

Research Brief

Implications from Research Results

Presented at the November 2006 OHREC Public Meeting



Infections Due to Medical Care in Oregon Hospitals, 2003-2005

Background

Healthcare Associated Infections (HAI) are defined as infections contracted in healthcare settings while receiving treatment for other conditions. HAI, which include infections at surgical or trauma sites, infections caused by the use of IVs and catheters and ventilator-associated pneumonias, extend hospital stays and complicate medical care, causing worse clinical outcomes and higher rates of mortality.

The U.S. Centers for Disease Control and Prevention estimates that HAI contracted in U.S. hospitals account for approximately two million infections, 90,000 deaths and an estimated \$4.5 billion in excess costs annually. It has also been estimated that 5-15% of all hospitalized patients experience an HAI and that these cases currently are widely under-reported. This Brief is an initial attempt to describe the extent and state-level financial impact of HAI in hospitals in Oregon from 2003 to 2005.

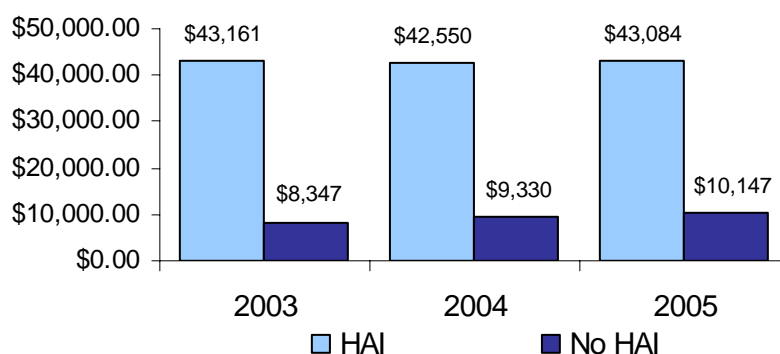
Key Findings

- The average estimated cost per stay is at least \$32,000 higher for a patient with an HAI compared to a patient without an HAI
- The estimated excess Medicaid costs for HAI exceeded \$2.4 million in 2005
- The estimated excess costs for all payers for HAI exceeded \$15 million in 2005
- The excess costs are not explained by differences in age, gender, comorbidities, or severity of illness.

Selected Infections Due to Medical Care

These infections are secondary diagnoses primarily related to the use of intra-venous devices (IVs). Cases are excluded if the patient has compromised immunity (e.g., cancer, HIV); if one of the two diagnosis codes is the primary diagnosis; or if the length of stay is less than two days.

Figure 1: Average Cost per Stay, Infections Due to Medical Care (Oregon)



Infections Due to Medical Care in Oregon Hospitals, 2003-2005

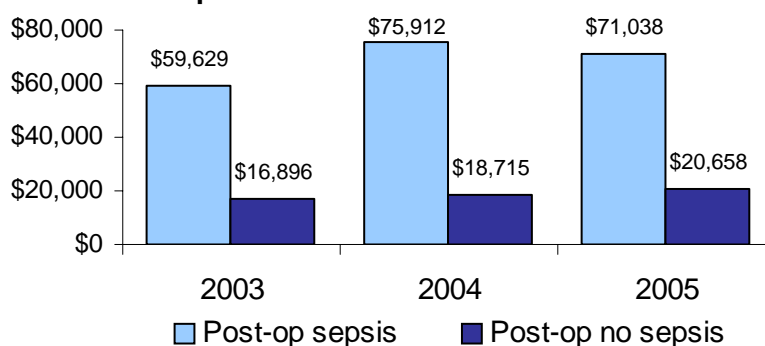
As expected, there was a dramatic difference in mean estimated cost for patients with HAI compared to patients with no HAI (Figure 1). The potential excess costs average over \$32,000 per patient. Statewide, the potential excess cost is greater than \$11 million per year.

Post-Operative Sepsis

These are secondary diagnosis codes in patients with an elective surgical procedure (verified by a surgical DRG and a surgical procedure code). Cases are excluded as described for infections due to medical care with the following differences: the length of stay exclusion is less than four days rather than two, and pregnancy and childbirth cases are

excluded. As with infections due to medical care, there were dramatic differences in the average estimated cost for post-operative hospital patients with sepsis compared to post-operative hospital patients without sepsis (Figure 2).

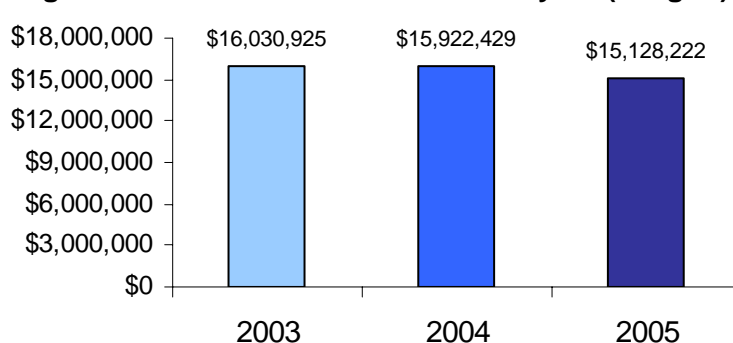
Figure 2: Average Cost per Stay, Post-Operative Sepsis



Statewide, the potential excess costs for post-operative sepsis were over \$12 million from 2003 to 2005, and approximately \$1.1 million of the total were costs to Medicaid.

For the large proportion of capitated Medicaid patients, the excess costs are indirectly reflected in the capitation rate. Statewide, the total excess costs for infections due to medical care and post-operative sepsis resulted in \$8.1 million in costs to Medicaid during calendar years 2003, 2004, and 2005. The total statewide costs for all payers exceeded \$47 million during calendar years 2003, 2004, and 2005 (Figure 3).

Figure 3: Total Excess Cost for All Payers (Oregon)



Policy Implications

Healthcare acquired infections have serious clinical, financial and policy implications for Oregon. At minimum, these estimates of excess costs represent an opportunity to redirect scarce resources currently spent treating HAI. Reducing HAI could contribute to a reduction in the rate of increase in insurance premiums and help prevent those on the bubble from dropping their coverage. As part of the effort to improve the transparency of health care quality and cost, the state should work with hospitals to improve reporting and to develop practical interventions to eliminate most or all HAI.



The Office for Oregon
Health Policy & Research

Infections Due to Medical Care in Oregon Hospitals, 2003-2005

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Infections Due to Medical Care in Oregon Hospitals, 2003-2005

Key Findings

- The average estimated cost per stay at Oregon hospitals is approximately \$32,000 higher for a patient with a healthcare associated infection compared to a patient without a healthcare associated infection.
- The estimated excess Medicaid costs in Oregon for healthcare associated infections exceeded \$2.4 million in 2005.
- The estimated excess costs in Oregon for all payers for healthcare associated infections exceeded \$15 million in 2005.
- The excess costs are not explained by differences in age, gender, comorbidities, or severity of illness.

Background

The U.S. Centers for Disease Control and Prevention (CDC) estimates that healthcare associated infections contracted in U.S. hospitals account for approximately two million infections, 90,000 deaths and an estimated \$4.5 billion in excess costs annually.¹ It has also been estimated that 5-15% of all hospitalized patients experience an HAI and that these cases are widely under-reported.²⁻⁴

Healthcare Associated Infections (HAI) are defined as infections contracted in healthcare settings while receiving treatment for other conditions. HAI, which include infections at surgical or trauma sites, infections caused by the use of IVs and catheters and ventilator-associated pneumonias, extend hospital stays and complicate medical care, causing worse clinical outcomes and higher rates of mortality.⁵⁻⁸

While there is little doubt that HAIs have serious clinical, financial, and policy implications for patients, hospitals and the state of Oregon, beginning to quantify the extent of those impacts is difficult. There is no consensus about how to define and measure HAI, and existing methods may not accurately and consistently detect HAI cases.⁹ This is partially because some HAIs, such as surgical site infections, often show up only after discharge¹⁰ while others, such as ventilator-associated pneumonias, can be difficult to detect. Nevertheless, a wide and growing body of literature utilizing various methods has reported dramatic differences in clinical outcomes and costs in hospitalized patients with HAI compared to hospitalized patients without HAI.

This Brief is an initial attempt to describe the extent and state-level financial impact of healthcare associated infections in hospitals in Oregon from 2003 to 2005. Because there is no “gold standard” data source in Oregon, the Office for Oregon Health Policy and Research (OHPR) applied a case-finding approach developed by the U.S. Agency for Healthcare Research and Quality (AHRQ), which utilizes readily available hospital discharge data to develop an estimate of HAI cases and their costs.

AHRQ Patient Safety Indicators

The AHRQ has constructed a series of evidence-based formulas, or algorithms, known as Patient Safety Indicators (PSIs), to work with hospital discharge records.¹¹ Two of the AHRQ PSIs, *Selected Infections Due to Medical Care (PSI 07)* and *Post-Operative Sepsis (PSI 13)*, are intended to detect HAI cases. The PSIs were developed and refined by a panel of clinicians and peer reviewers facilitated by the Evidence-based Practice Center at UCSF-Stanford. The AHRQ

Patient Safety Indicators tend to conservatively identify HAI cases, probably underestimating the true number of events.

Estimated Cost of HAIs

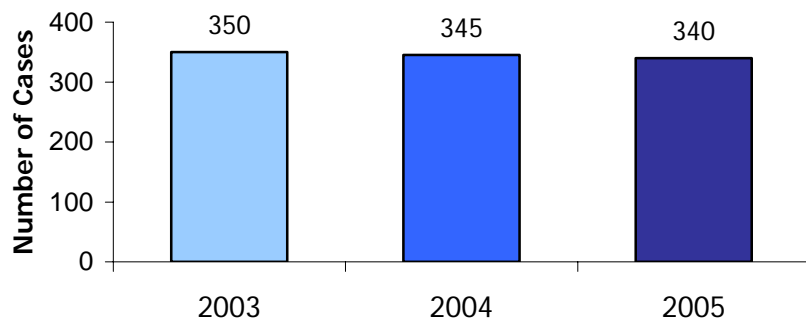
In order to estimate the “excess” costs associated with the HAIs included in this analysis, OHP used data available in the annual hospital discharge data collected by the Oregon Association of Hospitals and Health Systems (OAHHS). The hospital discharge data consists of patient-level billing extracts which include “total charges,” or the dollar amount charged for the hospitalization, not the amount paid or the actual cost of care. To obtain a better estimate of true costs, total charges for each case were multiplied by hospital cost-to-charge ratios produced by the U.S. Centers for Medicare and Medicaid Services (CMS). This is a rough estimate since the available cost-to-charge ratios are averages for groups of Oregon hospitals and may not accurately reflect the true costs incurred at a specific hospital. The estimated costs were aggregated to the state level by year and then stratified by primary payer; outliers, or cases with excessively high or excessively low costs, were excluded. The average cost was then calculated at the state level and by primary payer. Finally, the estimated costs of HAIs are calculated as “excess” costs, or those risk-adjusted costs that are above what would be expected for the same condition or procedure had there been no infection.

Selected Infections Due to Medical Care

The AHRQ Indicator for *Selected Infections Due to Medical Care (PSI 07)* flags two secondary diagnosis codes, primarily related to the use of intravenous devices (IVs). Cases are excluded if the patient has compromised immunity (e.g., cancer, HIV); if one of the two diagnosis codes is the primary diagnosis; or if the length of stay is less than two days.

Overall, the annual number of cases identified by the AHRQ indicator remained relatively unchanged from 2003 to 2005 (Figure 1).

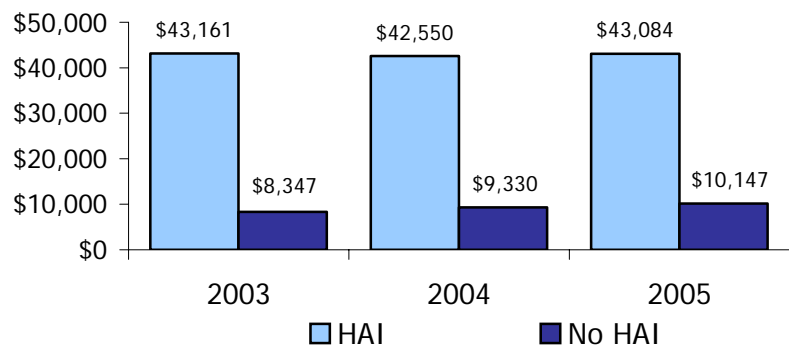
Figure 1: Infection due to medical care (Oregon)



As expected, there was a dramatic difference in average estimated costs for patients with HAI compared to patients with no HAI (Figure 2). The potential *excess* costs average over \$32,000 per patient.

Statewide, the potential excess cost across all payers for selected infections due to medical care is greater than \$11 million per year.

Figure 2: Average Cost per Stay (Oregon)



The estimated excess Medicaid costs for selected infections due to medical care were about \$2.4 million in 2005 (Figure 3).

Most HAI cases were paid by Medicare or commercial insurance (Figure 4).

Post-Operative

Figure 3: Potential Excess Medicaid Costs (Oregon)

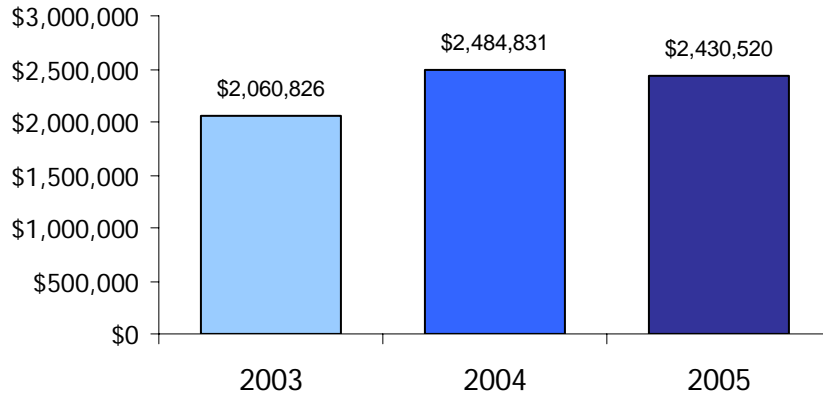
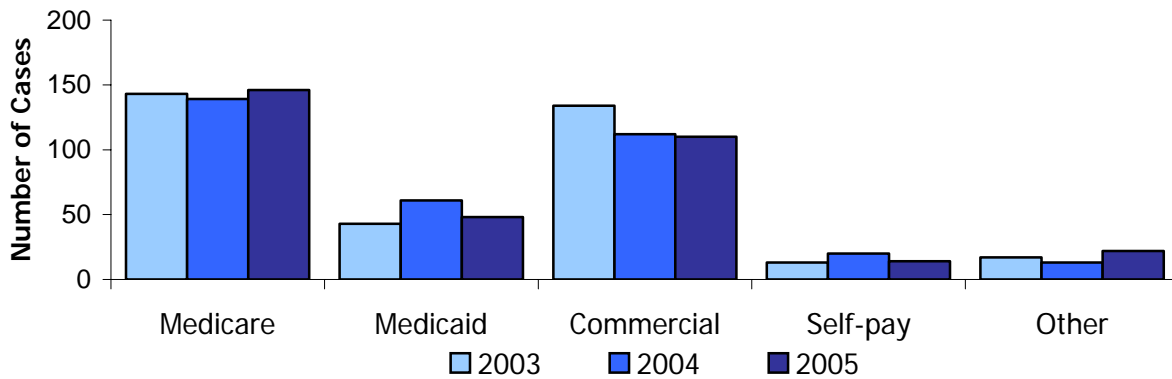


Figure 4: Infections Due to Medical Care by Payer (Oregon)



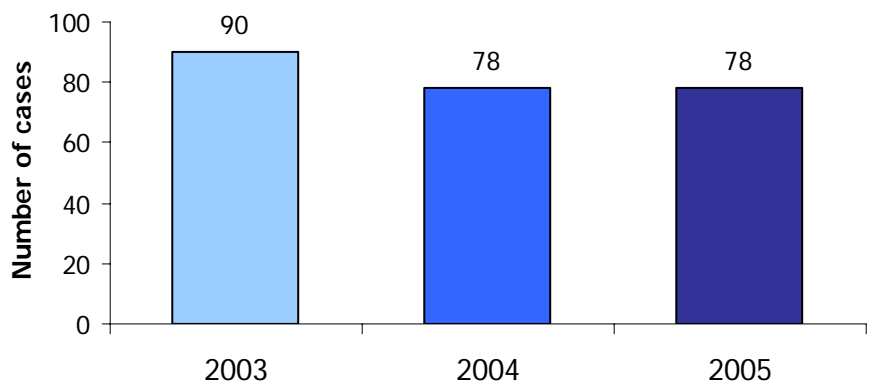
Sepsis

The AHRQ indicator for *Post-Operative Sepsis (PSI 13)* flags 20 secondary diagnosis codes in patients with an elective surgical procedure (verified by a surgical DRG and a surgical procedure code).

Cases are excluded as described above for the *Infections Due to Medical Care* indicator with the following differences: the length of stay exclusion is less than four days rather than two, and pregnancy and childbirth cases are excluded.

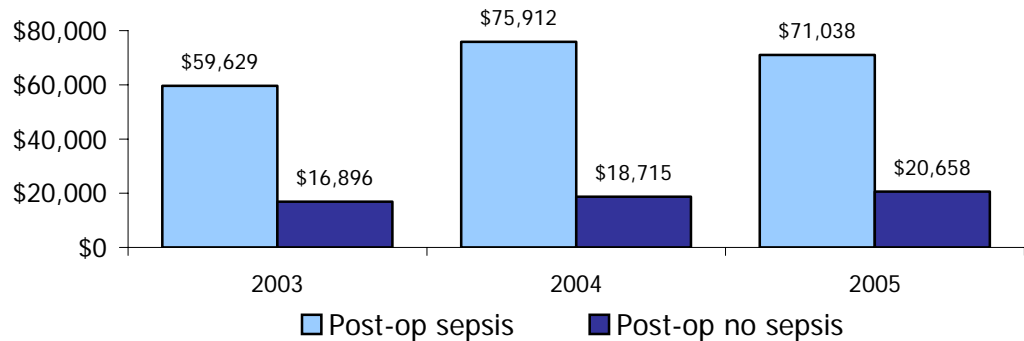
Overall, a relatively small number of cases are detected in the hospital discharge data (Figure 5).

Figure 5: Post-Operative Sepsis (Oregon)



As with infections due to medical care, there were dramatic differences in the average estimated cost for post-operative hospital patients with sepsis compared to

Figure 6: Average Estimated Cost per Stay (Oregon)

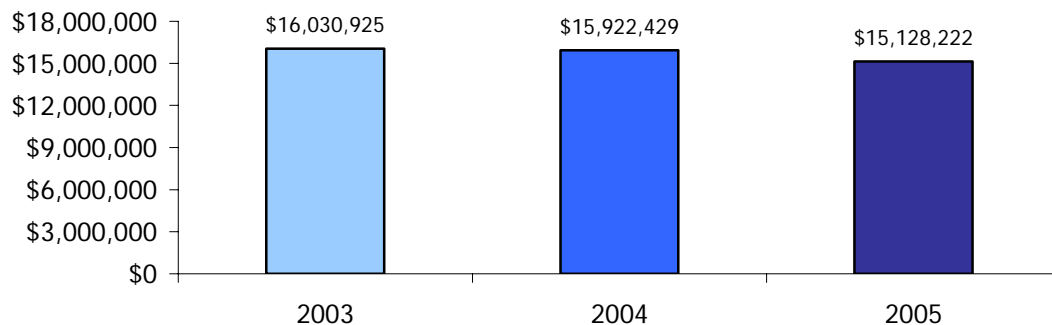


post-operative hospital patients without sepsis (Figure 6). ***Statewide, the potential excess costs for post-operative sepsis were over \$12 million from 2003 to 2005, and approximately \$1.1 million of the total were costs to Medicaid.***

Total Estimated Excess Costs

Statewide, the estimated total excess costs for *Infections Due to Medical Care and Post-Operative Sepsis* combined resulted in \$8.1 million in costs to Medicaid during calendar years 2003, 2004, and 2005. The estimated total statewide costs for all payers exceeded \$47 million during calendar years 2003, 2004, and 2005 (Figure 7).

Figure 7: Total Excess Costs for All Payers (Oregon)



Other Potential Explanations

Any of the estimates of excess cost are influenced by many factors that might also affect the overall costs of care, and these must be accounted for in any model which attempts to assign these costs to the presence of an HAI. For instance, the AHRQ *Post-Operative Sepsis* indicator is impacted to some degree by age, gender, and the severity of illness. The age and gender differences are quite modest and cannot explain the significant cost differences between patients with HAI and without HAI.

One could easily argue, however, that much of the differences in cost could be explained by the severity of a patient's illness aside from HAI. One way to examine the impact of severity of illness is to examine the relationship between severity and cost using a risk-adjustment methodology such as 3Ms APR-DRG program. The APR-DRG program assigns each patient a Severity of Illness (SOI) score based on his or her diagnoses, procedure undergone, age, gender, and patient status at discharge.¹² Patients with higher SOI scores are more severely ill. In patients who are otherwise identical, patients with HAI can generally be expected to have

Table 1: Severity of Illness

Year	Severity of Illness (SOI)	All Patients	Medical-Surgical Patients with No HAI	Medical-Surgical Patients with HAI
2003	Minor	32.0%	32.0%	3.4%
	Moderate	45.9%	45.9%	27.7%
	Major	18.5%	18.5%	28.3%
	Extreme	3.7%	3.6%	40.6%
2004	Minor	36.7%	36.8%	4.1%
	Moderate	42.3%	42.3%	20.0%
	Major	17.7%	17.6%	44.9%
	Extreme	3.3%	3.2%	31.0%
2005	Minor	35.4%	35.5%	4.4%
	Moderate	42.3%	42.4%	20.0%
	Major	18.5%	18.4%	35.0%
	Extreme	3.7%	3.7%	40.6%

higher SOI scores than patients without HAI. This proved to be true for Oregon's medical and surgical inpatients with HAI from 2003 through 2005 (Table 1).

Even after stratifying by minor, moderate, major, and extreme severities of illness, dramatic differences in the average estimated cost remain (Table 2).

Costs can be further stratified by principal diagnosis so that average costs for patients with the same diagnoses and severity of illness with and without HAI can be compared (Table 3). Again, the cost differences remain.

Thus, severity of illness does not explain the estimated

cost differences in patients with HAI compared to patients without HAI. These results are consistent with national studies that found excess costs for patients with HAI after controlling for severity of illness.¹³⁻¹⁸

Table 2: Estimated Average Cost by Severity of Illness

Year	Severity of Illness (SOI)	Medical-Surgical Patients with No HAI	Medical-Surgical Patients with HAI
2003	Minor	\$6,094	\$11,364
	Moderate	\$7,409	\$15,285
	Major	\$11,155	\$31,551
	Extreme	\$26,496	\$72,486
2004	Minor	\$6,568	\$8,715
	Moderate	\$8,556	\$16,541
	Major	\$13,030	\$37,809
	Extreme	\$31,176	\$71,049
2005	Minor	\$7,108	\$13,562
	Moderate	\$9,156	\$18,925
	Major	\$13,951	\$31,476
	Extreme	\$31,952	\$69,002

Table 3: Estimated Average Costs by Selected Diagnoses

Principal diagnosis	Severity of Illness (SOI)	Medical-Surgical Patients with No HAI	Medical-Surgical Patients with HAI
Acute respiratory failure	Extreme	\$28,442	\$88,552
Subarachnoid hemorrhage	Major	\$40,251	\$68,791
Acute renal failure	Major	\$8,267	\$30,902

Another possible explanation for the estimated differences in costs is the number of other illnesses, or comorbidities, per patient. The median number of severe comorbidities is not dramatically different in patients with HAI compared to those without HAI (Table 4), even when

stratified by severity of illness and selected principal diagnoses (Table 5). Severe comorbidities do not explain the large cost differences in patients with HAI compared to those without HAI.

Finally, the results reported here are also extremely unlikely to be due to random chance or misclassification.

As previously noted, HAI are

probably widely under-reported,

which serves only to underestimate the true number of patients with HAI. If 5 -15% of all hospitalized patients develop HAI, then at least 17,000 Oregonians suffered from HAI each year from 2003-2005. Under-reporting HAI also causes substantial under-estimation of total excess healthcare costs resulting from HAI.

Table 4: Median number of severe comorbidities

Severity of Illness (SOI)	Medical-Surgical Patients with No HAI	Medical-Surgical Patients with HAI
Minor	1	1
Moderate	2	1
Major	2	2
Extreme	2	1

Table 5: Median number of severe comorbidities

Principal diagnosis	Severity of Illness (SOI)	Medical-Surgical Patients with No HAI	Medical-Surgical Patients with HAI
Acute respiratory failure	Extreme	3	2
Subarachnoid hemorrhage	Major	1	2
Acute renal failure	Major	3	2

Policy Implications

Healthcare acquired infections have serious clinical, financial and policy implications for Oregon. ***Using AHRQ's conservative estimates of infections due to medical care and post-operative sepsis, the total estimated expenses to the state for Medicaid costs during calendar years 2003, 2004, and 2005 is at least \$8.1 million, or approximately \$2.7 million per calendar year on average.*** The excess costs are not explained by differences in age, gender, severity of illness, or severe comorbidities. Due to the conservative estimates and the high likelihood of under-reporting, the true costs are probably much higher.

Statewide, the overall excess costs of HAI during 2003, 2004, and 2005 averaged approximately \$15.5 million per calendar year. At minimum, these estimates of excess costs represent an opportunity to redirect scarce resources currently spent treating HAI. Reducing HAI and therefore the costs associated with HAI could contribute to a reduction in the rate of increase in insurance premiums.

As part of the effort to improve the transparency of health care quality and cost, the state should work with hospitals to improve reporting and to develop practical interventions to eradicate HAI. The potential savings from eliminating most or all HAI could reduce Medicaid costs to the state as well as mitigate the financial and health impacts of HAI on Oregonians.

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Appendix A: Comorbidities Flagged by AHRQ PSI Indicators

AIDS
Alcohol abuse
Congestive heart failure
Chronic blood loss anemia
Chronic pulmonary disease
Coagulopathy
Deficiency anemia
Depression
Diabetes
Diabetes with chronic complications
Drug abuse
Fluid and electrolyte disorders
Hypothyroidism
Hypertension
Liver disease
Lymphoma
Metastatic cancer
Obesity
Other neurological disorders
Paralysis
Peptic ulcer disease with bleeding
Peripheral vascular disease
Pulmonary circulation disease
Psychoses
Renal failure
Rheumatoid arthritis
Solid tumor without metastasis
Valvular disease
Weight loss