



The Impact of Healthcare-associated Infections in Pennsylvania 2010



Pennsylvania Health Care Cost Containment Council
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About PHC4

The Pennsylvania Health Care Cost Containment Council (PHC4) is an independent state agency charged with collecting, analyzing and reporting information that can be used to improve the quality and restrain the cost of health care in the state. It was created in the mid-1980s when Pennsylvania businesses and labor unions, in collaboration with other key stakeholders, joined forces to enact market-oriented health care reforms. As a result of their years of effort, the General Assembly passed legislation (Act 89 of 1986) creating PHC4.

The primary goal is to empower purchasers of health care benefits, such as businesses or labor union health/welfare funds, as well as other stakeholders, with information they can use to improve quality and restrain costs. Nearly 100 organizations and individuals annually utilize PHC4's special requests process to access and use data. More than 600,000 public reports on patient treatment results are downloaded from the PHC4 website each year. Today, PHC4 is a recognized national leader in public health care reporting.

It is governed by a 25-member board of directors, representing business, labor, consumers, health care providers, insurers, and state government.

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Key Findings

- In 2010, there were 1,880,189 patients admitted to PA hospitals; 21,319 (1.13 percent) of these patients contracted at least one healthcare-associated infection (HAI) — down from 2009 when 1.20 percent of patients contracted an HAI.
- Generally speaking, patients with HAIs stayed in the hospital longer and had higher in-hospital mortality and readmission rates than those who did not contract an HAI.
 - In 2010, the mortality rate for patients with an HAI was 9.1 percent — down from 9.4 percent in 2009. The mortality rate was 1.7 percent for patients without an HAI.
 - The average length of stay for patients with an HAI was 21.9 days in 2010 and was 5.0 days for patients without an HAI.
 - Of the patients with HAIs, 41.9 percent were readmitted within 30 days; 31.3 percent were readmitted specifically for a complication or infection. For patients without an HAI, 16.3 percent were readmitted within 30 days, with 6.3 percent readmitted specifically for a complication or infection.
- The estimated average Medicare fee-for-service payment for hospital stays for patients who acquired an HAI was \$21,378. The estimated average Medicare fee-for-service payment for those without an HAI was \$6,709.
- Of the Medicare patients with an HAI, 40.2 percent (3,227 patients) were readmitted within 30 days for any reason. The estimated average Medicare payment for these readmissions was \$8,940, with an estimated total Medicare fee-for-service payment of \$28.8 million.
- Of the Medicare patients with an HAI, 30.5 percent (2,451 patients) were readmitted within 30 days for a complication or infection. The estimated average Medicare payment for these readmissions was \$9,483, with an estimated total Medicare fee-for-service payment of more than \$23 million.
- The average Medicaid fee-for-service payment for hospitalizations for patients with an HAI was \$33,329. For hospitalizations for patients without an HAI, the average Medicaid fee-for-service payment was \$6,040.¹
- Of the Medicaid patients with an HAI, 35.6 percent (284 patients) were readmitted within 30 days for any reason. The average Medicaid payment for these types of readmissions was \$9,653.
- Of the Medicaid patients with an HAI, 24.0 percent (191 patients) were readmitted within 30 days for a complication or infection. The average Medicaid payment for these types of readmissions was \$11,199.

It is important to note that patient outcomes and hospital payments may not have been related to the HAI. Other factors may have influenced differences in outcomes and payments between cases with and without an HAI.

Conditions with the highest percent of healthcare-associated infections (HAIs):

Leukemia and lymphomas
Respiratory failure (adult)
Abdominal hernia
Heart valve disorders
Aneurysm/blood clot of artery in abdomen or limb

Procedures with the highest percent of surgical site infections (SSIs):

Peripheral vascular bypass surgery
Colon and rectal surgery
Small bowel surgery
Liver, pancreas, and bile duct surgery
Surgery to repair hernia

¹ The Medicaid payment data reported is for 2009 hospitalizations (the most recent data available to PHC4).

Healthcare-associated infections (HAIs) are one of the nation's most important public health challenges. The Centers for Disease Control and Prevention (CDC) estimates that 1.7 million patients contract healthcare-associated infections, also known as HAIs, every year, and nearly 99,000 of them die.¹ The annual direct medical costs of HAIs to U.S. hospitals range from \$28.4 to \$33.8 billion.²

The Pennsylvania Health Care Cost Containment Council (PHC4) first reported on HAIs in 2005. With the enactment of Act 52 of 2007, hospitals began reporting HAI data using the CDC's National Healthcare Safety Network (NHSN), which is a web-based system for capturing facility-wide data on the occurrence of reportable HAIs. This data is then made available to PHC4, the Pennsylvania Department of Health (DOH), and the Pennsylvania Patient Safety Authority.

Using its hospital discharge data, PHC4 is in a unique position to examine the impact HAIs have on the patients who acquire them. This report includes data from 2010 and examines mortality rates, readmission rates, lengths of hospital stay, payment information, and other data for patients who contract HAIs.

Understanding this Report

Data

The data in this report came from multiple sources. Hospitals reported healthcare-associated infections using the CDC's NHSN. This data is subjected to validation and correction processes by the PA DOH. Information on inpatient discharges from January 1, 2010 to December 31, 2010 was submitted by PA hospitals directly to PHC4 and is subjected to PHC4 validation and correction processes. The Medicare payment data was provided by the Centers for Medicare and Medicaid Services, and the Medicaid payment data was provided by the Pennsylvania Department of Public Welfare.

The healthcare-associated infections reported are for infections that patients acquired during a hospital stay, with the exception of surgical site infections. Surgical site infections may have been detected either during the hospitalization in which the procedure was performed or after discharge during post-discharge surveillance.

Healthcare-associated Infection Rates

As part of Act 52 requirements, the Pennsylvania Department of Health (DOH) publicly reports hospital-specific healthcare-associated infection (HAI) rates. In its most recent report, DOH noted a 3.4 percent decline between 2009 and 2010 in the rate of HAIs per 1,000 patient days.³ The report, *Healthcare-Associated Infections (HAI) in Pennsylvania Hospitals – 2010*, can be found on DOH's website at www.health.state.pa.us.

Hospitals across Pennsylvania are making great strides to prevent HAIs through strict adherence to evidence-based practices and adoption of newer technologies. Infection preventionists — along with hospital leadership, medical professionals and administrative staff — are working collaboratively to track HAIs and to focus on proven techniques that improve infection control.

¹ Klevens R, Edwards JR, Richards CL, et al. Estimating health care-associated infections and deaths in U.S. hospitals, 2002. *Public Health Rep.* 2007;122:160-166.

² Scott RD. *The direct medical costs of healthcare-associated infections in U.S. hospitals and the benefits of prevention, 2009*. Division of Healthcare Quality Promotion, National Center for Preparedness, Detection, and Control of Infectious Diseases, Coordinating Center for Infectious Diseases, Centers for Disease Control and Prevention, 2009.

³ Pennsylvania Department of Health. *Healthcare-associated infections (HAI) in Pennsylvania hospitals – 2010 report*. Pennsylvania Department of Health, 2011.

Introduction

Patients Included in this Report

This report includes information on 1,880,189 patients of all ages treated in PA hospitals during calendar year 2010. These patients were treated in several types of inpatient facilities: 1) general acute care hospitals, including acute care hospitals whose care is limited to special populations or medical conditions; 2) long-term acute care hospitals, which treat patients with acute conditions who need longer term care than provided in a general acute care hospital; 3) inpatient rehabilitation hospitals; 4) inpatient psychiatric hospitals; and 5) other inpatient hospital types such as those for drug and alcohol treatment.

Measures Reported

Number and Percent of Patients with an HAI – The number and percent of patients who contracted a health-care-associated infection as identified and reported by the hospital.

Number and Percent of Patients without an HAI – The number and percent of patients who did not contract a healthcare-associated infection.

Mortality Percent – The percent of patients who died during the hospitalization.

Average Length of Stay – The number of days, on average (mean), a patient stayed in the hospital.

Number and Percent of Readmissions for Any Reason – The number and percent of patients who were readmitted for any reason to any PA hospital, where the admit date was within 30 days of the discharge date of the original hospitalization.

Number and Percent of Readmissions for Complication or Infection – The number and percent of patients who were readmitted specifically with the principal diagnosis of a complication or infection.

Estimated Average Medicare Payment – The estimated average (mean) amount general acute care hospitals were paid for care of Medicare patients in the fee-for-service system. Patient liabilities (e.g., coinsurance and deductible dollar amounts) were not included. Payments from Medicare Advantage plans (Medicare HMOs) were not included. The average payment reported is for the entire length of stay, and not just for the treatment related to the infection. Only patients age 65 and older treated in general acute care hospitals were included in this analysis. The average Medicare fee-for-service payments were estimated for 2010 hospitalizations using 2009 Medicare payment data (the most recent data available to PHC4).

Average Medicaid Payment – Medicaid fee-for-service payment information is provided in a separate section of this report. The average payment reported is for the entire length of stay, and not just for the treatment related to the infection. The Medicaid payment data reported is for 2009 hospitalizations since 2009 data was the most recent data available to PHC4. Payments for 2010 hospitalizations were not estimated since the Medicaid population for 2010 is not easily predicted, unlike Medicare where the population was estimated using patient age.

It is important to note that patient outcomes and hospital payments may not have been related to the HAI. See discussion under "Examples of How HAIs Impact Hospital Stays" on page 5.

Hospital Stays with HAIs

In 2010, there were 1,880,189 patients admitted to PA hospitals; 21,319 (1.13 percent) of these patients contracted at least one healthcare-associated infection (HAI) — down from 2009 when 1.20 percent of patients contracted an HAI.

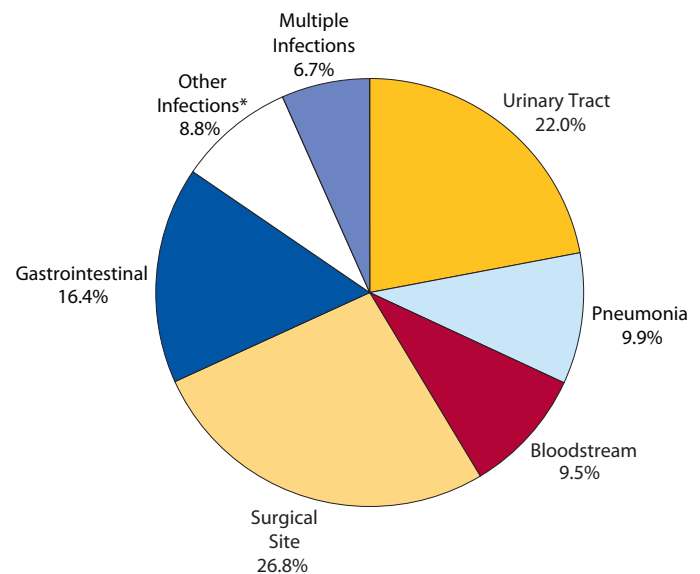
The largest percent of these HAIs were surgical site infections (26.8 percent), followed by urinary tract infections (22.0 percent) and gastrointestinal infections (16.4 percent).

Patient Outcomes

Generally speaking, patients with HAIs stayed in the hospital longer and had higher in-hospital mortality and readmission rates than those who did not contract an HAI (Table 1). Similar results have been observed in data from previous years. Medicare payments for hospital stays for patients who contracted an HAI also tended to be higher.

- In 2010, the mortality rate for patients with an HAI was 9.1 percent — down from 9.4 percent in 2009. The mortality rate was 1.7 percent for patients without an HAI.
- Patients with pneumonia had the highest mortality rate at 24.7 percent.
- The average length of stay for patients with an HAI was 21.9 days in 2010, a slight increase from 21.6 days in 2009. The average length of stay for patients without an HAI was 5.0 days in 2010.
- Patients with multiple infections had the longest average length of stay at 54.5 days.
- Of the patients with HAIs, 41.9 percent were readmitted within 30 days; 31.3 percent were readmitted specifically for a complication or infection. For patients without an HAI, 16.3 percent were readmitted within 30 days with 6.3 percent readmitted specifically for a complication or infection.
- Patients with surgical site infections (SSIs) had the highest percent of readmissions at 61.9 percent. Many SSIs are detected after discharge from the hospitalization in which the procedure was performed, that is, during a readmission or other post-discharge surveillance.
- In 2010, 56.6 percent of patients who contracted a surgical site infection were readmitted specifically for a complication or infection, up from 53.6 percent in 2009.
- In 2010, the estimated average Medicare fee-for-service payment for hospital stays for patients who acquired an HAI was \$21,378. The estimated average Medicare fee-for-service payment for those without an HAI was \$6,709.

Figure 1. Distribution of HAIs by Infection Type



* Other infections include: bone and joint; central nervous system; cardiovascular system; eye, ear, nose, throat or mouth, including upper respiratory; lower respiratory system (other than pneumonia); reproductive system; skin and soft tissue; and systemic infections.

Hospital Stays with HAIs

Table 1. Outcomes for Patients With and Without HAIs, 2010

	Number of Patients	Percent of Patients with an HAI	Mortality Percent	Average Length of Stay (in Days)	Percent of Patients Readmitted for Any Reason	Percent of Patients Readmitted for a Complication or Infection	Estimated Average Medicare Payment ^a
Total	1,880,189	NA	1.8%	5.2	16.6%	6.6%	\$6,929
Patients with Infections	21,319	1.13%	9.1%	21.9	41.9%	31.3%	\$21,378
Urinary Tract	4,696	0.25%	5.5%	19.6	27.6%	15.9%	\$15,698
Pneumonia	2,110	0.11%	24.7%	24.3	30.4%	19.0%	\$32,227
Bloodstream	2,016	0.11%	19.3%	32.7	37.8%	22.7%	\$22,618
Surgical Site ^b	5,711	0.61%	1.3%	10.0	61.9%	56.6%	\$17,281
Gastrointestinal	3,489	0.19%	9.4%	20.1	37.9%	25.4%	\$15,112
Other Infections ^c	1,874	0.10%	7.3%	27.7	35.0%	19.3%	\$29,790
Multiple Infections	1,423	0.08%	16.4%	54.5	39.0%	26.0%	\$47,615
Patients without Infections	1,858,870	NA	1.7%	5.0	16.3%	6.3%	\$6,709

^a The estimated payments are for hospitalizations covered by the Medicare fee-for-service system only and are based on the entire hospital stay, not just for treatment related to the infection.

^b Calculations for percent of surgical site infections include only those patients who underwent a surgical procedure.

^c Other infections include: bone and joint; central nervous system; cardiovascular system; eye, ear, nose, throat or mouth, including upper respiratory; lower respiratory system (other than pneumonia); reproductive system; skin and soft tissue; and systemic infections.

NA: Not applicable

Examples of How HAIs Impact Hospital Stays

While healthcare-associated infections (HAIs) are considered a common cause of morbidity and mortality,¹ it is important to note that patient outcomes may not have been related to the infection. Some of the differences in outcomes may be influenced by other factors, including the complex medical needs of the patient that necessitated hospitalization. Still, one study that examined the differences in mortality and length of stay for patients with an HAI and those without found that the differences in these outcome measures cannot be explained on the basis of how sick the patient was at the time of admission.²

The impact of HAIs can range from relatively minor to devastating and life-threatening. The following examples demonstrate that not all HAIs equally affect the number of days a patient stays in the hospital or the payment the hospital receives from Medicare.

Scenario 1: A 75-year-old man undergoes a partial hip replacement and contracts a healthcare-associated urinary tract infection during his stay that does not result in any further complications. He is expected to be in the hospital for six days, and his length of stay is not impacted by the fact that a urinary tract infection was contracted. The Medicare payment of \$16,500 for his hospital care remains unaffected.

Scenario 2: A 75-year-old man undergoes a partial hip replacement and develops a healthcare-associated pneumonia during his stay and consequently undergoes a tracheostomy with continued mechanical ventilation. An inpatient stay anticipated to be six days is extended to 25 days. The Medicare payment that would have been \$16,500 is now \$104,100.

¹ Lucado J, Paex K, Andrews R, et al. *Adult hospital stays with infections due to medical care, 2007*. Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, 2010.

² Peng MM, Kurtz S, Johannes RS. Adverse outcomes from hospital-acquired infection in Pennsylvania cannot be attributed to increased risk on admission. *Am J Med Qual.* 2006; 21:175-285.

Hospital Stays with HAIs

Common Principal Diagnoses for Patients with HAIs

What conditions are associated with the highest number of HAIs?

Table 2a displays the top principal reasons for which patients with the highest number of healthcare-associated infections were originally admitted to a hospital in 2010. Patient outcomes are also displayed.

- Of the 21,319 patients with an HAI, primary cancer patients had the highest number of HAIs at 1,618. Just over 3 percent of these patients contracted an HAI. Primary cancer patients with an HAI had a higher mortality rate at 8.1 percent, a longer average length of stay at 17.9 days, and a higher readmission rate for complication or infection at 36.4 percent than primary cancer patients without an HAI.

Table 2a. Top Reasons for Admission for Patients with the Highest Number of HAIs

Principal Reason for Admission ^a	Number of Patients	Percent of Patients	Mortality Percent	Average Length of Stay (in Days)	Percent of Patients Readmitted for a Complication or Infection
Total Patients^b					
Patients with HAI	21,319	1.1%	9.1%	21.9	31.3%
Patients without HAI	1,858,870	98.9%	1.7%	5.0	6.3%
Primary cancer					
Patients with HAI	1,618	3.3%	8.1%	17.9	36.4%
Patients without HAI	47,013	96.7%	3.2%	5.5	7.3%
Respiratory failure (adult)					
Patients with HAI	1,023	5.4%	18.0%	41.5	33.8%
Patients without HAI	17,772	94.6%	15.1%	13.0	17.6%
Inpatient rehabilitation care^c					
Patients with HAI	965	2.3%	0.2%	23.2	13.8%
Patients without HAI	40,423	97.7%	0.2%	13.3	8.2%
Septicemia					
Patients with HAI	938	2.3%	22.6%	29.1	25.6%
Patients without HAI	39,988	97.7%	14.2%	7.9	14.9%
Complication of internal device, implant, or graft					
Patients with HAI	861	2.3%	8.5%	21.9	43.1%
Patients without HAI	36,502	97.7%	1.7%	6.0	14.0%
Intestinal inflammation					
Patients with HAI	693	1.7%	3.9%	16.7	31.7%
Patients without HAI	40,924	98.3%	0.8%	4.8	5.8%
Fracture of hip, leg, or foot					
Patients with HAI	661	2.4%	4.4%	11.6	30.7%
Patients without HAI	27,412	97.6%	1.5%	5.3	6.7%
Stroke					
Patients with HAI	614	2.1%	15.6%	20.3	20.9%
Patients without HAI	28,863	97.9%	7.4%	5.9	9.6%
Arthritis and joint disorders					
Patients with HAI	579	1.0%	0.2%	5.3	48.8%
Patients without HAI	55,644	99.0%	0.1%	3.4	3.1%
Pregnancy and related disorders					
Patients with HAI	555	0.4%	0.2%	6.2	33.8%
Patients without HAI	147,788	99.6%	< 0.1%	2.7	0.7%

^a Principal reasons for admission are based on the Agency for Healthcare Research and Quality's Clinical Classifications Software (CCS).

^b Calculations for Total Patients include all patients, not just the patients included in the top reasons for admission.

^c Inpatient rehabilitation services provided in general acute care hospitals are typically for conditions such as stroke and other brain and spinal cord injuries, burns, and post-operative knee or hip replacement surgery.

Hospital Stays with HAIs

What conditions are associated with the highest percent of HAIs?

Table 2b displays the top principal reasons for which patients with the highest percent of healthcare-associated infections were originally admitted to a hospital in 2010. Patient outcomes are also displayed.

- Patients admitted for leukemia and lymphomas had the highest percent of HAIs at 6.5 percent. Leukemia and lymphoma patients with an HAI had a higher mortality rate at 18.6 percent, a longer average length of stay at 36.5 days, and a higher rate of readmission for a complication or infection at 15.4 percent than leukemia and lymphoma patients without an HAI.

Table 2b. Top Reasons for Admission for Patients with the Highest Percent of HAIs

Principal Reason for Admission ^a	Number of Patients ^b	Percent of Patients	Mortality Percent	Average Length of Stay (in Days)	Percent of Patients Readmitted for a Complication or Infection
Leukemia and lymphomas					
Patients with HAI	318	6.5%	18.6%	36.5	15.4%
Patients without HAI	4,589	93.5%	7.2%	10.0	10.6%
Respiratory failure (adult)					
Patients with HAI	1,023	5.4%	18.0%	41.5	33.8%
Patients without HAI	17,772	94.6%	15.1%	13.0	17.6%
Abdominal hernia					
Patients with HAI	426	4.0%	4.0%	12.2	43.8%
Patients without HAI	10,135	96.0%	0.9%	4.4	5.5%
Heart valve disorders					
Patients with HAI	274	4.0%	12.4%	22.7	29.0%
Patients without HAI	6,594	96.0%	2.7%	8.0	9.9%
Aneurysm/blood clot of artery in abdomen or limb					
Patients with HAI	239	3.8%	9.2%	19.7	33.7%
Patients without HAI	6,074	96.2%	5.9%	5.7	8.5%
Primary cancer					
Patients with HAI	1,618	3.3%	8.1%	17.9	36.4%
Patients without HAI	47,013	96.7%	3.2%	5.5	7.3%
Crushing injury or internal injury					
Patients with HAI	154	3.1%	9.7%	28.7	17.1%
Patients without HAI	4,876	96.9%	3.2%	5.9	5.2%
Fungus infection (e.g., respiratory or skin infection caused by fungus)					
Patients with HAI	38	3.0%	26.3%	29.5	24.0%
Patients without HAI	1,235	97.0%	4.4%	8.0	13.2%
Spinal cord injury and head trauma					
Patients with HAI	455	2.9%	9.5%	24.4	24.9%
Patients without HAI	15,509	97.1%	5.8%	5.2	4.9%
Intestinal obstruction					
Patients with HAI	464	2.7%	9.5%	19.3	21.6%
Patients without HAI	16,538	97.3%	2.0%	5.6	7.2%

^a Principal reasons for admission are based on the Agency for Healthcare Research and Quality's Clinical Classifications Software (CCS).

^b Conditions with less than 30 patients with HAIs were not considered when identifying conditions with the highest percent of HAIs.

A Closer Look at Surgical Site Infections

Surgical site infections (SSIs) were the most commonly occurring HAI, comprising 26.8 percent of all HAIs. For purposes of reporting HAIs through the National Healthcare Safety Network (NHSN), SSIs can be identified either during the hospitalization in which the procedure occurred or after the patient has been discharged from the hospital during post-discharge surveillance, that is, a readmission to the same or a different hospital, a follow-up visit to a physician office, or a surgeon survey via mail or phone. When a different hospital, physician, or surgeon office identifies the infection, they report it back to the hospital where the procedure was performed. The hospital where the procedure was performed attributes the infection to a particular procedure

category and reports the infection into NHSN. The extent of a hospital's post-discharge surveillance may affect the number of surgical site infections reported.

- Of the 5,711 patients who had a surgical site infection, 1,291 (22.6 percent) were detected before the patient was discharged from the hospital where the procedure was performed and 4,420 (77.4 percent) were detected during post-discharge surveillance.
- Table 3 displays the number of days from the date of procedure to the detection of the surgical site infection for the 4,420 patients with SSIs detected during post-discharge surveillance.

Table 3. SSIs Detected During Post-Discharge Surveillance

Number of Days from Procedure to Detection of SSI	Number of Patients	Percent of Patients
Within 7 days	237	5.3%
8-18 days	1,917	43.4%
19-30 days	1,387	31.4%
Over 30 days*	879	19.9%
Total patients with SSIs detected during post-discharge surveillance	4,420	100.0%

* Per NHSN instructions, with the exception of surgical procedures involving implants (e.g., metal rods or screws, mechanical heart valve), the period for reporting surgical site infections is 30 days from the date of the procedure. For surgeries with implants, the eligible period for reporting extends to 365 days from the date of the procedure. This report includes SSIs for procedures performed in 2010 that were identified and reported during 2010 or during the first quarter of 2011. As such, the number of post-discharge surveillance SSIs identified for surgical procedures involving implants may be underreported.

Surgical Site Infections

Common Procedures for Patients with Surgical Site Infections

What procedure categories are associated with the highest *number* of surgical site infections (Table 4a)?

- Colon and rectal surgery remained the procedure with the highest number of patients who acquired a surgical site infection, 738 patients in 2010 and 758 patients in 2009. Of these patients, 42.3 percent were readmitted within 30 days for a complication or infection.
- Of the top procedure categories, patients who underwent spinal fusion/refusion and contracted a surgical site infection had the highest readmission rate for a complication or infection in 2010 at 77.7 percent, up from 75.2 percent in 2009. Of the spinal fusion/refusion patients who did not acquire a surgical site infection, approximately 3.5 percent were readmitted for a complication or infection in 2009 and 2010.

What procedure categories are associated with the highest *percent* of surgical site infections (Table 4b)?

- Peripheral vascular bypass surgery remained the procedure with the highest percent of patients who acquired surgical site infections. Of all the patients who underwent this procedure, 7.7 percent contracted a surgical site infection in 2010 compared to 7.1 percent in 2009.

^a Procedure categories are based on the CDC's NHSN Operative Categories.

^b The number of patients who underwent a procedure and acquired a surgical site infection (SSI) was determined using the NHSN data in which hospitals attributed SSIs to a particular NHSN procedure category. The number of patients who underwent a procedure and did not acquire a SSI was determined using the principal procedure in the discharge data that hospitals reported to PHC4.

^c Calculations for Total Patients include all patients with a procedure, not just patients included in the top procedure categories.

^d Procedure categories with less than 30 patients with SSIs were not considered when identifying procedures with the highest percent of SSIs.

Table 4a.

Procedure Category ^a	Number of Patients ^b	Percent of Patients	Average Length of Stay (in Days)	Percent of Patients Readmitted for a Complication or Infection
Total Patients^c				
Patients with SSI	5,711	0.6%	10.0	56.6%
Patients without SSI	930,281	99.4%	5.4	6.6%
Colon and rectal surgery				
Patients with SSI	738	4.4%	14.3	42.3%
Patients without SSI	15,854	95.6%	9.4	9.0%
Spinal fusion/refusion				
Patients with SSI	373	1.9%	6.9	77.7%
Patients without SSI	19,507	98.1%	3.9	3.5%
Cesarean section (C-section)				
Patients with SSI	368	0.8%	4.6	39.1%
Patients without SSI	43,389	99.2%	3.6	0.8%
Knee replacement surgery				
Patients with SSI	317	0.8%	4.1	58.4%
Patients without SSI	37,535	99.2%	3.4	3.1%
Hip replacement surgery				
Patients with SSI	316	1.4%	5.5	73.2%
Patients without SSI	22,858	98.6%	4.1	5.5%

Table 4b.

Procedure Category ^a	Number of Patients ^{b, d}	Percent of Patients	Average Length of Stay (in Days)	Percent of Patients Readmitted for a Complication or Infection
Peripheral vascular bypass surgery				
Patients with SSI	189	7.7%	8.2	75.7%
Patients without SSI	2,263	92.3%	7.3	11.2%
Colon and rectal surgery				
Patients with SSI	738	4.4%	14.3	42.3%
Patients without SSI	15,854	95.6%	9.4	9.0%
Small bowel surgery				
Patients with SSI	256	4.1%	17.3	37.6%
Patients without SSI	5,991	95.9%	12.1	12.2%
Liver, pancreas, and bile duct surgery				
Patients with SSI	134	4.0%	17.0	54.5%
Patients without SSI	3,238	96.0%	9.8	9.9%
Surgery to repair hernia				
Patients with SSI	255	3.9%	7.4	57.4%
Patients without SSI	6,367	96.1%	4.5	4.9%

A Closer Look at Readmissions for Patients with HAIs

Reducing readmissions is a priority among the medical community, researchers and policymakers who are focused on identifying the causes of readmissions and implementing evidence-based strategies to reduce those that are preventable. One national study found that almost one-fifth of Medicare patients are readmitted within 30 days of discharge and a third are rehospitalized within 90 days.¹ While not all readmissions can be prevented, high-quality care and appropriate coordination and continuity of care after discharge may lessen the need for subsequent hospitalizations. There is ongoing debate about the best way to identify preventable readmissions; as such, a reasonable place to focus attention might be on patients who are readmitted for a complication or infection.

Table 5 displays the number and percent of HAI patients who were readmitted to a hospital within 30 days and the number and percent of patients for which the principal reason for the readmission was a complication or infection.

- Of the HAI patients included in this analysis,² 41.9 percent (7,127 patients) were readmitted to a PA hospital within 30 days for any reason, with 31.3 percent readmitted specifically for a complication or infection.
- For patients without an HAI, 16.3 percent were readmitted for any reason, with 6.3 percent readmitted specifically for a complication or infection.
- Patients who contracted a surgical site infection had the highest readmission rate for any reason at 61.9 percent, followed by patients who contracted multiple infections at 39.0 percent, and patients who contracted a gastrointestinal infection at 37.9 percent.
- Patients with surgical site infections also had the highest percent of readmissions for a complication or infection at 56.6 percent, followed by those with multiple infections at 26.0 percent and gastrointestinal infections at 25.4 percent.

Table 5. Readmissions within 30 Days for Patients with HAIs

	Patients Readmitted for Any Reason		Patients Readmitted for a Complication or Infection	
	Number	Percent	Number	Percent
Patients with Infections	7,127	41.9%	5,333	31.3%
Urinary Tract	1,101	27.6%	634	15.9%
Pneumonia	440	30.4%	275	19.0%
Bloodstream	488	37.8%	293	22.7%
Surgical Site	3,164	61.9%	2,893	56.6%
Gastrointestinal	1,078	37.9%	722	25.4%
Other Infections*	475	35.0%	262	19.3%
Multiple Infections	381	39.0%	254	26.0%
Patients without Infections	252,717	16.3%	97,988	6.3%

* Other infections include: bone and joint; central nervous system; cardiovascular system; eye, ear, nose, throat or mouth, including upper respiratory; lower respiratory system (other than pneumonia); reproductive system; skin and soft tissue; and systemic infections.

¹ Jencks SF, Williams MV, Coleman EA. Rehospitalizations among patients in the Medicare fee-for-service program. *N Eng J Med.* 2009;360:1418-1428.

² Of the 1,880,189 patients admitted to PA hospitals in 2010, 1,567,987 were evaluated for possible readmissions: 17,018 (of the 21,319) patients who contracted an HAI and 1,550,969 patients who did not. This readmission analysis did not include patients who died during the original hospital stay, were out-of-state residents, or for which data needed to link hospitalizations was missing.

In recent years, the Centers for Medicare and Medicaid Services (CMS) has sought to improve the quality of care through payment incentive programs that reward hospitals for meeting pre-established targets for improvement of health care and by reducing payments for negative consequences of care that result in injury, illness or death. Beginning in October 2008, CMS began a program of non-payment for a select set of conditions acquired in the hospital that might reasonably be prevented by following best practice guidelines. Included in these conditions are healthcare-associated infections (catheter-associated urinary tract infections, central line-associated bloodstream infections, and select surgical site infections) and conditions such as pressure ulcers and complications from blood transfusions. In the future, it is anticipated that Medicare payments will also be reduced when CMS considers hospitals' readmission rates to be higher than expected.

What are the average Medicare payments for conditions associated with the highest number and percent of HAIs for patients age 65 and older? Tables 6a and 6b display the top principal reasons for which patients (65 and older) with a healthcare-associated infection were originally admitted to a general acute care hospital in 2010. Table 6a displays conditions with the highest number of HAIs, and Table 6b displays the conditions with the highest percent of HAIs. The estimated Medicare payments for the initial hospitalizations for patients with and without an infection are reported. Estimated Medicare payments are also reported for readmissions within 30 days when the principal reason for the readmission was a complication or infection.

The estimated payments are for hospitalizations covered by the Medicare fee-for-service system only and are based on the entire hospital stay, not just for treatment related to the infection. Only patients age 65 and older were included in this analysis. The average Medicare fee-for-service payments were estimated for 2010 hospitalizations using 2009 Medicare payment data (the most recent data available to PHC4).

- In 2010, there were 714,172 hospital admissions for Medicare beneficiaries age 65 and older in PA general acute care hospitals; 9,742 (1.4 percent) of these patients acquired a healthcare-associated infection.
- o The estimated average Medicare payment for hospital stays for patients with an HAI was \$21,378. For hospital stays for patients without an HAI, the estimated average Medicare payment was \$6,709.
- o Of the Medicare patients with an HAI, 40.2 percent (3,227 patients) were readmitted within 30 days for any reason. The estimated average Medicare payment for these readmissions was \$8,940, with an estimated total Medicare payment of \$28.8 million (data not shown in Table 6a or 6b).
- o Of the Medicare patients with an HAI, 30.5 percent (2,451 patients) were readmitted within 30 days for a complication or infection. The estimated average Medicare payment for these readmissions was \$9,483, with an estimated total Medicare payment of more than \$23 million.
- For each of the conditions listed in Tables 6a and 6b, Medicare payments for the original hospitalizations for patients with an HAI were higher than for hospitalizations for patients without an HAI. These differences tend to be greater for the original hospitalizations and less pronounced for readmission hospitalizations for complication or infection.
- Across all conditions, the percent of patients readmitted for a complication or infection was higher for patients with an HAI than for those without.
- Patients age 65 and older admitted for primary cancer and intestinal obstruction were among the top ten conditions for both the number and percent of HAIs.
- Heart valve disorder patients had the highest percent of HAIs at 4.4 percent.
- Of the conditions listed in Tables 6a and 6b, patients with an HAI who underwent procedures for acquired foot deformities (e.g., bunion, hammer toe, club foot, and claw foot) had the highest percent of readmissions for a complication or infection at 57.1 percent, followed by benign neoplasm patients at 45.0 percent and arthritis and joint disorder patients at 44.7 percent.

Medicare Payments

Table 6a. Average Medicare Fee-for-Service Payments for Top Reasons for Admission of Patients 65 Years of Age and Older with the Highest Number of HAIs

Principal Reason for Admission ^a	Number of Patients	Percent of Patients	Estimated Average Medicare Payment for Original Hospital Stay ^b	Percent of Patients Readmitted for a Complication or Infection	Estimated Average Medicare Payment for Readmission for a Complication or Infection ^b
Total^c					
Patients with HAI	9,742	1.4%	\$21,378	30.5%	\$9,483
Patients without HAI	704,430	98.6%	\$6,709	8.8%	\$7,892
Primary cancer					
Patients with HAI	842	3.5%	\$22,591	33.8%	\$9,689
Patients without HAI	23,222	96.5%	\$8,689	8.3%	\$7,054
Septicemia					
Patients with HAI	511	2.0%	\$25,653	25.2%	\$9,649
Patients without HAI	25,380	98.0%	\$10,095	14.8%	\$8,865
Fracture of hip, leg, or foot					
Patients with HAI	443	2.6%	\$13,354	29.7%	\$9,020
Patients without HAI	16,645	97.4%	\$8,430	8.7%	\$7,666
Heart failure					
Patients with HAI	390	0.9%	\$17,066	22.3%	\$9,640
Patients without HAI	42,457	99.1%	\$6,082	9.5%	\$8,504
Inpatient rehabilitation care^d					
Patients with HAI	388	2.4%	\$16,066	15.2%	\$12,178
Patients without HAI	15,591	97.6%	\$14,092	8.1%	\$7,895
Complication of internal device, implant, or graft					
Patients with HAI	369	2.2%	\$22,964	44.3%	\$10,664
Patients without HAI	16,459	97.8%	\$9,661	12.8%	\$8,872
Stroke					
Patients with HAI	342	1.7%	\$22,984	21.1%	\$9,922
Patients without HAI	19,232	98.3%	\$6,438	9.9%	\$7,840
Arthritis and joint disorders					
Patients with HAI	319	1.1%	\$9,802	44.7%	\$7,755
Patients without HAI	28,841	98.9%	\$8,036	3.6%	\$6,270
Intestinal inflammation					
Patients with HAI	306	1.7%	\$23,866	24.6%	\$9,562
Patients without HAI	17,497	98.3%	\$5,062	7.3%	\$7,461
Intestinal obstruction					
Patients with HAI	282	3.0%	\$24,618	19.6%	\$10,798
Patients without HAI	8,965	97.0%	\$6,216	7.6%	\$8,628

^a Principal reasons for admission are based on the Agency for Healthcare Research and Quality's Clinical Classifications Software (CCS).

^b The estimated payments are for hospitalizations covered by the Medicare fee-for-service system only and are based on the entire hospital stay, not just for treatment related to the infection.

^c Calculations for Total Patients include all patients, not just the patients included in the top reasons for admission.

^d Inpatient rehabilitation services provided in general acute care hospitals are typically for conditions such as stroke and other brain and spinal cord injuries, burns, and post-operative knee or hip replacement surgery.

Medicare Payments

Table 6b. Average Medicare Fee-for-Service Payments for Top Reasons for Admission of Patients 65 Years of Age and Older with the Highest Percent of HAIs

Principal Reason for Admission ^a	Number of Patients ^b	Percent of Patients	Estimated Average Medicare Payment for Original Hospital Stay ^c	Percent of Patients Readmitted for a Complication or Infection	Estimated Average Medicare Payment for Readmission for a Complication or Infection ^c
Heart valve disorders					
Patients with HAI	217	4.4%	\$54,556	29.6%	\$11,927
Patients without HAI	4,756	95.6%	\$23,909	10.5%	\$6,864
Leukemia and lymphomas					
Patients with HAI	105	4.2%	\$29,156	15.1%	\$11,354
Patients without HAI	2,378	95.8%	\$12,011	10.4%	\$9,000
Aneurysm/blood clot of artery in abdomen or limb					
Patients with HAI	173	4.0%	\$38,908	31.9%	\$6,510
Patients without HAI	4,141	96.0%	\$13,320	9.0%	\$9,084
Abdominal hernia					
Patients with HAI	179	3.8%	\$21,087	35.8%	\$7,175
Patients without HAI	4,556	96.2%	\$7,606	5.9%	\$7,687
Crushing injury or internal injury					
Patients with HAI	40	3.7%	\$17,852	25.9%	\$3,698
Patients without HAI	1,047	96.3%	\$8,968	8.3%	\$9,482
Primary cancer					
Patients with HAI	842	3.5%	\$22,591	33.8%	\$9,689
Patients without HAI	23,222	96.5%	\$8,689	8.3%	\$7,054
Acquired foot deformities (e.g., bunion, hammer toe, club foot, and claw foot)					
Patients with HAI	82	3.3%	\$20,790	57.1%	\$13,484
Patients without HAI	2,385	96.7%	\$11,459	6.2%	\$7,044
Benign neoplasms					
Patients with HAI	90	3.2%	\$22,162	45.0%	\$17,848
Patients without HAI	2,701	96.8%	\$7,442	6.8%	\$5,945
Intestinal obstruction					
Patients with HAI	282	3.0%	\$24,618	19.6%	\$10,798
Patients without HAI	8,965	97.0%	\$6,216	7.6%	\$8,628
Spinal cord injury and head trauma					
Patients with HAI	178	2.9%	\$32,044	29.2%	\$9,292
Patients without HAI	5,919	97.1%	\$7,834	8.2%	\$7,615

^a Principal reasons for admission are based on the Agency for Healthcare Research and Quality's Clinical Classifications Software (CCS).

^b Conditions with less than 30 patients with HAIs were not considered when identifying conditions with the highest percent of HAIs.

^c The estimated payments are for hospitalizations covered by the Medicare fee-for-service system only and are based on the entire hospital stay, not just for treatment related to the infection.

Medicaid Payments

As with Medicare, Medicaid regulations seek to improve the quality of health care by reducing payments for a select set of medical errors and complications that result in injury, illness or death. Effective July 2011, the Centers for Medicare and Medicaid Services (CMS) extended the Medicare non-payment policy for the selected hospital-acquired conditions to Medicaid. States are required to implement non-payment policies for these conditions, which include catheter-associated urinary tract infections, central line-associated bloodstream infections, and several types of surgical site infections.

What are the average Medicaid payments for conditions associated with the highest number of HAIs for Medicaid patients? Table 7 displays the top principal reasons Medicaid patients with a healthcare-associated infection were originally admitted to a general acute care hospital in 2009. Patient outcomes and average Medicaid payments are also displayed.

The average Medicaid payments are for hospitalizations covered by the Medicaid fee-for-service system only and are for the entire hospital stay, not just for treatment related to the infection. The Medicaid payment data reported is for 2009 hospitalizations since 2009 data was the most recent data available to PHC4. Payments for 2010 hospitalizations were not estimated since the Medicaid population for 2010 is not easily predicted, unlike Medicare where the population was estimated using patient age.

- In 2009, the Medicaid fee-for-service payment data that was available to PHC4 included 77,246 general acute care hospitalizations paid for by the PA Department of Public Welfare's Medicaid fee-for-service program. Of these hospitalizations, 937 patients (1.2 percent) had at least one healthcare-associated infection.
 - The average Medicaid payment for hospitalizations for patients with an HAI was \$33,329. For hospitalizations for patients without an HAI, the average Medicaid payment was \$6,040.
 - Of the Medicaid patients with an HAI, 35.6 percent (284 patients) were readmitted within 30 days for any reason. The average Medicaid payment for these types of readmissions was \$9,653 (data not shown in Table 7).
 - Of the Medicaid patients with an HAI, 24.0 percent (191 patients) were readmitted within 30 days for a complication or infection. The average Medicaid payment for these types of readmissions was \$11,199.
- While Medicaid patients admitted to the hospital for pregnancy and related disorders had the highest number of HAIs (83 patients), the percent of these patients who acquired an HAI was low (0.5 percent) when compared to the percent of patients with an HAI for the remaining top conditions.
- For all conditions listed in Table 7, the average Medicaid payment for the original hospitalization was higher for patients with an HAI than for those without.
- Across all conditions, the percent of patients readmitted for a complication or infection was higher for patients with an HAI than for those without.

Medicaid Payments

Table 7. Average Medicaid Fee-for-Service Payments for Top Reasons for Admission of Patients with an HAI, 2009

Principal Reason for Admission ^a	Number of Patients ^b	Percent of Patients	Average Medicaid Payment for Original Hospital Stay ^c	Percent of Patients Readmitted for a Complication or Infection	Average Medicaid Payment for Readmission for a Complication or Infection ^c
Total^d					
Patients with HAI	937	1.2%	\$33,329	24.0%	\$11,199
Patients without HAI	76,309	98.8%	\$6,040	4.1%	\$9,384
Pregnancy and related disorders					
Patients with HAI	83	0.5%	\$10,426	25.7%	NR
Patients without HAI	17,087	99.5%	\$3,232	0.6%	\$2,565
Spinal cord injury and head trauma					
Patients with HAI	72	6.3%	\$73,518	16.7%	\$10,165
Patients without HAI	1,072	93.7%	\$13,788	2.9%	\$12,658
Stroke					
Patients with HAI	55	5.1%	\$62,961	13.3%	NR
Patients without HAI	1,025	94.9%	\$12,857	6.2%	\$12,291
Primary cancer					
Patients with HAI	53	3.9%	\$18,775	25.0%	\$9,881
Patients without HAI	1,300	96.1%	\$11,184	6.1%	\$6,594
Septicemia					
Patients with HAI	47	3.0%	\$37,314	26.3%	\$9,420
Patients without HAI	1,518	97.0%	\$10,578	15.0%	\$10,162
Crushing injury or internal injury					
Patients with HAI	46	7.6%	\$59,102	11.1%	NR
Patients without HAI	557	92.4%	\$18,156	4.7%	\$9,080

^a Principal reasons for admission are based on the Agency for Healthcare Research and Quality's Clinical Classifications Software (CCS).

^b Conditions with less than 30 patients with HAIs were not considered when identifying the top reasons for admissions.

^c Medicaid fee-for-service (FFS) was assigned as the primary payer when the payer (Medicaid) indicated the primary payer was Medicaid FFS, the payment was greater than zero, and the payment value was greater than the Medicare FFS payment (if present). Payments are for the entire hospital stay, not just for treatment related to the infection. Note that for the Medicaid patients readmitted for a complication or infection, 54.4 percent of the readmission hospitalizations were linked to Medicaid fee-for-service payments and could be included in the average Medicaid payment figures for readmissions for a complication or infection.

^d Calculations for Total Patients include all patients, not just the patients included in the top reasons for admission.

NR: Not reported; too few patients.

HAI by Hospital Type

Table 8 shows the percent of patients with a health-care-associated infection (HAI) by hospital type. The vast majority of patients in this analysis (more than 1.7 million or 95.3 percent) were treated at general acute care hospitals.

- At 9.70 percent, long-term acute care hospitals had the highest percent of patients with an HAI, followed by rehabilitation facilities at 2.12 percent and general acute care facilities at 1.09 percent.
- Urinary tract infections and gastrointestinal infections were the most common types of HAIs that occurred in long-term acute care hospitals and rehabilitation facilities.
- Surgical site infections were the most frequently occurring HAI for general acute care hospitals.

Table 8. Patients with an HAI by Hospital Type

	Number of Patients	General Acute Care Hospitals	Long-Term Acute Care Hospitals	Inpatient Rehabilitation Hospitals	Inpatient Psychiatric Hospitals	Other Inpatient Hospitals ^a
Total	1,880,189	1,792,056	10,326	25,949	46,725	5,133
Patients <i>with</i> Infections	21,319	1.09%	9.70%	2.12%	0.65%	0.16%
Urinary Tract	4,696	0.22%	2.87%	1.43%	0.08%	0.02%
Pneumonia	2,110	0.11%	0.51%	0.09%	0.01%	0.02%
Bloodstream	2,016	0.10%	1.88%	0.10%	<0.01%	0.02%
Surgical Site ^b	5,711	0.61%	0.00%	0.00%	0.00%	0.00%
Gastrointestinal	3,489	0.18%	2.21%	0.37%	0.03%	0.04%
Other Infections ^c	1,874	0.08%	0.97%	0.10%	0.53%	0.04%
Multiple Infections	1,423	0.07%	1.27%	0.04%	0.01%	0.02%

^a Other inpatient hospitals provide such services as drug and alcohol treatment.

^b Calculations for percent of surgical site infections include only those patients who underwent a surgical procedure.

^c Other infections include: bone and joint; central nervous system; cardiovascular system; eye, ear, nose, throat or mouth, including upper respiratory; lower respiratory system (other than pneumonia); reproductive system; skin and soft tissue; and systemic infections.

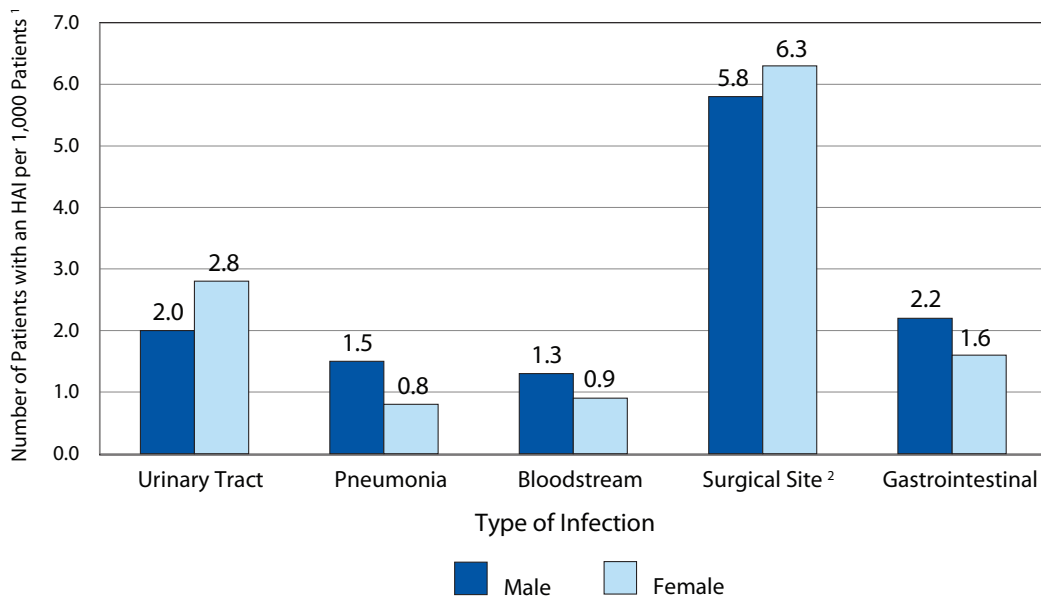
HAI and Patient Demographics

HAI by Gender

- In 2010, the rate of HAIs was higher for males than females, 12.1 per 1,000 for male patients compared to 10.7 per 1,000 female patients.
- The rate for both males and females decreased between 2009 and 2010.
- Surgical site infections were the most frequently occurring infection for both males and females.
- Females acquired more urinary tract infections than males, 2.8 per 1,000 female patients compared to 2.0 per 1,000 male patients. Females also acquired more surgical site infections than males, 6.3 per 1,000 patients compared to 5.8 per 1,000 patients.

Gender	Number of Patients with an HAI per 1,000 Patients ¹		
	2009	2010	Percent Change
Male	13.0	12.1	-6.9%
Female	11.3	10.7	-5.3%

Figure 2. Patients with HAI by Gender, 2010



¹ To account for differences in the percent of male and female patients, calculations for each gender include only patients of that particular gender (e.g., calculations for male patients include only male patients).

² Calculations for rate of surgical site infections include only those patients who underwent a surgical procedure.

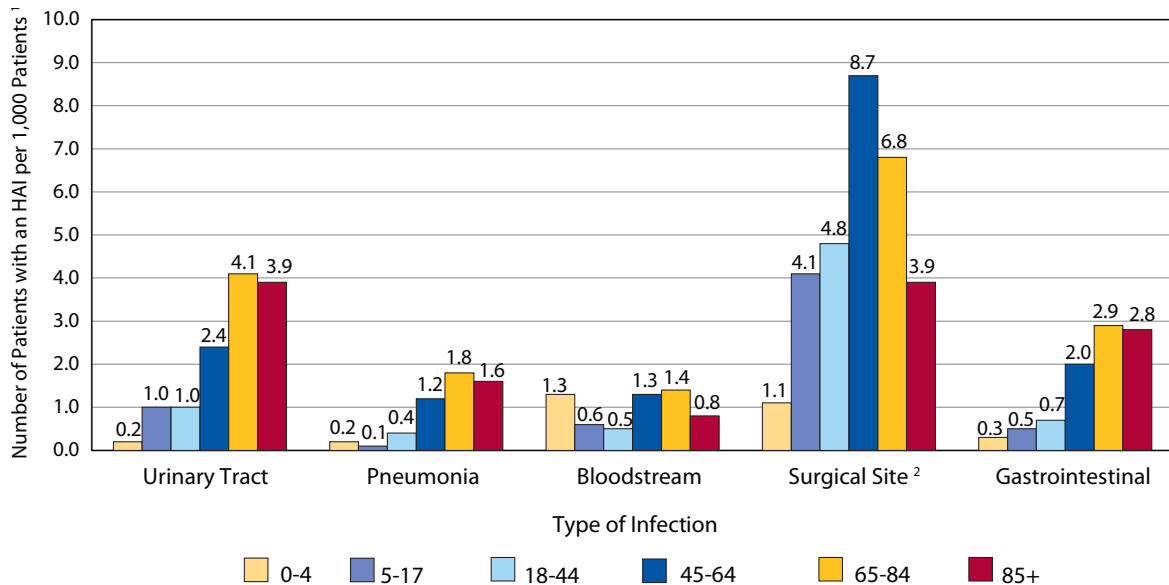
HAI and Patient Demographics

HAI by Age

- In general, older patients were more likely to acquire infections than younger patients.
- Patients 65 to 84 years of age had the highest rate of HAIs, 15.6 per 1,000 patients in that age group.
- Between 2009 and 2010, the rate of HAIs decreased for all adult age groups. The rate increased for patients 5 to 17 years of age.
- Surgical site infections were the most frequently occurring infection for all but the youngest and oldest age groups: 4.1 per 1,000 patients age 5-17; 4.8 per 1,000 patients age 18-44; 8.7 per 1,000 patients age 45-64; and 6.8 per 1,000 patients age 65-84.
- Bloodstream infections were the most frequently occurring HAI for patients in the youngest age group, 1.3 per 1,000 patients age 0-4.
- Urinary tract infections and surgical site infections were the most common types of infections acquired by patients in the oldest age group, both at 3.9 per 1,000 patients age 85 or older.

Age in Years	Number of Patients with an HAI per 1,000 Patients ¹		
	2009	2010	Percent Change
0-4	4.5	4.5	0.0%
5-17	5.8	6.0	3.4%
18-44	7.0	6.7	-4.3%
45-64	14.3	13.4	-6.3%
65-84	16.6	15.6	-6.0%
85+	12.8	11.6	-9.4%

Figure 3. Patients with HAI by Age, 2010



¹ To account for differences in the percent of patients in a particular age group, calculations for each age group include only patients in that particular group (e.g., calculations for patients 0-4 years of age include only patients 0-4 years of age).

² Calculations for rate of surgical site infections include only those patients who underwent a surgical procedure.

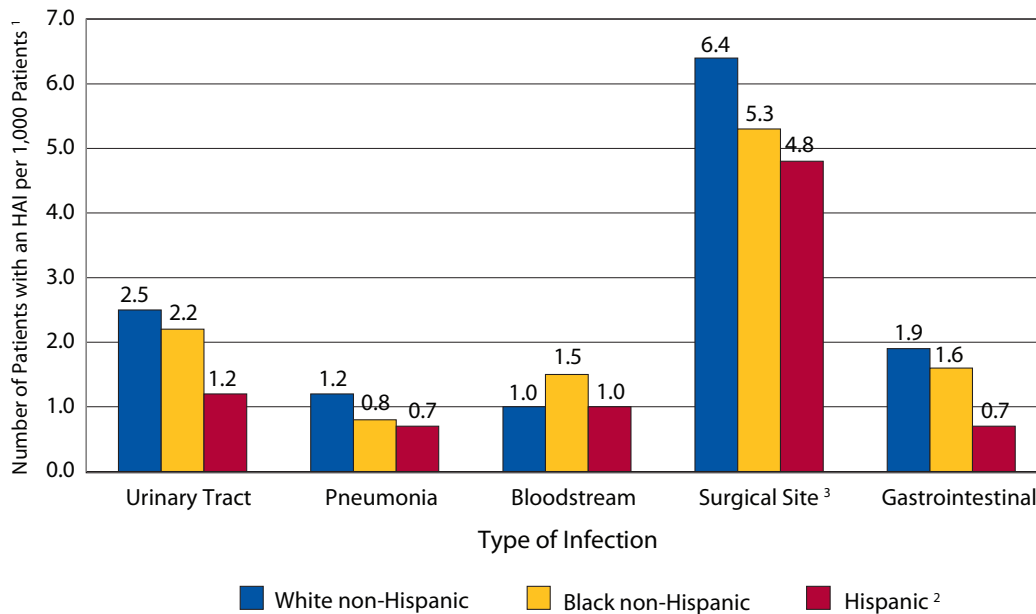
HAI and Patient Demographics

HAI by Race/Ethnicity

- HAIs occurred most frequently in white non-Hispanic patients at a rate of 11.6 per 1,000 patients.
- From 2009 to 2010, rates of HAIs decreased for all race/ethnicity groups.
- Surgical site infections were the most frequently occurring infection for all race/ethnicity groups: 6.4 per 1,000 white non-Hispanic patients; 5.3 per 1,000 black non-Hispanic patients; and 4.8 per 1,000 Hispanic patients.
- Black non-Hispanic patients acquired the most bloodstream infections at 1.5 per 1,000 patients. Hispanic and white non-Hispanic patients had 1.0 bloodstream infections per 1,000 patients.

Race/Ethnicity	Number of Patients with an HAI per 1,000 Patients ¹		
	2009	2010	Percent Change
White non-Hispanic	12.2	11.6	-4.9%
Black non-Hispanic	11.4	10.5	-7.9%
Hispanic ²	8.2	7.3	-11.0%

Figure 4. Patients with HAI by Race/Ethnicity, 2010



¹ To account for differences in the percent of patients of a particular race/ethnicity group, calculations for each race/ethnicity group include only patients in that particular group (e.g., calculations for black non-Hispanic patients include only black non-Hispanic patients).

² Internal PHC4 analysis suggests that Hispanic ethnicity may be slightly underreported.

³ Calculations for rate of surgical site infections include only those patients who underwent a surgical procedure.



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