Client: HEALTH BENCHMARKS, INC. STANDARD ALGORITHM

Measure Title: RISK-ADJUSTED COMPLICATIONS POST PRIMARY TOTAL HIP REPLACEMENT (THR) SURGERY

Disease State: Hip Arthroplasty

Indication Classification: Disease Management

Strength of Recommendation: Not applicable. Not a key recommendation for clinicians regarding diagnosis or treatment.

Organizations Providing Recommendation:
- American College of Chest Physicians
- National Surgical Infection Prevention Project

Clinical Intent: To assess the complication rate for primary total hip replacement surgery. Note that this measure is risk adjusted.

Physician Specialties: Surgery-Orthopedic, Mixed Specialty

Background: Disease Burden
- Based on the National Hospital Discharge Survey, approximately 234,000 patients underwent hip replacement surgery in 2004.[1]
- From 1995 to 2004, the rate of hip replacements in the elderly population increased by 38 percent, jumping from 27.1 per 10,000 population to 37.3 per 10,000 population.[1]
- Post-operative complications:
  - One study of 12,956 patients receiving Total Hip Replacement using Medicare claims data found an incidence rate of 0.9% for pulmonary embolism, 0.2% with deep infection, and 3.9% dislocation. The risk of these adverse outcomes remained elevated up to six weeks post discharge.[2]
  - Another study examining 9,367 joint replacement procedures (both hip and knee) from 1996 through 2001 found complications from pulmonary embolism at 0.4% and deep vein thrombosis at 1.4%.[3]
  - Furthermore, the American College of Chest Physicians guidelines estimates that the incidence of PE is around 4-10% and for deep-vein thrombosis within 20-80% for calf or proximal diagnoses. Approximately 10% of all hospital deaths are due to pulmonary embolism.[4]

Reason for Indicated Intervention or Treatment
• The inter-institutional and provider-level variation in the incidence of risk-adjusted complications after primary total hip replacement surgery suggests that differences in care may have an impact on these rates.

Evidence Supporting Intervention or Treatment

• Patients who do not receive antithrombotic prophylaxis have a 40-60% higher incidence of deep vein thrombosis following major orthopedic surgery.[4]

• Prophylactic administration of antibiotics can decrease postoperative morbidity, shorten hospitalization, and reduce the overall costs attributable to infections.[5-8]

• Based on the findings of one meta-analysis of 7 RCTs, prophylaxis for heterotopic ossification (HO) with post-operative external beam radiation is on average more effective than NSAIDs in preventing HO after major hip procedures, although absolute differences may be small.[9]

Clinical Recommendations

• Venous Thromboembolic Disease:
  o The ACCP recommends thromboprophylaxis regimens based on these risk categories: For moderate risk patients, either low-dose unfractionated heparin (LDUH) (5,000 U bid) or low-molecular-weight heparin (LMWH) (≤3,400 U once daily) is recommended (Strength of evidence: 1A). For higher risk patients who have multiple risk factors, it is recommended that they receive LDUH (5,000 U bid) or LMWH (>3,400 U daily) (Strength of evidence: 1A). As for high risk patients, it is recommended that this group receive combination therapy-LDUH three times a day or LMWH (>3,400 U daily) with graduated compression stocking and/or intermittent pneumatic compression devices (Strength of Evidence: 1C).[4]

• Infection:
  o The National Surgical Infection Prevention Project recommends that preoperative antimicrobial prophylaxis should be standard for all patients undergoing joint replacement.[5]
  o There are no specific specialty society recommendations or evidenced based practice guidelines regarding the prevention of dislocation, periprosthetic fracture, or heterotopic ossification related to total hip replacement surgery.

Source

Health Benchmarks, Inc.

Items adapted from other sources:

## DERIVING THE UNADJUSTED RATE FOR A PROVIDER

### Denominator Definition
Continuously enrolled members who underwent primary total hip replacement surgery during the 1 year period starting 150 days prior to the start of the measurement year.

### Denominator Codes
**Total hip replacement**
- CPT-4 code(s): 27130
- ICD-9 surgical proc code(s): 81.51

### Denominator Exclusion Definition
Members with evidence of the following conditions: femur fracture, conversion of previous hip surgery, complications from a previous THR during the 0-2 days prior to the index date (inclusive of the index date), members diagnosed with arthropathy associated with infection, hip arthrotomy for infection with drainage on the index date, or members with metastatic cancer or bone cancer during the 365 days prior through 4 days after the index date (inclusive of the index date).

### Denominator Exclusion Codes
- **Femur fracture**
  - ICD-9 diagnosis code(s): 820.xx-821.11
  - ICD-9 surgical proc code(s): 79.05, 79.15, 79.25, 79.35
  - CPT-4 code(s): 27230-27248, 27500-27507
- **Conversion of previous hip surgery**
  - CPT-4 code(s): 27132
- **Complications from a previous THR**
  - ICD-9 diagnosis code(s): 996.4x, 996.60, 996.66, 996.67, 996.70, 996.77, 996.78, V54.0x
  - ICD-9 surgical proc code(s): 78.60, 78.65, 80.00, 80.05, 81.53
  - CPT-4 code(s): 20680, 27090, 27091, 27134, 27137, 27138
- **Bone infections**
  - ICD-9 diagnosis code(s): 711.05, 711.65, 711.95, 730.00, 730.05, 730.10, 730.15, 730.20, 730.25, 730.90, 730.95
- **Arthrotomy, hip for infection with drainage**
  - CPT-4 code(s): 27030
- **Bone and Metastatic Cancer**
  - ICD-9 diagnosis code(s): 170.6x, 170.7x, 170.9x, 195.3x, 195.5x, 198.5x, 199.0x, 733.14
  - CPT-4 code(s): 27075-27079

### Numerator Definition
Members who DID NOT have evidence of any of the following complications related to THR:
- Pulmonary embolism (PE), joint infection, deep vein thrombosis, in the 1-90 days after index date (exclusive of the index date)
- Dislocation in the 2-90 days after the index date (exclusive of the index date)
• Musculoskeletal readmission in the 8-90 days after the index date (exclusive of the index date)
• Expired in the 0-90 days after the index date (inclusive of the index date)

**Numerator Codes**

**PE**
- **ICD-9 diagnosis code(s):** 415.1x
- **Deep vein thrombosis**
- **ICD-9 diagnosis code(s):** 453.4x, 453.8x

**Inpatient setting**
- **CPT-4 code(s):** 99221-99223, 99231-99233, 99238-99239, 99251-99255, 99261-99263, 99291-99300, 99356-99357, 99431-99440
- **UB revenue code(s):** 0100-0114, 0117-0124, 0127-0134, 0137-0144, 0147-0154, 0157-0159, 0160-0169, 0190-0219, 0220-0229, 0720-0729, 0800-0809, 0987

**Outpatient setting**
- **CPT-4 code(s):** 99201-99205, 99211-99215, 99241-99245, 99271-99275, 99301-99313, 99315-99316, 99318-99337, 99341-99350, 99354-99355, 99381-99387, 99391-99397, 99401-99429, 99450, 99455-99456
- **UB revenue code(s):** 0500-0529, 0570-0599, 0770-0779, 0820-0859, 0882, 0982-0983

**Prothrombin time test**
- **CPT-4 code(s):** 85610

**Post THR Joint Infection**
- **CPT-4 code(s):** 27030

**Joint infection**
- **ICD-9 diagnosis code(s):** 711.00, 711.05, 711.60, 711.65, 711.90, 711.95, 730.00, 730.05, 730.10, 730.15, 730.20, 730.25, 730.30, 730.90, 730.95, 996.60, 996.66, 996.67

**Confirming procedures**
- **ICD-9 surgical proc code(s):** 78.60, 78.65, 80.00, 80.05, 80.10, 80.15, 81.91
- **CPT-4 code(s):** 20680, 26992, 27052, 27070, 27071, 27075, 27076, 27077, 27078, 27079, 27090

**Dislocation**
- **ICD-9 surgical proc code(s):** 79.75, 79.85
- **CPT-4 code(s):** 27250, 27252-27254, 27265-27266

**Musculoskeletal readmission**
- **DRG code(s):** 210-213, 216, 217, 233, 234, 471, 545

**Physician Attribution**

**Description**
Score only the physician who performed the index date surgery.

**References**


DERIVING THE PREDICTED RATE FOR A PROVIDER

Statistical Methodology for THR

Patient populations are inherently variable, ensuring that providers will treat an array of patients that are likely different in composition of risk compared to patient pools treated by other providers. This variability, particularly with regard to general health status, can account for a large proportion of the measured quality of care differences between providers and lead to incorrect findings and conclusions if not considered. To generate a meaningful statistic that reflects only differences in provider practice patterns, appropriate statistical method such as the conventional logistic regression is used to model the probability of occurrence of the THR complication by controlling for a variety of patient mix and severity of illness factors such as demographics (age, gender) and comorbidities during a specific period.

Model specification
For j-th patient who received a THR procedure from physician i, we modeled the complication indicator variable Yij (1 for complication and 0 otherwise) as follows:

\[ G(E(Y_{ij})) = \beta_0i \text{ (physician) } i + \beta_1 \text{ age categories (0-35, 35-45, 45-55, 55-65, 65-75, and over 75 years old)} + \beta_2 \text{ gender} + \beta_3 \text{ Charlson Comorbidity Index} + \beta_4 \text{ Specific arthritis diagnosis, i.e., a flag for each of the following: rheumatoid arthritis, osteoarthritis, or avascular necrosis.} \]

Where E(Yij) is the expected value of Yij and G is a monotonic differentiable link function that describes how the expected value of Yi is related to the predictors. A binomial distribution for Y
and logit link function, i.e., logistic regression will be applied to estimate the physician effect (indexed by $\beta_0i$) on the likelihood of developing a complication after surgical procedure, controlling for the patient level characteristics variables.

**Prediction**

Based on the parameter estimates of physician indicators from the above model, the average risk adjusted likelihood of complication for physician $i$ was obtained using the following equation:

$$P_i = \frac{\exp(\beta_0i + X\beta)}{1 + \exp(\beta_0i + X\beta)}$$

Where,

- $\exp$: exponential function;
- $\beta_0i$: parameter estimates indexed physician effects;
- $X\beta$: the estimated regression coefficients from the model*mean values for each covariate.

$P_i$ can be interpreted as the expected complication rate physician $i$ would have if he/she treated all THR surgical procedures at his/her actual level of performance. Comparing risk adjusted THR complication rates across physicians would measure physician $i$’s performance assuming that this provider encountered the typical or average case distribution experienced by his/her peers.