**Appendix: Electronic Query Descriptions**

**CLABSI**

Eligibility:

All pediatric patients less than 22 years old who had ambulatory visits at one of these five sites from October 1, 2010 through September 30, 2015 were eligible for inclusion.

**3 Queries:**

**Query 1: Patients with ICD9 codes for CLABSI:**

1. All children with ICD-9 codes for infections or complications due to central catheter or indwelling devices billed in ambulatory settings, on admission, or within 48 hours of admission.

1. ICD9 999.31: Other and unspecified infection due to central venous catheter
2. ICD9 999.32: Bloodstream infection due to central venous catheter
3. ICD9 999.33: Local infection due to central venous catheter
4. ICD9 999.34: Acute infection following transfusion, infusion, or injection of blood and blood products
5. ICD9 999.39: Infection following other infusion, injection, transfusion, or vaccination
6. ICD9 996.60: Infection and inflammatory reaction due to unspecified device, implant, and graft
7. ICD9 996.62: Infection and inflammatory reaction due to other vascular device, implant, and graft
8. ICD9 996.69: Infection and inflammatory reaction due to other internal prosthetic device, implant, and graft
9. ICD9 996.70: Other complications due to unspecified device, implant, and graft
10. ICD9 996.74: Other complications due to other vascular device, implant, and graft
11. ICD9 996.79: Other complications due to other internal prosthetic device, implant, and graft

**Query 2: Patients with positive blood cultures & ICD9/CPT codes suggesting diagnoses at high risk for or specific central catheter usage:**

1. Patients with positive blood culture (defined as any organism growth) collected >2 days after discharge or <2 days after admission and one of the below diagnoses

2. Exclude patients already identified in Query 1

1. Diagnosis of Oncology:
2. ICD9 140.0-149.0: Malignant neoplasm of lip, oral cavity and pharynx
3. ICD9 150.0-159.0: Malignant neoplasm of digestive organs and peritoneum
4. ICD9 160.0-165.0: Malignant neoplasm of respiratory and intrathoracic organs
5. ICD9 170.0-176.0: Malignant neoplasm of bone, connective tissue, skin and breast
6. ICD9 179.0-189.0: Malignant neoplasm of genitourinary organs
7. ICD9 190.0-199.0: Malignant neoplasm of other and unspecified sites
8. ICD9 200.0-209.0: Malignant neoplasm of lymphatic and hematopoietic tissue
9. ICD9 210.0-229.0: Benign neoplasms
10. ICD9 230.0-234.0: Carcinoma in situ
11. ICD9 235.0-238.0: Neoplasms of uncertain behavior
12. ICD9 239.0: Neoplasms of unspecified nature
13. Diagnosis of Chemotherapy & Immunotherapy:
14. ICD9 V07.2: Prophylactic immunotherapy
15. ICD9 V07.39: Administration, prophylactic chemotherapeutic NEC
16. ICD9 V58.11: Antineoplastic chemotherapy encounter for oral, intravenous
17. ICD9 V58.0: Radiation therapy
18. ICD9 V58.12: Immunotherapy
19. ICD9 V66.2: Convalescence following chemotherapy
20. Diagnosis of Bone Marrow Transplant:
21. ICD9 41.00: Bone marrow transplant, not otherwise specified
22. ICD9 41.01: Autologous bone marrow transplant without purging
23. ICD9 41.02: Allogeneic bone marrow transplant with purging
24. ICD9 41.03: Allogeneic bone marrow transplant without purging
25. ICD9 41.04: Autologous hematopoietic stem cell transplant without purging
26. ICD9 41.05: Allogeneic hematopoietic stem cell transplant without purging
27. ICD9 41.06: Cord blood stem cell transplant
28. ICD9 41.07: Autologous hematopoietic stem cell transplant with purging
29. ICD9 41.08: Allogeneic hematopoietic stem cell transplant with purging
30. ICD9 41.09: Autologous bone marrow transplant with purging
31. ICD9 41.31: Biopsy of bone marrow
32. ICD9 41.38: Other diagnostic procedures on bone marrow
33. ICD9 41.92: Injection into bone marrow
34. ICD9 41.98: Other operations on bone marrow
35. ICD9 v42.81: Transplanted bone marrow
36. ICD9 996.85: Bone marrow
37. ICD9 996.69: Infection or inflammation
38. ICD9 996.51: Rejection
39. Diagnosis of Hematology Disorder:
40. ICD9 282: Hereditary hemolytic anemias
41. ICD9 282.0: Hereditary spherocytosis
42. ICD9 282.1: Hereditary elliptocytosis
43. ICD9 282.2: Anemias due to disorders of glutathione metabolism
44. ICD9 282.3: Other hemolytic anemias due to enzyme deficiency
45. ICD9 282.4: Thalassemias
46. ICD9 282.40: Thalassemia, unspecified
47. ICD9 282.41: Sickle-cell thalassemia without crisis
48. ICD9 282.42: Sickle-cell thalassemia with crisis
49. ICD9 282.43: Alpha thalassemia
50. ICD9 282.44: Beta thalassemia
51. ICD9 282.45: Delta-beta thalassemia
52. ICD9 282.46: Thalassemia minor
53. ICD9 282.47: Hemoglobin E-beta thalassemia
54. ICD9 282.49: Other thalassemia
55. ICD9 282.5: Sickle-cell trait
56. ICD9 282.6: Sickle-cell disease
57. ICD9 282.60: Sickle-cell disease, unspecified
58. ICD9 282.61: Hb-SS disease without crisis
59. ICD9 282.62: Hb-SS disease with crisis
60. ICD9 282.63: Sickle-cell/Hb-C disease without crisis
61. ICD9 282.64: Sickle-cell/Hb-C disease with crisis
62. ICD9 282.68: Other sickle-cell disease without crisis
63. ICD9 282.69: Other sickle-cell disease with crisis
64. ICD9 282.7: Other hemoglobinopathies
65. ICD9 282.8: Other specified hereditary hemolytic anemias
66. ICD9 282.9: Hereditary hemolytic anemia, unspecified
67. ICD9 283: Acquired hemolytic anemias
68. ICD9 283.0: Autoimmune hemolytic anemias
69. ICD9 283.1: Non- autoimmune hemolytic anemias
70. ICD9 283.10: Non-autoimmune hemolytic anemia, unspecified
71. ICD9 283.11: Hemolytic Uremic Syndrome
72. ICD9 283.19: Other non- autoimmune hemolytic anemias
73. ICD9 283.2: Hemoglobinuria due to hemolysis from external causes
74. ICD9 283.9: Acquired hemolytic anemia, unspecified
75. ICD9 284: Aplastic anemia and other bone marrow failure syndromes
76. ICD9 284.0: Constitutional aplastic anemia
77. ICD9 284.01: Other specified aplastic anemias
78. ICD9 284 .09: Other constitutional aplastic anemia
79. ICD9 284.1: Pancytopenia
80. ICD9 284 .11: Antineoplastic chemotherapy induced pancytopenia
81. ICD9 284.12: Other drug-induced pancytopenia
82. ICD9 284 .19: Other pancytopenia
83. ICD9 284.2: Myelophthisis
84. ICD9 284 .8: Other specified aplastic anemias
85. ICD9 284.81: Red cell aplasia (acquired) (adult)(with thymoma)
86. ICD9 284.89: Other specified aplastic anemias
87. ICD9 284.9: Aplastic anemia, unspecified
88. ICD9 285: Other and unspecified anemias
89. ICD9 285.0: Sideroblastic anemia
90. ICD9 285.21: Anemia in chronic kidney disease
91. ICD9 285.22: Anemia in neoplastic disease
92. ICD9 285.3: Antineoplastic chemotherapy induced anemia
93. ICD9 286: Coagulation defects
94. ICD9 286.0: Congenital factor VIII disorder
95. ICD9 286.1: Congenital factor IX disorder
96. ICD9 286.2: Congenital factor XI deficiency
97. ICD9 286.3: Congenital deficiency of other clotting factors
98. ICD9 286.4: Von Willebrand’s disease
99. ICD9 286.5: Hemorrhagic disorder due to intrinsic circulating anticoagulants
100. ICD9 286.52: Acquired hemophilia
101. ICD9 286.53: Antiphospholipid antibody with hemorrhagic disorder
102. ICD9 286.59: Other hemorrhagic disorder due to intrinsic circulating anticoagulants, antibodies or inhibitors
103. ICD9 286.6: Defibrination syndrome
104. ICD9 286.7: Acquired coagulation factor deficiency
105. ICD9 287: Purpura and other hemorrhagic conditions
106. ICD9 287.0: Allergic purpura
107. ICD9 287.2: Other nonthrombocytopenic purpuras
108. ICD9 287.30: Primary thrombocytopenia, unspecified
109. ICD9 287.31: Immune thrombocytopenic purpura
110. ICD9 287.32: Evan’s syndrome
111. ICD9 287.33: Congenital and hereditary thrombocytopenic purpura
112. ICD9 287.4: Secondary thrombocytopenia
113. ICD9 288: Diseases of white blood cells
114. ICD9 288.0: Neutropenia
115. ICD9 288.02: Cyclic neutropenia
116. ICD9 288.03: Drug induced neutropenia
117. ICD9 288.09: Other neutropenia
118. ICD9 288.1: Functional disorders of polymorphonuclear neutrophils
119. ICD9 288.2: Genetic anomalies of leukocytes
120. ICD9 288.4: Hemophagocytic syndromes
121. ICD9 288.8: Other specified disease of white blood cells
122. ICD9 289: Other diseases of blood and blood-forming organs
123. ICD9 289.4: Hypersplenism
124. ICD9 289.6: Familial polycythemia
125. ICD9 289.83: Myelofibrosis
126. Diagnosis of Cystic Fibrosis:
127. ICD9 277.0X
128. Diagnosis of Intestinal Failure/Malabsorption:
129. ICD9 579.X
130. Diagnosis of Renal Failure:
131. ICD9 586
132. Diagnosis of Pulmonary Hypertension:
133. ICD9 416.0
134. Diagnosis of Immunodeficiency:
135. ICD9 279.X
136. Diagnosis of TPN Usage:
137. ICD9 v58.9
138. ICD9 99.15
139. Diagnosis Related to SSI
     1. ICD9 Codes:
140. ICD9 998.5: Postoperative infection
141. ICD9 998.51: Infected postoperative seroma
142. ICD9 998.59: Other postoperative infection
143. ICD9 Procedure Codes for Soft Tissue Excision:
     1. ICD9 83.0-83.1
     2. ICD9 83.14-83.49

c. ICD9 83.99

1. ICD9 Procedure Codes for Skin and Subcutaneous incision and Debridement

a. ICD9 86.0-86.22

b. ICD9 86.28

c. ICD9 86.3-86.5

d. ICD9 86.99

* 1. CPT Codes:

1. CPT 10180: Incision and drainage, complex, postoperative wound infection
2. CPT 10061: Incision and drainage of abscess [e.g., carbuncle, suppurative hidradenitis, cutaneous or subcutaneous abscess, cyst, furuncle, or paronychia; complicated or multiple
3. CPT 10140: Seroma/hematoma/fluid collection
4. Diagnosis of Infection Requiring Prolonged Antibiotics:
5. ICD9 013.XX: Tuberculosis of meninges and central nervous system
6. ICD9 320.XX: Inflammatory diseases of the central nervous system
7. ICD9 322.9: Meningitis
8. ICD9 324.X: Intracranial and intraspinal abscess
9. ICD9 376.03: Orbital osteomyelitis
10. ICD9 424.90: Diagnosis of endocarditis
11. ICD9 510: Empyema
12. ICD9 511.9: Unspecified pleural effusion
13. ICD9 513.0: Abscess of lung and mediastinum
14. ICD9 730.XX: Osteomyelitis
15. Infectious Disease Clinic Visit
16. ICD9/CPT Codes for Central Line Usage or Central Access:
    1. ICD9 Codes:

a. ICD9 V58.81: Fitting and adjustment of vascular catheter

b. ICD9 V53.90: Fitting and adjustment of device, unspecified type

c. ICD9 996.74: Other complications due to other vascular device, implant, and graft

d. ICD9 38.93: Venous catheterization, not elsewhere classified

e. ICD9 38.97: Central venous catheter placement with guidance

* 1. CPT Codes:

a. CPT 36555: Non-tunneled central venous catheter under 5 years of age

b. CPT 36556: Non-tunneled central venous catheter 5 years of age or older

c. CPT 36557: Tunneled central venous catheter under 5 years of age

d. CPT 36558: Tunneled central venous catheter 5 years of age or older

e. CPT 36560: Tunneled central venous catheter with port under 5 years of age

f. CPT 36561: Tunneled central venous catheter with port 5 years of age or older

g. CPT 36563: Tunneled central venous catheter with pump

h. CPT 36565: Tunneled central venous catheter with 2 catheters without port

i. CPT 36566: Tunneled central venous catheter with 2 catheters with port

j. CPT 36568: PICC without port or pump under 5 years of age

k. CPT 36569: PICC without port or pump 5 years of age or older

l. CPT 36570: PICC with port under 5 years of age

m. CPT 36571: PICC with port 5 years of age or older

n. CPT 36575: Repair of central venous catheter without port or pump

o. CPT 36576: Repair of central venous catheter with port or pump

p. CPT 36578: Replacement, catheter only, with port or pump

q. CPT 36580: Replacement, complete, non-tunneled catheter without port or pump through same venous access

r. CPT 36581: Replacement, complete, non-tunneled catheter with port or pump through same venous access

s. CPT 36582: Replacement, complete, tunneled catheter with port through same venous access

t. CPT 36583: Replacement, complete, tunneled catheter with pump through same venous access

u. CPT 36584: Replacement, complete, PICC without port or pump, through same venous access

v. CPT 36585: Replacement, complete, PICC with port or pump, through same venous access

w. CPT 36589: Removal tunneled central venous catheter without port or pump

x. CPT 36590: Removal tunneled central venous catheter with port or pump

y. CPT 75998: Fluoroscopic guidance for central venous access device

z. CPT 76937: Ultrasound guidance for vascular access

**Query 3: Patients with ICD9/CPT codes suggesting central catheter usage:**

1. Patients with ICD-9/CPT codes for central catheterization:
2. Exclude patients already in Query 1or Query 2
3. ICD9 Codes:

a. ICD9 V58.81: Fitting and adjustment of vascular catheter

b. ICD9 V53.90: Fitting and adjustment of device, unspecified type

c. ICD9 996.74: Other complications due to other vascular device, implant, and graft

d. ICD9 38.93: Venous catheterization, not elsewhere classified

e. ICD9 38.97: Central venous catheter placement with guidance

1. CPT Codes:

a. CPT 36555: Non-tunneled central venous catheter under 5 years of age

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c. CPT 36557: Tunneled central venous catheter under 5 years of age

d. CPT 36558: Tunneled central venous catheter 5 years of age or older

e. CPT 36560: Tunneled central venous catheter with port under 5 years of age

f. CPT 36561: Tunneled central venous catheter with port 5 years of age or older

g. CPT 36563: Tunneled central venous catheter with pump

h. CPT 36565: Tunneled central venous catheter with 2 catheters without port

i. CPT 36566: Tunneled central venous catheter with 2 catheters with port

j. CPT 36568: PICC without port or pump under 5 years of age

k. CPT 36569: PICC without port or pump 5 years of age or older

l. CPT 36570: PICC with port under 5 years of age

m. CPT 36571: PICC with port 5 years of age or older

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o. CPT 36576: Repair of central venous catheter with port or pump

p. CPT 36578: Replacement, catheter only, with port or pump

q. CPT 36580: Replacement, complete, non-tunneled catheter without port or pump through same venous access

r. CPT 36581: Replacement, complete, non-tunneled catheter with port or pump through same venous access

s. CPT 36582: Replacement, complete, tunneled catheter with port through same venous access

t. CPT 36583: Replacement, complete, tunneled catheter with pump through same venous access

u. CPT 36584: Replacement, complete, PICC without port or pump, through same venous access

v. CPT 36585: Replacement, complete, PICC with port or pump, through same venous access

w. CPT 36589: Removal tunneled central venous catheter without port or pump

x. CPT 36590: Removal tunneled central venous catheter with port or pump

y. CPT 75998: Fluoroscopic guidance for central venous access device

z. CPT 76937: Ultrasound guidance for vascular access

**CAUTI:**

Eligibility:

All pediatric patients less than 22 years old who had ambulatory visits at one of these five sites from October 1, 2010 through September 30, 2015 were eligible for inclusion.

**3 Queries:**

**Query 1: Patients with ICD9 codes for CAUTI:**

1. All children with ICD-9 codes for infections or complications due to catheter or indwelling devices billed in ambulatory settings, on admission, or within 48 hours of admission.

* 1. ICD9 996.64: Infection and inflammatory reaction due to indwelling urinary catheter effective 1989
  2. ICD9 996.65: Infection and inflammatory reaction due to other genitourinary device, implant and graft effective 1989
  3. ICD9 996.76: Other complications due to genitourinary device, implant and graft effective 1989
  4. ICD9 E879.6: Urinary catheterization as the cause of abnormal reaction of patient first use 2009
  5. ICD9 997.5: Urostomy-associated UTI is assigned to code
  6. ICD9 996.30 or 996.31 or 996.39: Mechanical complications due to GU device, due to urethral indwelling catheter, other complication
  7. ICD9 596.81 Infection of cystostomy effective 2011 (or ICD9 997.5 before 2011)

**Query 2: Patients with positive urine cultures & ICD9/CPT codes suggesting diagnoses at high risk for or specific urinary catheter usage:**

1. Patients with positive urine culture (defined as any organism growth) collected >2 days after discharge or <2 days after admission and one of the below diagnoses

2. Exclude patients already in Cohort 1

1. Diagnosis of Neuromuscular disease:
   * 1. ICD9 741.00-.03, 741.90-93, 344.61: Spina bifida
     2. ICD9 952.00-.09, 952.10-19, 952.2, 952.3, 952.4, 952.8, 952.9: Spinal cord injury without evidence of spinal bone injury
2. Diagnosis of Urinary disease:
3. ICD9 596.54, 596.4, 596.51-596.55, 596.59: Neurogenic bladder
4. ICD9 788.2: Urinary retention
5. Diagnosis of Cerebral Palsy:
6. ICD9 343.0: Congenital Diplegia
7. ICD9 343.1: Congenital Hemiplegia
8. ICD9 343.2: Congenital Quadriplegia
9. ICD9 343.3: Congenital Monoplegia
10. ICD9 343.4: Infantile Hemiplegia
11. ICD9 343.8: Other Specified Infantile Cerebral Palsy
12. ICD9 343.9: Infantile Cerebral Palsy Unspecified
13. Diagnoses at High Risk for Catheter usage:
14. ICD9 598.9: Urethral stricture
15. ICD9 599.71: Gross hematuria
16. ICD9 599.4: urethral false passage
17. ICD9 596.0: bladder neck obstruction
18. Diagnosis of Vesicoureteral reflux:
19. ICD9 593.70, 593.71, 593.72: vesicoureteral reflux unspecified or without reflux nephropathy, with unilateral reflux nephropathy or with bilateral reflux nephropathy
20. Long Term antibiotic usage:
21. ICD9 V58.62: Long-term use antibiotic, billable medical code that can be used to indicate a diagnosis on a reimbursement claim
22. ICD-9/CPT Codes for Urinary Catheterization:
23. ICD9 Codes:
    * + 1. ICD9 V53.6: Fitting and adjustment of urinary devices
        2. ICD9 57.94: Insertion of indwelling urinary catheter
        3. ICD9 57.95: Replacement of indwelling urinary catheter
        4. ICD9 51701: Insertion of non-indwelling bladder catheter
        5. ICD9 51702: Insertion of temporary indwelling bladder catheter; simple
        6. ICD9 51703: Insertion of temporary indwelling bladder catheter; complicated
        7. V58.82: Fitting and adjustment of nonvascular catheter, should be used for claims with a date of service on or before September 30, 2015
        8. E879.6: Urinary catheterization as the case of abnormal reaction of patient or of later complication without misadventure at time of procedure
24. CPT Codes:
    * + 1. CPT A4321: Therapeutic agent for urinary catheter irrigation
        2. CPT A4333: Urinary catheter anchoring device, adhesive skin attachment, each
        3. CPT A4334: Urinary catheter anchoring device, leg strap, each
        4. CPT A4351: Intermittent urinary catheter; straight tip, with or without coating (Teflon, silicone, silicone elastomer, or hydrophilic, etc.), each
        5. CPT A4352: Intermittent urinary catheter; Coude (curved) tip, with or without coating (Teflon, silicone, silicone elastomeric, or hydrophilic, etc.), each
        6. CPT A4353: Intermittent urinary catheter, with insertion supplies

**Query 3: Patients with ICD9/CPT codes suggesting urinary catheter usage:**

1. Patients with ICD-9/CPT codes for urinary catheterization:
2. Exclude patients already in Cohort 1or Cohort 2
3. ICD9 Codes:
   * + 1. ICD9 V53.6: Fitting and adjustment of urinary devices
       2. ICD9 57.94: Insertion of indwelling urinary catheter
       3. ICD9 57.95: Replacement of indwelling urinary catheter
       4. ICD9 51701: Insertion of non-indwelling bladder catheter
       5. ICD9 51702: Insertion of temporary indwelling bladder catheter; simple
       6. ICD9 51703: Insertion of temporary indwelling bladder catheter; complicated
       7. V58.82: Fitting and adjustment of nonvascular catheter, should be used for claims with a date of service on or before September 30, 2015
       8. E879.6: Urinary catheterization as the cause of abnormal reaction of patient or of later complication without misadventure at time of procedure
4. CPT Codes:
   * + 1. CPT A4321: Therapeutic agent for urinary catheter irrigation
       2. CPT A4333: Urinary catheter anchoring device, adhesive skin attachment, each
       3. CPT A4334: Urinary catheter anchoring device, leg strap, each
       4. CPT A4351: Intermittent urinary catheter; straight tip, with or without coating (Teflon, silicone, silicone elastomer, or hydrophilic, etc.), each
       5. CPT A4352: Intermittent urinary catheter; Coude (curved) tip, with or without coating (Teflon, silicone, silicone elastomeric, or hydrophilic, etc.), each
       6. CPT A4353: Intermittent urinary catheter, with insertion supplies

**SSI:**

Eligibility:

All pediatric patients less than 22 years old who had ambulatory visits at one of these five sites from October 1, 2010 through September 30, 2015 were eligible for inclusion.

**3 Queries:**

**Query 1: Patients with ICD9 codes for SSI:**

1. Defined as all children with ambulatory surgery (no overnight stay following surgery) who had a subsequent ICD9 Code for Postoperative Infection within 30 days.

1. **ICD9 998.5:** Postoperative infection
2. **ICD9 998.51:** Infected postoperative seroma
3. **ICD9 998.59:** Other postoperative infection
4. **ICD9 Procedure Codes for Soft Tissue Excision:**
   * 1. **ICD9 83.0-83.1**
     2. **ICD9 83.14-83.49**
     3. **ICD9 83.99**
5. **ICD9 Procedure Codes for Skin and Subcutaneous incision and Debridement**
   * 1. **ICD9 86.0-86.22**
     2. **ICD9 86.28**
     3. **ICD9 86.3-86.5**
     4. **ICD9 86.99**
6. **CPT 10180**: Incision and drainage, complex, postoperative wound infection
7. **CPT 10061:** Incision and drainage of abscess [e.g., carbuncle, suppurative hidradenitis, cutaneous or subcutaneous abscess, cyst, furuncle, or paronychia]; complicated or multiple
8. **CPT 10140**: Seroma/hematoma/fluid collection

**Query 2: Patients with visit codes suggesting high risk for ambulatory SSI:**

1. Defined as ambulatory surgery with one or more of the below criteria for high risk inclusion in the 30 days following the ambulatory surgery.
2. Exclude patients already in Cohort 1
3. 20% random sample performed
4. Emergency Department Visit
5. Two or more outpatient visits to any clinics
6. Admission on surgery day +1 through and including day +30
7. Wound Culture ordered
8. CBC ordered (CPT codes 85025, 85027, 85004, 85007, 85008, 85009, 85032, 85048 and 80050)
9. New antibiotic prescription (based on NDC codes)
10. Return to Operating Room

**Query 3: Patients with ambulatory surgery:**

1. Patients who had ambulatory surgery
2. Exclude patients already in Cohort 1or Cohort 2
3. 20% random sample performed