2 as likely to be discharged home;
 - 2 X more likely to be discharged to other short-term care;
 - 3 X more likely to be discharged to long-term care; and
 - 8 X more likely to die (Hall 2011)

- In 2008, only 2% of hospitalizations were for sepsis/septicemia, yet they made up 17% of in-hospital deaths. (Hall 2011)

- Infection and related sepsis/septicemia are the leading cause of death in noncardiac-ICUs—accounting for as many as 60% of deaths. (Vincent 2009)

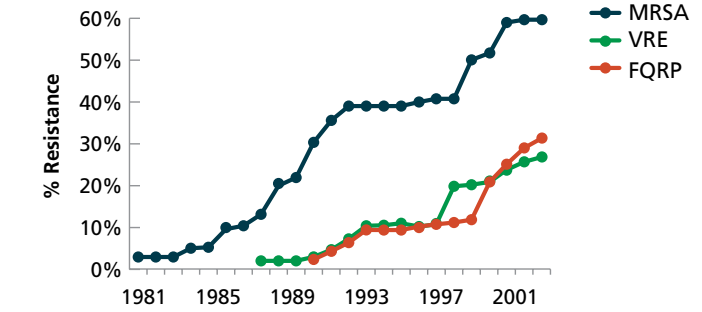
Of the **99,000 ANNUAL DEATHS** from HAIs:

- 35,967** are from pneumonia
- 30,665** from bloodstream infections
- 13,088** from urinary tract infections
- 8,205** from surgical site infections; and
- 11,062** from infections at other sites. (Klevens 2007)

- In one year, *MRSA* killed more Americans (~19,000) than emphysema, HIV/AIDS, Parkinson's disease, and homicide combined. (IDSA 2012)

Rising Resistance

INCREASE IN ANTIBIOTIC RESISTANCE (NNIS 1999)



- 63% of surveyed infectious disease physicians treated a patient with at least 1 drug-resistant infection that year. 56% believed those infections to be on the rise. (Hersh 2012)

~70% ARE RESISTANT TO AT LEAST ONE ANTIMICROBIAL DRUG. (IDSA 2004) of hospital-acquired HAIs

- Resistance of *Klebsiella pneumoniae* to antibiotics has dramatically increased—from 5.3% to 11.6% for 3rd generation cephalosporins (between 1999 and 2010), and from <0.1% to 4.5% for carbapenems (between 2002 and 2010). (Braykov 2013)
- High-level Penicillin resistant *Streptococcus pneumoniae* increased 1,000-fold over 17 years. (Laxminarayan 2007)
- *C. difficile*-related deaths in the U.S. increased 35% each year, from 1999 to 2004. (Redelings 2007)

The Value of Innovation

Preventing & Treating HAIs and Lowering Resistance

- Practices that lead to a 20% reduction in preventable hospital-acquired HAIs would save up to \$6.8 billion in medical costs. A 70% reduction would lead to a savings of up to \$31.5 billion. (Scott 2009)
- A 20% reduction in DRIs would save between 5.7 and 11.3 million additional hospital days and between \$3.2 and \$5.2 billion in healthcare costs, each year. (Roberts 2009)

- Effective pre-surgery antibiotic use can reduce 60-day mortality in the elderly by 50%. (Silber 2005)

- Between 2001 and 2010, vaccine use prevented an estimated 170,000 severe pneumococcal infections and 10,000 deaths, and saved an estimated \$310 million in direct medical costs each year. (Frieden 2010)

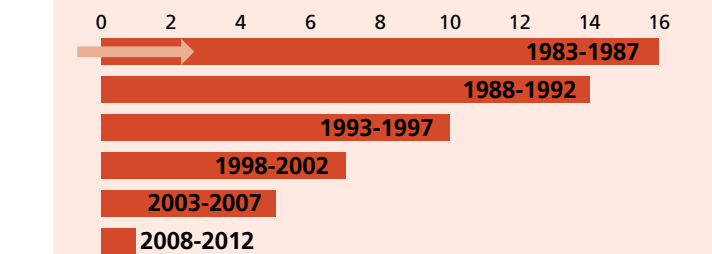
- An antibiotic stewardship program saved a total of \$17 million over 8 years, with antibiotic costs rising \$1 million in the first year after discontinuation. (Standiford 2012)

- Infection control practices saved an estimated 27,000 lives and \$1.8 billion in medical costs between 2001 and 2009. (Frieden 2011)

- Standardization of best practice interventions reduced central line-associated blood stream infections and saved an estimated 1,800 lives and \$280 million. (Clancy 2010)
- A multimodal infection control program reduced the rate of hospital-acquired HAIs by more than 1/3 and improved quality of care and patient outcomes. (Ebnother 2008)

Losing Ground

TOTAL NUMBER OF NEW ANITBACTERIAL AGENTS



(Spellberg 2008)

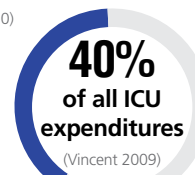
- The value of an antibiotic to a drug company is negative \$50 million—compared to the positive value of \$1 billion for a new musculoskeletal drug. (Towse 2011)

The Economic Burden

THE ANNUAL DIRECT COST OF HAIs TO U.S. HOSPITALS RANGES FROM: **\$28.4 to \$45 BILLION** (Scott 2009)

- Patients with HAIs cost, on average, **\$43,000 more per hospital stay** than those without an infection (\$52,096 vs. \$9,377). (Lucado 2010)

- Infection and related sepsis/septicemia account for ...



The Added Cost of Drug Resistance

- Drug-resistant infections (DRIs) increase the length of hospital stays by more than 23% and the cost by close to 30%. (Mauldin 2010)
- DRIs cost the U.S. healthcare system between \$16.6 and \$26 billion in extra costs each year. (Roberts 2009)
- The societal costs of antibiotic resistant infections are around \$35 billion each year—this includes the cost of lost wages and premature deaths. (Roberts 2009)
- As an example, the median treatment cost for *MRSA* patients over a 6-month period was 118% higher than the cost of treating drug-susceptible *MRSA* strains. (Mauldin 2010)