

# Patient-Reported Outcomes

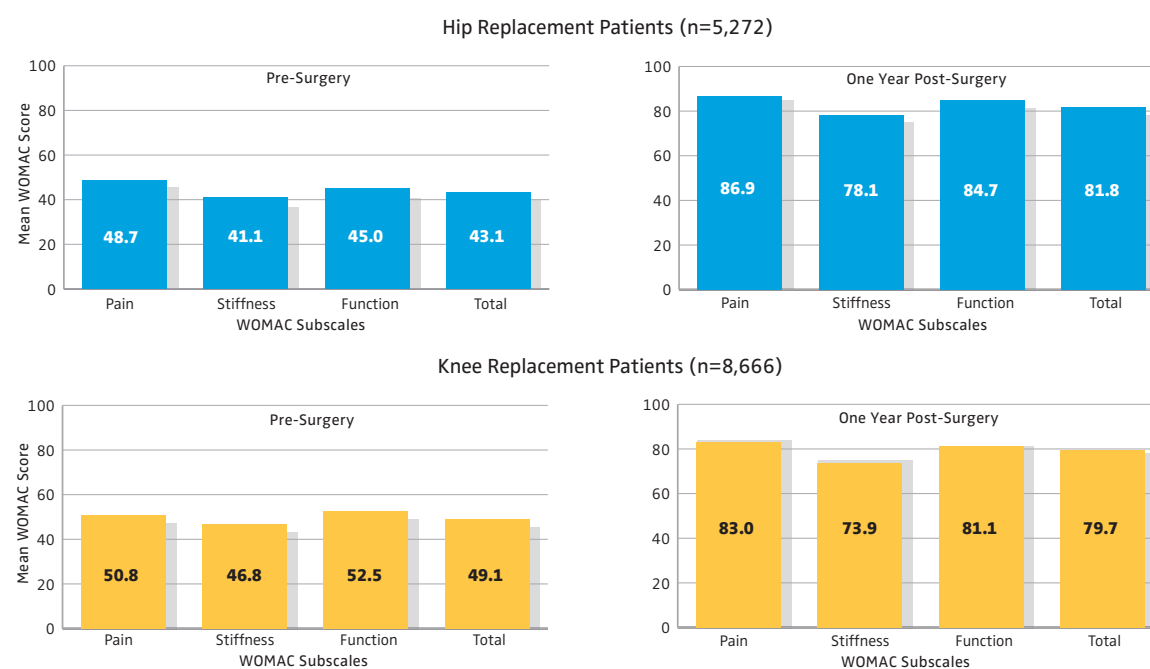
CJRR collects information directly from patients, using several standardized surveys.

- The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), a 24-question survey, assesses a patient's hip and knee pain, stiffness, and function on a scale of 0 to 100, with 100 being maximum function and minimum pain, by asking questions related to a patient's activities such as:
  - "How much pain do you have when walking on a flat surface? "...or sitting?"
  - "How severe is your stiffness when you first wake up in the morning?"
  - "How much difficulty do you have when getting up from a sitting position?"
- The Veterans Rand 12-Item Health Survey (VR-12) assesses a patient's general quality of life (physical and mental components scores) with 12 questions. As with the WOMAC, the VR-12 has a scale of 0 to 100, with 100 indicating the best health.
- The UCLA Activity Score surveys a patient's hip and knee pain and function on a 10-point scale from a 1 – "wholly inactive: dependent upon others; cannot leave residence," to a 5 – "sometimes participate in moderate activities," to a 10 – "regularly participate in impact sports, such as jogging, tennis, skiing, acrobatics, ballet, heavy labor, or backpacking." This score is generated from a single question.

CJRR offers multiple options for PRO survey completion. Patients can complete their PRO surveys online using a secure CJRR web-based interface (on a phone, computer, or tablet), or in paper form, which can be sent directly to CJRR via secure electronic fax. This reduces the administrative burden on surgeons and staff and ensures that PRO collection is uniform and complete. It's estimated that it takes patients 15-30 minutes to answer these 37 questions in the three surveys. See CJRR Appendix A.

## PRO Results

### WOMAC Hip and Knee Mean Scores Pre-Surgery and One Year Post-Surgery (N=13,938)

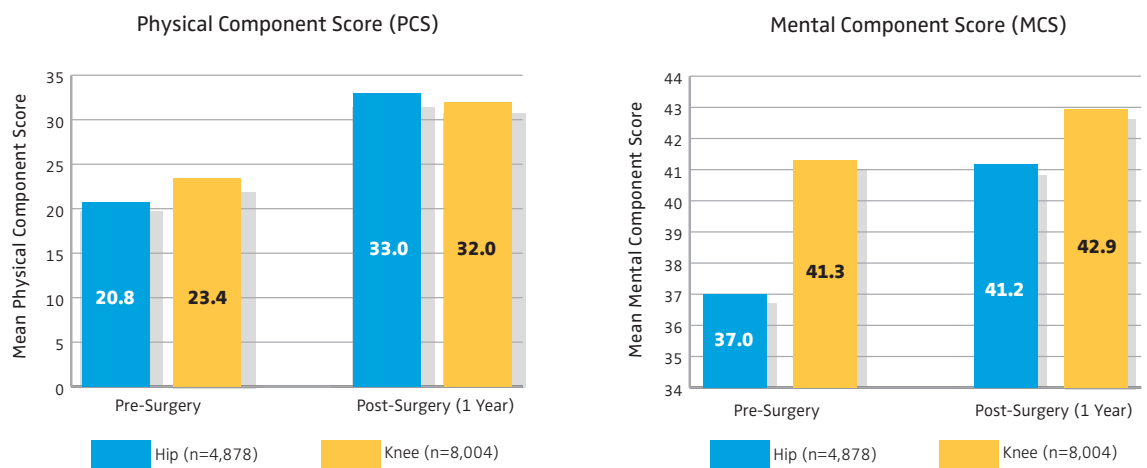


### Change in WOMAC Score Pre-Surgery and One Year Post-Surgery, by Hospital\*

Hospital	Patients Who Had Surgery and Were Eligible to Take a Survey	Number of Eligible Patients Who Completed both Pre-op and 1-Year PRO, N (%)	Case Mix-Adjusted Percentage of Patients Who Reported Meaningful Improvement	Performance Rating
Alta Bates Summit Medical Center, Alta Bates Campus	217	69 (31.8%)	80.1%	★★★★★
Cedars-Sinai Medical Center	569	81 (14.2%)	83.5%	★★★★★
John Muir Medical Center, Concord	142	33 (23.2%)	92.8%	★★★★★
Eisenhower Medical Center	120	88 (73.3%)	95.4%	★★★★★
Hoag Orthopedic Institute	3,764	442 (11.7%)	89.0%	★★★★★
PIH Health Hospital - Whittier	346	49 (14.2%)	87.4%	★★★★★
St. Joseph Hospital (Orange, CA)	187	75 (40.1%)	88.9%	★★★★★
St. Jude Medical Center (Fullerton, CA)	166	40 (24.1%)	90.5%	★★★★★
Stanford Health Care	500	101 (20.2%)	88.0%	★★★★★
Alta Bates Summit Medical Center, Summit Campus	255	75 (29.4%)	87.0%	★★★★★
University of California, San Francisco Medical Center	999	576 (57.7%)	88.1%	★★★★★
John Muir Medical Center, Walnut Creek	325	53 (16.3%)	88.8%	★★★★★

\*For hospitals with >30 eligible patients who completed both pre-surgical and 1 year post-surgical PROs.

### VR-12 Hip and Knee Mean Scores for Physical and Mental Component Scores, Pre-Surgery and One Year Post-Surgery (N=12,882)



**Table 3: Change in VR-12 Physical and Mental Scores Pre-Surgery and One Year Post-Surgery by Hospital\*****Change in VR-12 Physical Score**

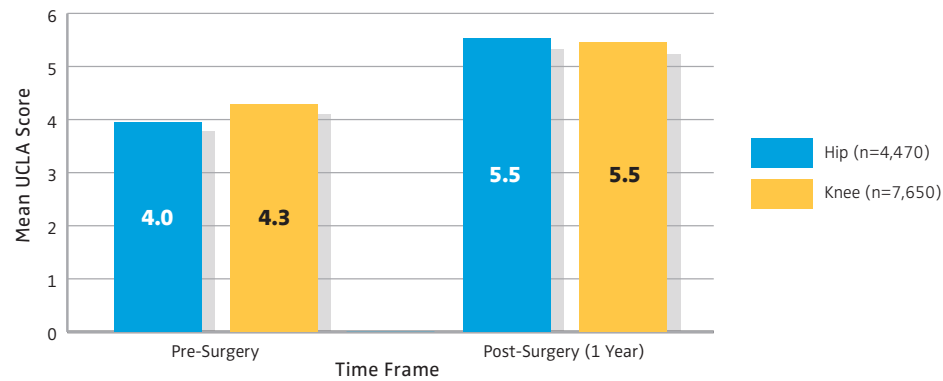
Hospital	Patients Who Had Surgery and Were Eligible to Take a Survey	Number of Eligible Patients Who Completed both Pre-op and 1-Year PRO, N (%)	Case Mix-Adjusted Percentage of Patients Who Reported Meaningful Improvement	Performance Rating
Alta Bates Summit Medical Center, Alta Bates Campus	217	75 (34.6%)	58.6%	★★★★★
Cedars-Sinai Medical Center	569	82 (14.4%)	72.2%	★★★★★
John Muir Medical Center, Concord	142	32 (22.5%)	80.8%	★★★★★
Eisenhower Medical Center	120	88 (73.3%)	80.5%	★★★★★
PIH Health Hospital - Whittier	346	50 (14.5%)	74.3%	★★★★★
St. Joseph Hospital (Orange, CA)	187	76 (40.6%)	74.3%	★★★★★
St. Jude Medical Center (Fullerton, CA)	166	44 (26.5%)	77.7%	★★★★★
Stanford Health Care	500	102 (20.4%)	69.9%	★★★★★
Alta Bates Summit Medical Center, Summit Campus	255	88 (34.5%)	72.1%	★★★★★
University of California, San Francisco Medical Center	999	587 (58.8%)	71.2%	★★★★★
John Muir Medical Center, Walnut Creek	325	54 (16.6%)	76.0%	★★★★★

**Change in VR-12 Mental Score**

Hospital	Patients Who Had Surgery and Were Eligible to Take a Survey	Number of Eligible Patients Who Completed both Pre-op and 1-Year PRO, N (%)	Case Mix-Adjusted Percentage of Patients Who Reported Meaningful Improvement	Performance Rating
Alta Bates Summit Medical Center, Alta Bates Campus	217	75 (34.6%)	30.4%	★★★★★
Cedars-Sinai Medical Center	569	82 (14.4%)	39.2%	★★★★★
John Muir Medical Center, Concord	142	32 (22.5%)	37.6%	★★★★★
Eisenhower Medical Center	120	88 (73.3%)	49.2%	★★★★★
PIH Health Hospital - Whittier	346	50 (14.5%)	36.2%	★★★★★
St. Joseph Hospital (Orange, CA)	187	76 (40.6%)	42.2%	★★★★★
St. Jude Medical Center (Fullerton, CA)	166	44 (26.5%)	43.7%	★★★★★
Stanford Health Care	500	102 (20.4%)	47.0%	★★★★★
Alta Bates Summit Medical Center, Summit Campus	255	88 (34.5%)	33.1%	★★★★★
University of California, San Francisco Medical Center	999	587 (58.8%)	36.9%	★★★★★
John Muir Medical Center, Walnut Creek	325	54 (16.6%)	36.9%	★★★★★

\*For hospitals with &gt;30 eligible patients who completed both pre-surgical and 1 year post-surgical PROs.

## UCLA Hip and Knee Mean Scores Pre-Surgery and One Year Post-Surgery (N=12,120)



### Change in UCLA Score Pre-Surgery and One Year Post-Surgery, by Hospital\*

Hospital	Patients Who Had Surgery and Were Eligible to Take a Survey	Number of Eligible Patients Who Completed both Pre-op and 1-Year PRO, N (%)	Case Mix-Adjusted Percentage of Patients Who Reported Meaningful Improvement	Performance Rating
Alta Bates Summit Medical Center, Alta Bates Campus	217	76 (35.0%)	61.1%	★★★★★
Cedars-Sinai Medical Center	569	77 (13.5%)	71.6%	★★★★★
John Muir Medical Center, Concord	142	31 (21.8%)	62.7%	★★★★★
Eisenhower Medical Center	120	88 (73.3%)	76.4%	★★★★★
Hoag Orthopedic Institute	3,764	429 (11.4%)	66.9%	★★★★★
PIH Health Hospital - Whittier	346	49 (14.2%)	71.2%	★★★★★
St. Joseph Hospital (Orange, CA)	187	73 (39.0%)	70.1%	★★★★★
St. Jude Medical Center (Fullerton, CA)	166	48 (28.9%)	52.5%	★★★★★
Stanford Health Care	500	99 (19.8%)	67.7%	★★★★★
Alta Bates Summit Medical Center, Summit Campus	255	89 (34.9%)	50.6%	★★★★★
University of California, San Francisco Medical Center	999	586 (58.7%)	64.8%	★★★★★
John Muir Medical Center, Walnut Creek	325	53 (16.3%)	60.5%	★★★★★

\*For hospitals with >30 eligible patients who completed both pre-surgical and 1 year post-surgical PROs.

# CJRR Appendix A

## CJRR Methodology for Reporting Meaningful Change in Risk-Adjusted Patient-Reported Outcomes

*Risk-Adjustment for Patient-Reported Outcomes of Total Joint Replacement Surgeries California Joint Replacement Registry February 4, 2015*

### Background

The California Joint Replacement Registry (CJRR) plans to publicly report risk-adjusted patient reported outcomes (PRO) for joint replacement surgeries in CJRR-participating hospitals. Risk-adjustment controls for diseases and conditions and other patient characteristics that vary from hospital to hospital and may cause PROs to vary because of circumstances outside of a provider's control. These PRO results are based on data collected in CJRR about surgeries that occurred from April 1, 2011 through November 6, 2014. The calculations are current as of December 31, 2014.

### Model Development

#### Patient Sample

Patients undergoing primary total<sup>a</sup> hip or primary total knee replacement (unilateral or bilateral) were included in the risk adjustment modeling and subsequent public reporting. Patients with pathological fractures or malignant neoplasms (primary or metastatic cancer) were excluded. See the accompanying list for excluded codes. A total of 5,780 eligible patients were registered by CJRR during the study period beginning April 1, 2011 through November 6, 2014, at 14 participating hospital sites. Cases are eligible if at least one year has elapsed since the procedure occurred. Cases are complete if the patient has finished a pre-procedure PRO survey and also a one-year post-procedure PRO survey. There were 1,155 completed cases. The hospital response rate is the number of complete cases divided by the number of eligible cases. These PRO scores and performance outcome results are based on data collected in CJRR about surgeries that occurred from April 1, 2011 to November 6, 2014. The calculations are current as of December 31, 2014.

#### PRO Measure

CJRR collects PRO data using three distinct surveys: Veterans Rand 12-Item Health Survey (VR-12), Western Ontario and McMaster Universities Arthritis Index (WOMAC), and the UCLA Activity Index. The PRO measure that CJRR will report publicly at this time is the WOMAC, which is a condition-specific survey that asks patients about symptoms, pain, stiffness, and the patient's ability to perform various routine activities of daily life that are progressively more physically demanding<sup>b</sup>.

From the WOMAC data, the specific outcome measure to be reported is the percentage of WOMAC respondents that had Minimal Clinically Important Differences (MCID) between pre- and post- WOMAC scores<sup>c</sup>. Survey responses sometimes have statistically significant differences that are associated with small clinical changes. The MCID accounts for this, making sure that all patients who are counted as having positive post-procedure change have meaningful changes in their WOMAC scores.

### Exclusion Codes Used in CJRR PRO Measure

170.6	Malignant neoplasm of pelvic bones sacrum and coccyx
170.7	Malignant neoplasm of long bones of lower limb
170.9	Malignant neoplasm of short bones of lower limb
195.3	Malignant neoplasm of pelvis
195.5	Malignant neoplasm of lower limb
198.5	Secondary malignant neoplasm of bone and bone marrow
199.0	Disseminated malignant neoplasm
733.1	Pathological fracture unspecified site
733.14	Pathological fracture of neck of femur
733.15	Pathological fracture of other specified part of femur
733.19	Pathological fracture of other specified site
733.8	Malunion and nonunion of fracture
733.81	Malunion of fracture
733.82	Nonunion of fracture
733.95	Stress fracture of other bone
733.96	Stress fracture of femoral neck
733.97	Stress fracture of shaft of femur
808.0	Closed fracture of acetabulum
808.1	Open fracture of acetabulum
808.2	Closed fracture of pubis
808.3	Open fracture of pubis
808.41	Closed fracture of ilium
808.42	Closed fracture of ischium
808.43	Multiple closed pelvic fractures with disruption of pelvic circle
808.44	Multiple closed pelvic fractures without disruption of pelvic circle
808.49	Closed fracture of other specified part of pelvis
808.50	Open fracture of other specified part of pelvis
808.51	Open fracture of ilium
808.52	Open fracture of ischium
808.53	Multiple open pelvic fractures with disruption of pelvic circle
808.54	Multiple open pelvic fractures without disruption of pelvic circle
808.8	Unspecified closed fracture of pelvis
820	Fracture of neck of femur
820.0	Transcervical fracture closed
820.00	Fracture of unspecified intracapsular section of neck of femur closed
820.01	Fracture of epiphysis (separation) (upper) of neck of femur closed
820.02	Fracture of midcervical section of femur closed
820.03	Fracture of base of neck of femur closed
820.09	Other transcervical fracture of femur closed
820.1	Transcervical fracture open
820.10	Fracture of unspecified intracapsular section of neck of femur open
820.11	Fracture of epiphysis (separation) (upper) of neck of femur open

### Risk Adjustment Methods

The risk-adjustment approach used in CJRR compares the 95% confidence interval of each hospital's risk-adjusted PRO MCID rate (RAR) to all participating hospitals' overall PRO MCID rate to identify hospital performance "Better" or "Worse" outliers. The risk-adjusted PRO results represent what a hospital's PRO MCID rate would have been if the hospital had a patient case mix identical to the reference population. For CJRR, the reference population is the patient population of all CJRR participating hospitals. A hospital's RACR is calculated by dividing the hospital's observed PRO MCID rate by the hospital's expected PRO MCID rate (obtained from the risk model calculation) to get the observed/expected (O/E) ratio. If the O/E ratio is greater than one, the hospital has a higher PRO MCID rate than expected given its patient mix. If the O/E ratio is less than one, the hospital has a lower PRO MCID rate than expected. The O/E ratio is then multiplied by the overall PRO MCID rate of all participating hospitals to obtain the hospital's risk-adjusted PRO MCID rate.

### Statistical Analysis

All candidate risk factors were entered into a stepwise, backward-selection logistic regression model. Candidate risk factors included age, gender, race (Caucasian), ASA Class, ASA Class grouped, hip vs. knee procedure, multiple simultaneous procedures, diabetes, immunocompromised status, obese, hypertension history, MI history, CAD History, CLD history, VTE history, count of risk factors, surgery year, and median household income. These variables were collected from patient records where available and reported by participating hospitals. Patients with missing data for these variables were assigned a value not associated with MCIDs. For example, a patient with missing BMI would be assigned an obese score of "No."

The variable selection method required an individual predictor to be associated with PRO MCID at the 0.05 level of significance to be retained. Predictor variables that did not meet this level of significance were dropped. A final risk model was specified by keeping all predictor variables that met the 0.05 level of significance in the automated selection method, and by adding additional variables that were not statistically significant but were clinically meaningful.

The CJRR Reporting Subcommittee determined that the resulting risk adjustment model had adequate fit (Hosmer-Lemesow lack-of-fit chi-square = 0.299, n.s.), and that it was adequately predictive (c=0.78).

### Final Risk Adjustment Variables

The final risk adjustment regression model included several patient-level variables known to be associated with improved patient-reported outcomes:

- Preoperative WOMAC score
- Age: Patient age in years at the time of surgery
- Gender: Male / Female
- Race: Caucasian / Other
- ASA Physical Status Classification System score: (III/IV) / (I/II)
- Obese: Body Mass Index (BMI) score of 30 greater
- Diabetes: Yes / No
- Hypertension History: Yes / No
- Chronic Lung Disease History: Yes / No
- Hip vs. Knee Procedure

### Calculation of Hospital Risk-Adjusted MCID Outcome

The risk-adjustment regression model was used to calculate expected MCIDs for each hospital using patient-level data. The expected PRO MCID rate was the number of expected MCIDs as predicted by the risk-adjustment model, divided by the total number of actual, eligible joint replacement surgery cases, multiplied by 100. The expected event rate is adjusted for the severity of the hospital's case mix. The observed PRO MCID rate was the number of observed MCIDs divided by the total number of eligible joint replacement surgery cases, multiplied by 100.

The risk-adjusted MCID rate (RAR) was obtained by multiplying the population observed MCID rate (87.1%) by the hospital's Observed / Expected ratio. The risk-adjusted event rate reflects the best estimate of what a provider's MCID rate would have been if the provider had a patient case mix identical to the overall CJRR average. This rate is comparable among providers because it accounts for the differences in patient severity-of-illness.

Each provider's performance rating was based on a comparison of the 95% confidence interval (CI) of each provider's RAR to the population average MCID rate (87.1%). The Poisson exact probability method was used for computing the 95% CI for the RAR.

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<sup>a</sup> Partial procedures, resurfacings, and revisions were excluded.

<sup>b</sup> <http://www.womac.org/womac/index.htm>

<sup>c</sup> Change in WOMAC Score between Pre-Op and 1-year Post-Op  $\geq$  the Minimal Clinically Important Difference (0.5\*standard deviation of mean change in scores).

