



The Impact of Healthcare-associated Infections in Pennsylvania 2009





About PHC4

The Pennsylvania Health Care Cost Containment Council (PHC4) is an independent state agency established by Pennsylvania law (Act 89 of 1986, as amended). PHC4 is charged with collecting, analyzing and reporting information that can be used to improve the quality and restrain the cost of health care in Pennsylvania.

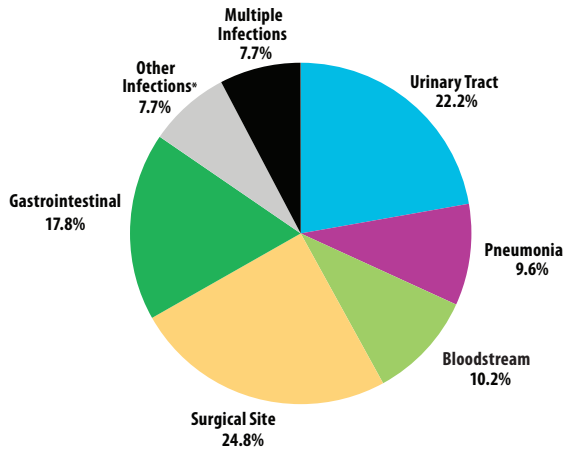
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Key Findings

- Of the 1,939,111 patients admitted to Pennsylvania hospitals in 2009, 23,287 (1.2 percent) contracted at least one healthcare-associated infection (HAI) during their stay.

Distribution of HAIs Across Infection Types



It is important to note that the outcomes reported for patients with an HAI may not have been related to the infection. Some of the differences in outcomes between patients with and without an HAI may have been influenced by other factors, including the complex medical needs of the patient that necessitated hospitalization. See page 7 of this report for two scenarios which demonstrate that not all HAIs equally impact patient outcomes.

- The mortality rate for patients who acquired an HAI during their hospitalization was 9.4 percent. The mortality rate was 1.8 percent for patients without an HAI.
- The average length of stay among patients who acquired an infection during their hospital stay was 21.6 days. The average length of stay for patients who did not acquire an infection was 4.9 days.
- Of Medicare beneficiaries age 65 and older treated in Pennsylvania general acute care hospitals, 10,721 (1.5 percent) contracted an HAI during their hospital stay. The estimated Medicare payment for these hospitalizations averaged \$20,471. The estimated average Medicare payment for hospitalizations without an HAI was \$6,615.

Readmissions

- Of the patients who acquired an infection during their hospital stay, 29.8 percent were readmitted within 30 days for an infection or complication. Of the patients without an HAI, 6.2 percent were readmitted within 30 days for an infection or complication.
- Patients who acquired surgical site infections had the highest readmission rate within 30 days for an infection or complication at 53.6 percent.
- Of the Medicare patients age 65 and older who acquired an infection during their hospital stay, 29.5 percent were readmitted within 30 days for an infection or complication. The estimated total Medicare payment for these readmissions was more than \$24.6 million. Of the Medicare patients age 65 and older without an HAI, 8.7 percent were readmitted for an infection or complication.

Reducing hospital readmissions presents opportunities to improve patient care and reduce health care costs; but even with optimal care, not all readmissions are avoidable. While there is ongoing debate about the best way to identify preventable readmissions, a reasonable place to focus attention might be on patients who are readmitted for infection or complication.

Why Patients Were Hospitalized

Top Reasons for Admission for Patients with an HAI

Primary cancer
 Inpatient rehabilitation care
 Sepsis
 Respiratory failure (adult)
 Complication of internal device, implant, or graft

Top Procedures for Patients with a Surgical Site Infection

Colon and rectal surgery
 Cesarean section (C-section)
 Knee replacement surgery
 Cardiac surgery
 Spinal fusion/refusion

* 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.

Healthcare-associated infections 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) began reporting 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 surveillance 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. Participation in NHSN is a state-mandated requirement for health care facilities in an increasing number of states.

As part of Act 52 requirements, DOH publicly reports hospital-specific HAI rates. In its most recent report, DOH noted a 12.5 percent decline in HAIs statewide from 2008 to 2009.³ 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.

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 2009 and examines mortality rates, readmission rates, lengths of hospital stay, hospital charges, payment information, and other data as it relates to patients who contract HAIs.

Understanding the Report

Data

The data in this report came from three sources. Using the CDC's NHSN, hospitals reported infections they identified as HAIs, which were subjected to validation and correction processes by DOH. Information on inpatient discharges from January 1, 2009 to December 31, 2009 was submitted by hospitals directly to PHC4 and was subjected to PHC4 validation and correction processes. The Medicare payment data was provided by the Centers for Medicare and Medicaid Services.

Cases Included in the Report

This report includes information on 1,939,111 patients treated in Pennsylvania hospitals during calendar year 2009. 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

1. Klevens, R., Edwards, J. R., Richards, C. L., Horan, T. C., Gaynes, R. P., Pollock, D. A., & Cardo, D. M. (2007). Estimating health care-associated infections and deaths in U.S. hospitals, 2002. *Public Health Reports*, 122, 160-166.

2. Scott, R. D. (2009). *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.

3. The Pennsylvania Department of Health. (2010). *Healthcare-associated infections (HAI) in Pennsylvania hospitals – 2009* (technical report).

acute care hospitals, which treat patients with acute conditions that need longer term care than provided in a general acute care hospital; 3) inpatient rehabilitation hospitals; 4) inpatient psychiatric hospitals; and 5) other inpatient facility types such as those for drug and alcohol treatment.

Measures Reported

Number and Percent of Cases – The number and percent of cases with infections represent the number/percent of hospitalizations in which the patient contracted a healthcare-associated infection as identified and reported by the hospital. The number and percent of cases without infections are also reported.

Percent of Mortality – The percent of mortality represents the percent of patients who died during the hospitalization. It is important to note that the cause of death may not have been related to the healthcare-associated infection.

Number and Percent of Readmissions for Any Reason – These figures represent the number/percent of patients who were readmitted for any reason in any Pennsylvania hospital, where the admit date was within 30 days of the discharge date of the original hospitalization. While some re-hospitalizations can be expected, high-quality care may lessen the need for subsequent hospitalizations.

Percent of Readmissions for Infection or Complication – Unlike the previous measure which takes into consideration all subsequent hospitalizations within 30 days of discharge of the original hospitalization, the percent of readmissions for infection or complication represents the percent of patients who were readmitted with a principal diagnosis of an infection or complication.

Average Length of Stay – The average (mean) length of stay represents the number of days, on average, a patient stayed in the hospital. How long a patient stays in the hospital may reflect upon the success of the treatment.

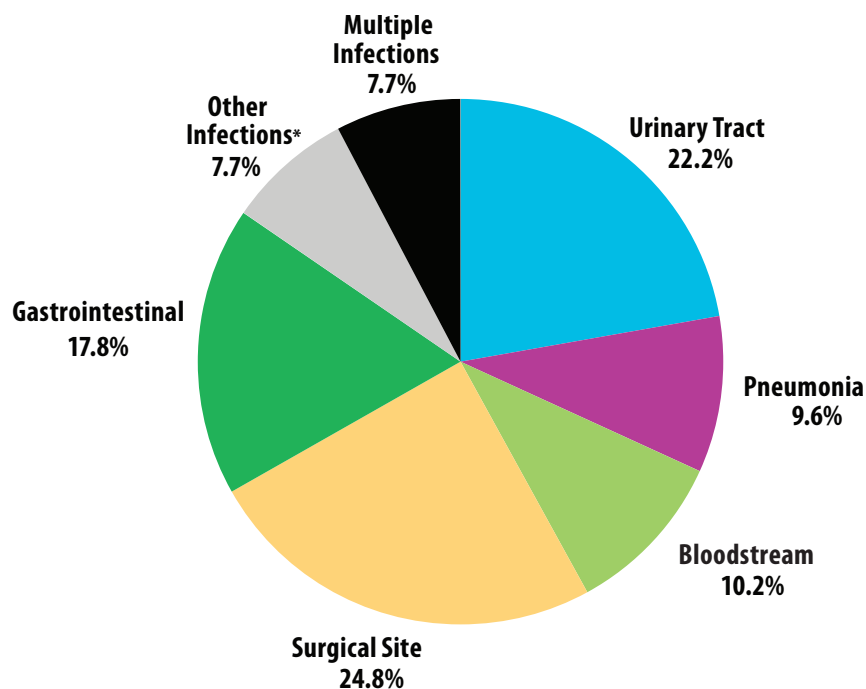
Average Hospital Charge – The average (mean) charge is the amount a hospital bills for a patient's care. Average hospital charges include the facility fee, but do not include professional fees (e.g., physician fees) and do not reflect the amount that a hospital is actually reimbursed. Generally, hospitals do not receive full reimbursement of charges because insurance companies and other large purchasers of health care usually negotiate large discounts. The average charge reported is for the entire length of stay, and not just for the treatment related to the infection.

Estimated Average Medicare Payment – This is 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 amount paid is different from a hospital charge. The average payment reported is for the entire length of stay, and not just for the treatment related to the infection. Only Medicare patients age 65 and older were included in this analysis; Medicare beneficiaries under age 65 were not included. The average Medicare payments were estimated for 2009 hospitalizations using 2008 Medicare payment data since 2008 data was the most recent data available to PHC4.

Hospital Stays with HAIs

This section provides findings on all types of healthcare-associated infections (HAIs) in Pennsylvania including the most common principal diagnoses for stays with HAIs and patient outcomes for hospitalizations with HAIs. In 2009, there were 1,939,111 patients admitted to Pennsylvania hospitals; 23,287 (1.2 percent) of these patients contracted at least one HAI during their stay. The largest percent of these HAIs were surgical site infections (24.8 percent), followed by urinary tract infections (22.2 percent) and gastrointestinal infections (17.8 percent).

Distribution of HAIs Across Infection Types



23,287 Patients with an HAI - 1.2% of 2009 Hospitalizations

* 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

Common Principal Diagnoses

The table below displays the top 25 principal reasons that patients who contracted an HAI were originally admitted to a hospital in 2009. In addition to the principal reasons for admission, PHC4 data provides information regarding patients' hospital experiences including mortality rates, average length of stay and readmission rates. Historically, comparison of patients with and without HAIs has demonstrated notable increases in mortality and length of stay for the hospitalizations in which an HAI occurred. The table below demonstrates this same pattern for mortality and 30-day readmissions for each of the conditions reported: mortality and readmission percentages are higher for cases with infections than for those without an infection.

Top 25 Reasons for Admission for Patients with an HAI

Principal Reason for Admission*	Patients <i>with</i> an HAI				Patients <i>without</i> an HAI			
	Number of Cases	Percent of All Cases <i>with</i> HAI	Mortality Percent	Percent of Patients Readmitted for Any Reason	Number of Cases	Percent of All Cases <i>without</i> HAI	Mortality Percent	Percent of Patients Readmitted for Any Reason
Total Cases[†]	23,287	100.0%	9.4%	40.7%	1,915,824	100.0%	1.8%	16.3%
Primary cancer	1,657	7.1%	9.4%	44.6%	48,544	2.5%	3.1%	18.3%
Inpatient rehabilitation care	1,077	4.6%	0.4%	29.2%	40,852	2.1%	0.2%	19.9%
Septicemia	1,027	4.4%	22.9%	36.3%	36,289	1.9%	15.4%	23.5%
Respiratory failure (adult)	1,022	4.4%	19.4%	38.4%	18,738	1.0%	15.7%	26.9%
Complication of internal device, implant, or graft	876	3.8%	10.5%	51.5%	35,925	1.9%	1.6%	22.3%
Stroke	752	3.2%	9.2%	31.6%	28,791	1.5%	7.9%	17.9%
Intestinal inflammation	742	3.2%	6.3%	40.1%	40,272	2.1%	0.8%	16.2%
Fracture of hip, leg, or foot	724	3.1%	5.5%	38.6%	27,864	1.5%	1.4%	13.2%
Complication of surgical procedure or medical care	665	2.9%	6.5%	36.0%	26,942	1.4%	1.1%	19.9%
Arthritis and joint disorders	617	2.6%	0.8%	48.0%	55,328	2.9%	0.1%	6.0%
Pregnancy and related conditions	558	2.4%	0.4%	38.8%	152,433	8.0%	<0.1%	4.0%
Heart failure	553	2.4%	13.0%	41.5%	57,018	3.0%	3.0%	26.8%
Fetal and newborn conditions and complications	551	2.4%	6.0%	31.6%	145,294	7.6%	0.4%	5.1%
Spinal cord injury and head trauma	517	2.2%	9.7%	30.0%	15,674	0.8%	5.4%	14.1%
Heart attack	513	2.2%	13.5%	35.4%	31,929	1.7%	5.6%	18.6%
Intestinal obstruction	490	2.1%	8.6%	34.1%	16,697	0.9%	1.9%	18.6%
Coronary (heart) artery disease and chest pain	472	2.0%	4.2%	45.8%	77,018	4.0%	0.2%	14.2%
Osteoporosis and back disorders	462	2.0%	1.9%	66.7%	35,934	1.9%	0.1%	8.9%
Mental health disorders	435	1.9%	0.2%	21.8%	120,471	6.3%	0.1%	18.1%
Peripheral vascular disease (PVD)	421	1.8%	11.6%	53.9%	20,291	1.1%	2.6%	19.2%
Abdominal hernia	411	1.8%	5.1%	46.8%	10,263	0.5%	1.1%	11.1%
Secondary cancer	380	1.6%	14.7%	40.4%	16,174	0.8%	5.7%	27.8%
Pneumonia	367	1.6%	16.1%	43.2%	50,440	2.6%	3.6%	17.2%
Acute kidney failure	350	1.5%	15.7%	34.3%	21,407	1.1%	4.6%	24.2%
Leukemia and lymphomas	339	1.5%	18.6%	54.1%	4,501	0.2%	7.9%	40.9%

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

† Calculations for Total Cases include all cases, not just the cases included in the top 25 reasons for admission.

Hospital Stays with HAIs

Patient Outcomes

To understand the impact of HAIs on individual patients and health care resources, PHC4 evaluated mortality, length of stay, average hospital charge and, for the first time, readmissions. In addition to the 30-day readmission figures presented in the table below, more detailed information about the impact of readmissions is presented in the next section. To further quantify the financial impact of HAIs, a section on Medicare payments is also included in this report.

	Number of Cases	Percent of All Cases with HAI	Mortality Percent	Average Length of Stay (in Days)	Percent of Patients Readmitted for Any Reason	Average Charge*	Estimated Average Medicare Payment
Total Cases	1,939,111	NA	1.9%	5.1	16.5%	\$40,869	\$6,839
Cases with Infections	23,287	1.20%	9.4%	21.6	40.7%	\$306,943	\$20,471
Urinary Tract	5,175	0.27%	5.5%	19.6	27.8%	\$177,963	\$15,055
Pneumonia	2,238	0.12%	24.3%	23.8	30.9%	\$312,055	\$27,664
Bloodstream	2,365	0.12%	18.0%	31.1	38.2%	\$370,738	\$24,908
Surgical Site [†]	5,772	0.60%	1.3%	10.0	60.1%	\$124,599	\$15,331
Gastrointestinal	4,144	0.21%	8.9%	18.6	37.8%	\$175,153	\$14,932
Other Infections [‡]	1,799	0.09%	7.2%	26.5	29.7%	\$271,768	\$26,817
Multiple Infections	1,794	0.09%	20.4%	52.2	39.8%	\$1,514,894	\$47,837
Cases without Infections	1,915,824	NA	1.8%	4.9	16.3%	\$37,635	\$6,615

* In almost all cases, hospitals do not receive full reimbursement of charges. On an average basis, across all statewide inpatient cases (not just cases with infections), hospitals were paid approximately 26 percent of established charges in fiscal year 2009, based on financial data hospitals submitted to PHC4.

[†] Calculations for percent of surgical site infections only include those patients who underwent a surgical procedure.

[‡] 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.

HAIs are a common cause of morbidity and mortality.⁴ In 2009, patients who contracted an infection while hospitalized in Pennsylvania had higher mortality and readmission rates, longer lengths of stay, and higher estimated average Medicare payments. **However, it is important to note that these 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, length of stay and hospital charges for hospitalizations that contained an HAI and those that did not found that the differences in these measures cannot be explained on the basis of how sick the patient was at the time of admission.⁵

Unlike the charge data presented in the table above, the average Medicare payments are estimates of what general acute care hospitals were actually reimbursed for the treatment of Medicare patients. The estimated Medicare payments only include hospitalizations for Medicare patients who are age 65 and older; Medicare beneficiaries under age 65 were not included in this analysis.

4. Lucado, J., Paez, K., Andrews, R., & Steiner, C. (2010). *Adult hospital stays with infections due to medical care, 2007*. Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project.

5. Peng, M. M., Kurtz, S., & Johannes, R. S. (2006). Adverse outcomes from hospital-acquired infection in Pennsylvania cannot be attributed to increased risk on admission. *American Journal of Medical Quality*, 21(6), 175-285.

- The mortality rate for patients who acquired an HAI during the hospitalization was 9.4 percent. It was 1.8 percent for those without an HAI.
- Patients with pneumonia had the highest mortality rate (24.3 percent).
- The average length of stay for patients with an HAI was 21.6 days. It was 4.9 days for patients without an HAI.
- Patients with multiple infections had the longest average length of stay (52.2 days).
- The estimated average Medicare payment for patients who acquired an HAI during their hospitalization was \$20,471. The estimated average Medicare payment for those without an HAI was \$6,615.

Examples of How HAIs Impact Hospital Stays

The impact of healthcare-associated infections (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, the charge for the hospitalization, 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 charges for his care remain unaffected at \$45,200, and the Medicare payment of \$16,500 for the hospitalization is also 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. Charges expected to be \$45,200 are increased to \$142,000, and a Medicare payment that would have been \$16,500 is now \$104,100.

Why Look at Readmissions?

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.⁶ As such, examining readmission rates is important from both a quality of care and cost standpoint. While not all readmissions can be prevented, high-quality care may lessen the need for subsequent hospitalizations.

Of the patients included in this analysis* who contracted a healthcare-associated infection (HAI) during their initial hospital stay, 40.7 percent (7,590) were readmitted for any reason to a Pennsylvania hospital within 30 days with 29.8 percent readmitted specifically for an infection or complication. For patients who had not contracted an infection during their initial hospital stay, 16.3 percent were readmitted for any reason with 6.2 percent readmitted specifically for an infection or complication. Among patients with HAIs in this analysis, the reported HAI was contracted during the patient's initial hospitalization, not the readmission.

The table below displays the number and percent of patients who were readmitted to a hospital within 30 days and the percent of patients for which the principal reason for the readmission was an infection or complication.

- Patients who contracted a surgical site infection had the highest readmission rate for any reason at 60.1 percent, followed by patients who contracted multiple infections at 39.8 percent, patients who contracted a bloodstream infection at 38.2 percent and patients who contracted a gastrointestinal infection at 37.8 percent.
- Patients with surgical site infections also had the highest percent of readmissions for an infection or complication at 53.6 percent, followed by those with multiple infections at 27.3 percent and gastrointestinal infections at 24.5 percent.

	Number of Patients Readmitted for Any Reason	Percent of Patients Readmitted for Any Reason	Percent of Patients Readmitted for an Infection or Complication
Patients who contracted an HAI during their initial hospitalization and were readmitted within 30 days	7,590	40.7%	29.8%
Urinary Tract	1,230	27.8%	16.2%
Pneumonia	473	30.9%	20.4%
Bloodstream	603	38.2%	22.0%
Surgical Site	3,129	60.1%	53.6%
Gastrointestinal	1,300	37.8%	24.5%
Other Infections [†]	394	29.7%	17.4%
Multiple Infections	461	39.8%	27.3%
Patients who did not contract an HAI during their initial hospitalization and were readmitted within 30 days	260,350	16.3%	6.2%

[†] 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.

* Of the 1,939,111 patients admitted to Pennsylvania hospitals in 2009, 1,619,750 were evaluated for possible readmissions: 18,656 (of the 23,287) patients who contracted an HAI during the initial hospitalization and 1,601,094 patients who did not. Patients who died, were out-of-state residents, or for which data needed to link hospitalizations was missing were not included in this readmission analysis.

6. Jencks, S. F., Williams, M. V., & Coleman, E. A. (2009). Rehospitalizations among patients in the Medicare fee-for-service program. *New England Journal of Medicine*, 360, 1418-1428.

Surgical Site Infections: A Special Look at Readmissions

Since surgical site infections were the most commonly occurring HAI and had the highest percent of readmissions within 30 days, PHC4 took a further look at this topic. Slightly more than 60 percent of patients who contracted a surgical site infection were readmitted for any reason with over 53 percent readmitted for an infection or complication. Of the 5,772 patients who had a surgical site infection, 23.1 percent were identified before the patient was discharged from the hospital where the procedure was performed. For 76.9 percent of patients, their surgical site infections were identified 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 the National Healthcare Safety Network (NHSN). The extent of a hospital's post-discharge surveillance may affect the number of surgical site infections reported.

The table on the following page lists the top 20 procedure categories for the 5,772 patients who acquired a surgical site infection. The table displays the following information for each of the top 20 procedures: 1) the number and/or percent of all patients who underwent a particular procedure and did or did not acquire a surgical site infection, and 2) the percent of readmissions for patients who did or did not contract a surgical site infection.

- For each of the procedures listed in the table, the readmission percentages are higher for the patients who acquired a surgical site infection.
- Of the procedures listed, patients who acquired a surgical site infection with surgery of the spine (laminectomy) for stenosis or herniated disc as their procedure had the highest percent of readmissions for an infection or complication at 78.3 percent; of the patients who underwent this procedure and did not acquire a surgical site infection, 3.0 percent were readmitted for an infection or complication.
- At 75.2 percent, patients who underwent spinal fusion/refusion and contracted a surgical site infection had the second highest readmission rate for an infection or complication; of the spinal fusion/refusion patients who did not acquire a surgical site infection, 3.6 percent were readmitted for an infection or complication.
- While colon and rectal surgery was the procedure with the highest number of patients (758) who acquired a surgical site infection, peripheral vascular bypass was the procedure with the highest percent of patients who acquired surgical site infections. Of all the patients who underwent peripheral vascular bypass surgery, approximately 7.1 percent contracted a surgical site infection.

Readmissions

Top 20 Procedure Categories with a Surgical Site Infection (SSI)

Procedure Category*	Total Number of Patients who Underwent Procedure†	Patients with a SSI				Patients without a SSI		
		Number of Cases‡	Percent of Cases‡	Percent of Patients Readmitted for Any Reason	Percent of Patients Readmitted for an Infection or Complication	Number of Cases‡	Percent of Patients Readmitted for Any Reason	Percent of Patients Readmitted for an Infection or Complication
Total Cases**	956,744	5,772	0.60%	60.1%	53.6%	950,972	14.1%	6.5%
Colon and rectal surgery	17,250	758	4.39%	49.5%	43.3%	16,492	14.4%	9.1%
Cesarean section (C-section)	45,105	348	0.77%	45.2%	41.9%	44,757	1.9%	0.8%
Knee replacement surgery	37,285	346	0.93%	58.2%	54.5%	36,939	5.8%	3.4%
Cardiac surgery	17,950	336	1.87%	72.2%	64.8%	17,614	16.6%	10.1%
Spinal fusion/refusion	19,273	328	1.70%	79.6%	75.2%	18,945	6.6%	3.6%
Hip replacement surgery	22,984	298	1.30%	67.9%	65.2%	22,686	8.9%	5.5%
Surgery to repair bone fracture	18,163	252	1.39%	53.8%	47.4%	17,911	10.1%	5.5%
Brain surgery	9,398	231	2.46%	65.9%	45.3%	9,167	22.6%	10.7%
Surgery to repair hernia	6,925	231	3.34%	57.1%	53.8%	6,694	8.7%	5.2%
Hysterectomy (via abdominal incision)	15,236	224	1.47%	61.5%	54.5%	15,012	4.7%	3.2%
Abdomen/abdominal cavity surgery	7,394	206	2.79%	44.1%	33.9%	7,188	16.2%	9.7%
Small bowel surgery	5,857	196	3.35%	47.5%	37.4%	5,661	18.8%	11.2%
Peripheral vascular bypass surgery	2,642	187	7.08%	69.6%	64.6%	2,455	19.7%	10.5%
Surgery of spine (laminectomy) for stenosis or herniated disc	14,652	178	1.21%	81.3%	78.3%	14,474	5.8%	3.0%
Liver, pancreas, and bile duct surgery	3,422	136	3.97%	67.7%	61.3%	3,286	19.7%	11.4%
Stomach surgery	10,512	133	1.27%	58.8%	53.8%	10,379	9.5%	5.7%
Breast surgery	4,567	103	2.26%	52.1%	52.1%	4,464	5.7%	3.7%
Appendectomy	12,592	100	0.79%	57.3%	55.1%	12,492	4.7%	2.7%
Surgery to remove gallbladder	17,668	87	0.49%	58.0%	50.6%	17,581	8.6%	3.9%
Pacemaker/defibrillator surgery	20,093	76	0.38%	56.2%	52.1%	20,017	15.0%	6.9%

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

† Not all patients who underwent a procedure were included in the readmission analysis. Patients who died, were out-of-state residents, or for which data needed to link hospitalizations was missing were not included in this readmission analysis.

‡ 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.

** Calculations for Total Cases include all cases with a procedure, not just cases included in the top 20 procedure categories.

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. In October 2008, CMS began to reduce payments for a select set of medical errors and complications including several types of healthcare-associated infections (HAIs). In the future, Medicare payments will also be reduced when CMS considers hospitals' readmission rates to be higher than expected.

This section presents estimated Medicare payments for the top 25 principal reasons for which patients age 65 and older were originally admitted to a general acute care facility. Only Medicare patients age 65 and older were included in this analysis; Medicare beneficiaries under age 65 were not included. The estimated Medicare payments for the initial hospitalizations in which patients did or did not acquire an infection are reported. Estimated Medicare payments are also reported for readmissions within 30 days when the principal reason for the readmission was an infection or complication.

The estimated payments are based on the entire hospital stay, not just the payment for treatment related to the infection. Unlike hospital charges, these payments are estimates of what hospitals were actually reimbursed for the treatment of Medicare patients. It is important to note that the differences in Medicare payments for patients with and without HAIs are larger for the initial hospitalization in which an infection was or was not contracted. The differences in the estimated Medicare payments for readmissions for infection or complication are less pronounced.

- In 2009, there were 735,300 hospital admissions for Medicare beneficiaries age 65 and older in Pennsylvania general acute care hospitals; 10,721 (approximately 1.5 percent) of these patients contracted at least one HAI during their stay. The estimated average Medicare payment for the hospitalization in which patients acquired an infection was \$20,471. The estimated average Medicare payment was \$6,615 for a hospitalization in which patients did not acquire an infection.
- Of the Medicare patients age 65 and older who acquired an infection during their hospital stay, 29.5 percent were readmitted within 30 days for an infection or complication. The estimated total Medicare payment for these readmissions was more than \$24.6 million. Of the Medicare patients age 65 and older without an HAI, 8.7 percent were readmitted for an infection or complication.
- For each of the conditions listed in the table on the next two pages, Medicare payments for hospitalizations in which patients acquired an infection were higher than for hospitalizations in which patients did not acquire an infection.

Medicare Payments

Average Medicare Payment for Top 25 Reasons for Admission for Patients 65 Years of Age and Over with an HAI

Principal Reason for Admission*	Number of Cases	Percent of Cases	Estimated Average Medicare Payment for Hospital Stay in which HAI Occurred†	Percent of Patients Readmitted for Infection or Complication	Estimated Average Medicare Payment for Readmissions for Infection or Complication‡
Total Cases‡					
Cases with HAI	10,721	1.46%	\$20,471	29.5%	\$9,477
Cases without HAI	724,579	98.54%	\$6,615	8.7%	\$7,592
Primary cancer					
Cases with HAI	863	3.48%	\$21,564	35.4%	\$11,157
Cases without HAI	23,928	96.52%	\$8,829	8.4%	\$6,599
Septicemia					
Cases with HAI	574	2.39%	\$27,841	26.2%	\$8,365
Cases without HAI	23,410	97.61%	\$10,023	14.5%	\$8,580
Fracture of hip, leg, or foot					
Cases with HAI	485	2.79%	\$13,336	33.6%	\$9,131
Cases without HAI	16,876	97.21%	\$8,086	8.0%	\$7,668
Heart failure					
Cases with HAI	418	0.93%	\$16,679	24.1%	\$7,887
Cases without HAI	44,686	99.07%	\$5,949	9.5%	\$7,295
Inpatient rehabilitation care**					
Cases with HAI	409	2.50%	\$18,271	15.8%	\$8,049
Cases without HAI	15,937	97.50%	\$14,212	8.2%	\$7,999
Complication of internal device, implant, or graft					
Cases with HAI	383	2.28%	\$21,287	43.0%	\$8,501
Cases without HAI	16,425	97.72%	\$9,385	13.0%	\$8,963
Stroke					
Cases with HAI	378	1.92%	\$19,581	21.9%	\$8,319
Cases without HAI	19,305	98.08%	\$6,560	10.4%	\$7,606
Intestinal inflammation					
Cases with HAI	346	1.99%	\$20,442	28.9%	\$5,469
Cases without HAI	17,066	98.01%	\$5,321	7.4%	\$6,888
Heart attack					
Cases with HAI	335	1.68%	\$27,935	20.5%	\$8,566
Cases without HAI	19,549	98.32%	\$9,459	9.6%	\$8,239
Arthritis and joint disorders					
Cases with HAI	326	1.10%	\$11,683	43.5%	\$7,381
Cases without HAI	29,245	98.90%	\$7,979	3.8%	\$6,589
Intestinal obstruction					
Cases with HAI	302	3.19%	\$19,857	21.5%	\$9,327
Cases without HAI	9,169	96.81%	\$6,224	7.4%	\$8,941
Coronary (heart) artery disease and chest pain					
Cases with HAI	294	0.81%	\$29,209	32.7%	\$14,293
Cases without HAI	36,120	99.19%	\$6,902	5.2%	\$6,673

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

† The estimated payments are based on the entire hospital stay, not just the payment for treatment related to the infection.

‡ Calculations for Total Cases include all cases, not just the cases included in the top 25 reasons for admission.

** 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

Average Medicare Payment for Top 25 Reasons for Admission for Patients 65 Years of Age and Over with an HAI

Principal Reason for Admission*	Number of Cases	Percent of Cases	Estimated Average Medicare Payment for Hospital Stay in which HAI Occurred†	Percent of Patients Readmitted for Infection or Complication	Estimated Average Medicare Payment for Readmissions for Infection or Complication†
Peripheral vascular disease (PVD)					
Cases with HAI	274	1.95%	\$20,445	45.0%	\$8,450
Cases without HAI	13,765	98.05%	\$6,959	8.4%	\$7,866
Respiratory failure (adult)					
Cases with HAI	265	2.82%	\$27,698	26.1%	\$9,670
Cases without HAI	9,117	97.18%	\$10,131	15.9%	\$9,634
Acute kidney failure					
Cases with HAI	246	1.63%	\$12,033	19.4%	\$11,779
Cases without HAI	14,874	98.37%	\$5,676	12.9%	\$7,528
Complication of surgical procedure or medical care					
Cases with HAI	246	2.37%	\$22,237	23.6%	\$9,230
Cases without HAI	10,152	97.63%	\$7,158	13.5%	\$7,881
Abnormal heart beat					
Cases with HAI	243	0.51%	\$15,347	28.1%	\$9,713
Cases without HAI	47,731	99.49%	\$5,586	8.5%	\$6,645
Pneumonia					
Cases with HAI	209	0.74%	\$17,990	31.2%	\$7,784
Cases without HAI	28,131	99.26%	\$5,282	10.6%	\$7,569
Heart valve disorders					
Cases with HAI	206	4.29%	\$55,108	35.1%	\$16,053
Cases without HAI	4,599	95.71%	\$23,317	11.3%	\$8,747
Osteoporosis and back disorders					
Cases with HAI	204	1.59%	\$15,995	58.3%	\$12,000
Cases without HAI	12,601	98.41%	\$6,497	5.1%	\$7,092
Abdominal hernia					
Cases with HAI	199	4.11%	\$19,114	37.7%	\$7,208
Cases without HAI	4,642	95.89%	\$7,619	6.7%	\$7,762
Spinal cord injury and head trauma					
Cases with HAI	197	3.24%	\$29,431	20.3%	\$14,662
Cases without HAI	5,892	96.76%	\$7,933	8.9%	\$9,655
Aneurysm/blood clot of artery in abdomen or limb					
Cases with HAI	181	3.93%	\$41,336	38.7%	\$13,482
Cases without HAI	4,423	96.07%	\$13,576	8.5%	\$7,992
Secondary cancer					
Cases with HAI	174	2.11%	\$18,176	27.7%	\$5,555
Cases without HAI	8,056	97.89%	\$7,800	8.9%	\$7,389
Intestinal infection					
Cases with HAI	172	2.43%	\$12,010	18.2%	\$6,502
Cases without HAI	6,898	97.57%	\$5,435	12.9%	\$6,546

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

† The estimated payments are based on the entire hospital stay, not just the payment for treatment related to the infection.

HAIs by Facility Type

The percent of cases with a healthcare-associated infection (HAI) varied by inpatient facility type. The vast majority (95.4 percent) of patients in this analysis were treated at general acute care hospitals, followed by psychiatric facilities (2.5 percent) and rehabilitation facilities (1.4 percent).

- At 9.74 percent, long-term acute care hospitals have the highest percent of hospitalizations in which the patient acquired an infection, followed by rehabilitation facilities at 2.78 percent and general acute care facilities at 1.15 percent.
- Urinary tract infections and gastrointestinal infections are the most common types of HAIs that occur in long-term acute care hospitals and rehabilitation facilities.
- Surgical site infections are the most frequently occurring HAI for general acute care hospitals.

Cases with an HAI by Facility Type

	Number of Cases	General Acute Care Hospitals	Long-Term Acute Care Hospitals	Inpatient Rehabilitation Facilities	Inpatient Psychiatric Facilities	Other Inpatient Facilities*
Total Cases	1,939,111	1,849,657	9,892	26,767	47,913	4,882
Cases with Infections	23,287	1.15%	9.74%	2.78%	0.63%	0.18%
Urinary Tract	5,175	0.24%	2.97%	1.71%	0.05%	0.04%
Pneumonia	2,238	0.12%	0.54%	0.04%	0.01%	0.00%
Bloodstream	2,365	0.12%	1.65%	0.09%	0.00%	0.00%
Surgical Site [†]	5,772	0.61%	0.00%	0.00%	0.00%	0.00%
Gastrointestinal	4,144	0.20%	2.26%	0.80%	0.00%	0.04%
Other Infections [‡]	1,799	0.08%	0.86%	0.09%	0.55%	0.10%
Multiple Infections	1,794	0.09%	1.46%	0.06%	0.02%	0.00%

* Other inpatient facilities provide such services as drug and alcohol treatment.

[†] Calculations for percent of surgical site infections only include those patients who underwent a surgical procedure.

[‡] 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.

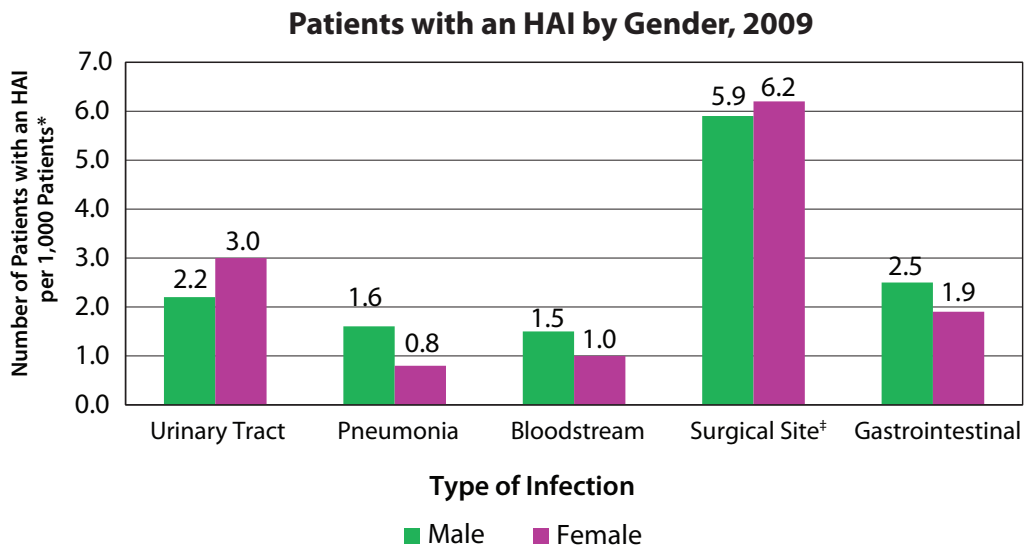
HAIs and Patient Demographics

This section presents information on three demographic characteristics – gender, age and race/ethnicity – for the patients who acquired a healthcare-associated infection (HAI). While differences are noted among demographic groups, HAIs affect patients from all walks of life.

HAIs by Gender

- There were slight differences between male and female patients in the rate of infections contracted while in the hospital. For any type of infection, 13.0 per 1,000 male patients contracted an infection compared to 11.3 per 1,000 female patients.

Gender	Number of Patients with an HAI per 1,000 Patients*
Male	13.0
Female	11.3



- Surgical site infections[‡] occurred most often for both males and females.
- The largest difference occurred in pneumonia; 1.6 per 1,000 male patients contracted pneumonia compared to 0.8 per 1,000 female patients.
- Females acquired more urinary tract infections than males, 3.0 per 1,000 female patients compared to 2.2 per 1,000 male patients.

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

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

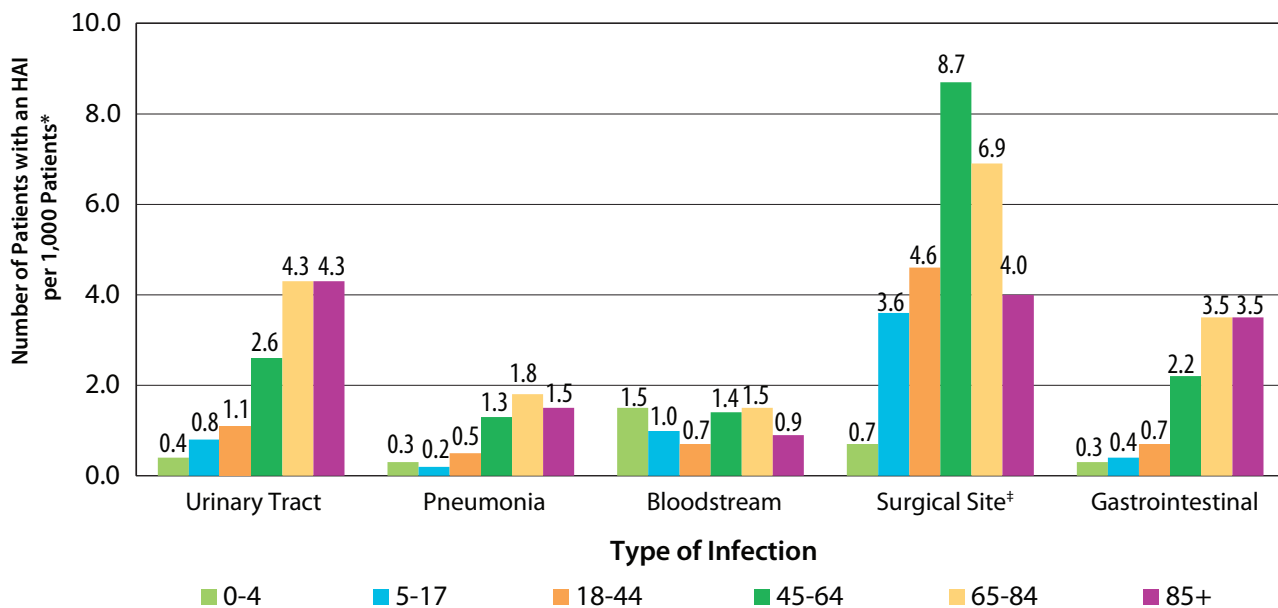
HAI and Patient Demographics

HAI by Age

- Older patients acquired more infections than younger patients.
- Patients 65 to 84 years of age had the highest rate of HAIs, 16.6 per 1,000 patients in that age group.

Age in Years	Number of Patients with an HAI per 1,000 Patients*
0-4	4.5
5-17	5.8
18-44	7.0
45-64	14.3
65-84	16.6
85+	12.8

Patients with an HAI by Age, 2009



- Surgical site infections[†] were the most frequently occurring infection for all but the youngest and oldest age groups: 3.6 per 1,000 patients age 5-17; 4.6 per 1,000 patients age 18-44; 8.7 per 1,000 patients age 45-64; and 6.9 per 1,000 patients age 65-84.
- Bloodstream infections were the most frequently occurring HAI for patients in the youngest age group, 1.5 per 1,000 patients age 0-4.
- Urinary tract infections were the most common type of infection acquired by patients in the oldest age group, 4.3 per 1,000 patients age 85 or older.

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

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

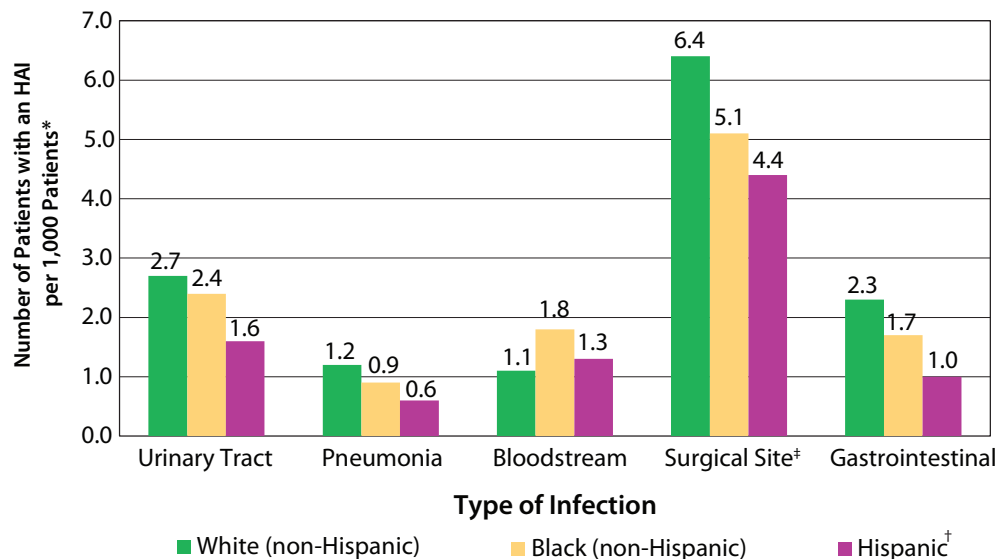
HAI and Patient Demographics

HAI by Race/Ethnicity

- HAI occurred most frequently in white (non-Hispanic) patients at a rate of 12.2 per 1,000 white (non-Hispanic) patients. Black (non-Hispanic) patients had 11.4 HAIs per 1,000 black (non-Hispanic) patients. Hispanic patients had 8.2 HAIs per 1,000 Hispanic patients.

Race/Ethnicity	Number of Patients with an HAI per 1,000 Patients*
White (non-Hispanic)	12.2
Black (non-Hispanic)	11.4
Hispanic [†]	8.2

Patients with an HAI by Race/Ethnicity, 2009



- Surgical site infections[‡] were the most frequently occurring infection for all race/ethnicity groups: 6.4 per 1,000 white (non-Hispanic) patients; 5.1 per 1,000 black (non-Hispanic) patients; and 4.4 per 1,000 Hispanic patients.
- Urinary tract, pneumonia, surgical site and gastrointestinal infections occurred more frequently for white (non-Hispanic) patients than for black (non-Hispanic) or Hispanic patients.
- Black (non-Hispanic) patients had the most bloodstream infections at 1.8 per 1,000 black (non-Hispanic) patients. Hispanic patients had 1.3 bloodstream infections per 1,000 Hispanic patients. White (non-Hispanic) patients had 1.1 bloodstream infections per 1,000 white (non-Hispanic) patients.

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

[†] Internal PHC4 analysis suggests that Hispanic ethnicity may be slightly underreported.

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

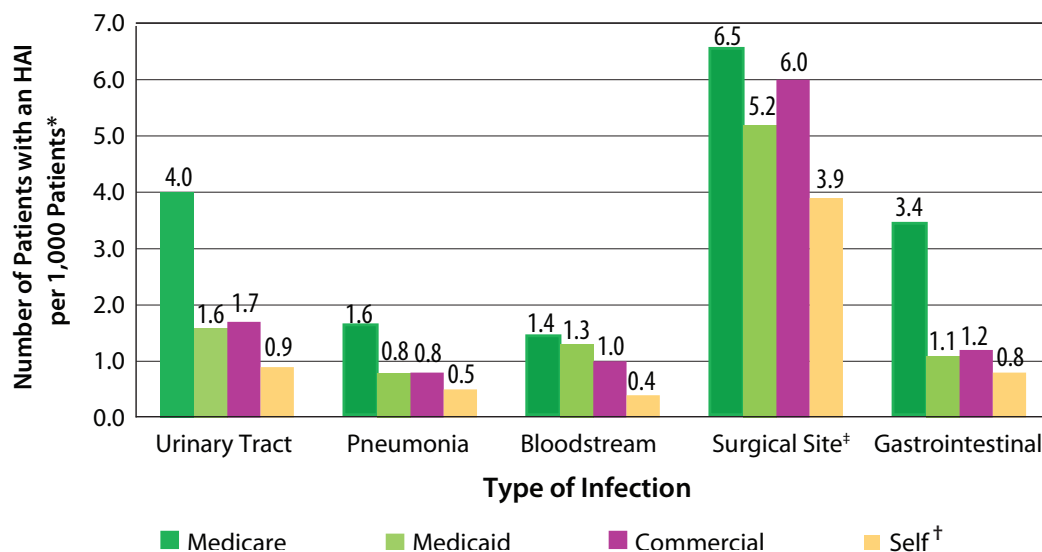
HAIs by Payer

This section shows the primary payer for hospitalizations in which patients contracted a healthcare-associated infection (HAI). Hospitalization data by payer sheds light on the financial burden of these infections, particularly the impact on Medicare.

- Medicare patients acquired infections while in the hospital more often than patients in any of the other payer groups (i.e., Medicaid, commercial or self).

Payer	Number of Patients with an HAI per 1,000 Patients*
Medicare	15.4
Medicaid	9.2
Commercial	9.7
Self†	5.0

Patients with an HAI by Payer, 2009



- Surgical site infections‡ were the most frequently occurring infection for all payers. Patients covered by Medicare had the most surgical site infections at 6.5 per 1,000 Medicare patients, followed by patients covered by commercial insurance at 6.0 per 1,000 commercial insurance patients.
- Patients covered by Medicare were much more likely to acquire urinary tract and gastrointestinal infections than patients covered by any of the other payers.

* To account for differences in the percent of patients of a particular payer group, calculations for each payer group only included patients in that particular group (e.g., calculations for Medicare patients only included Medicare patients).

† Includes patients who are uninsured.

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



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