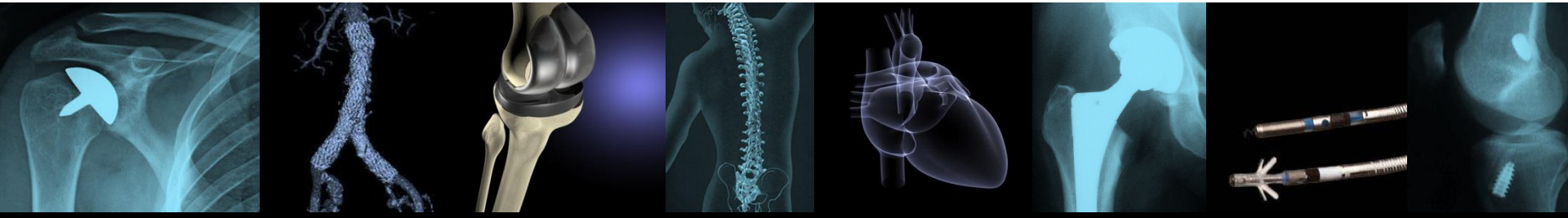
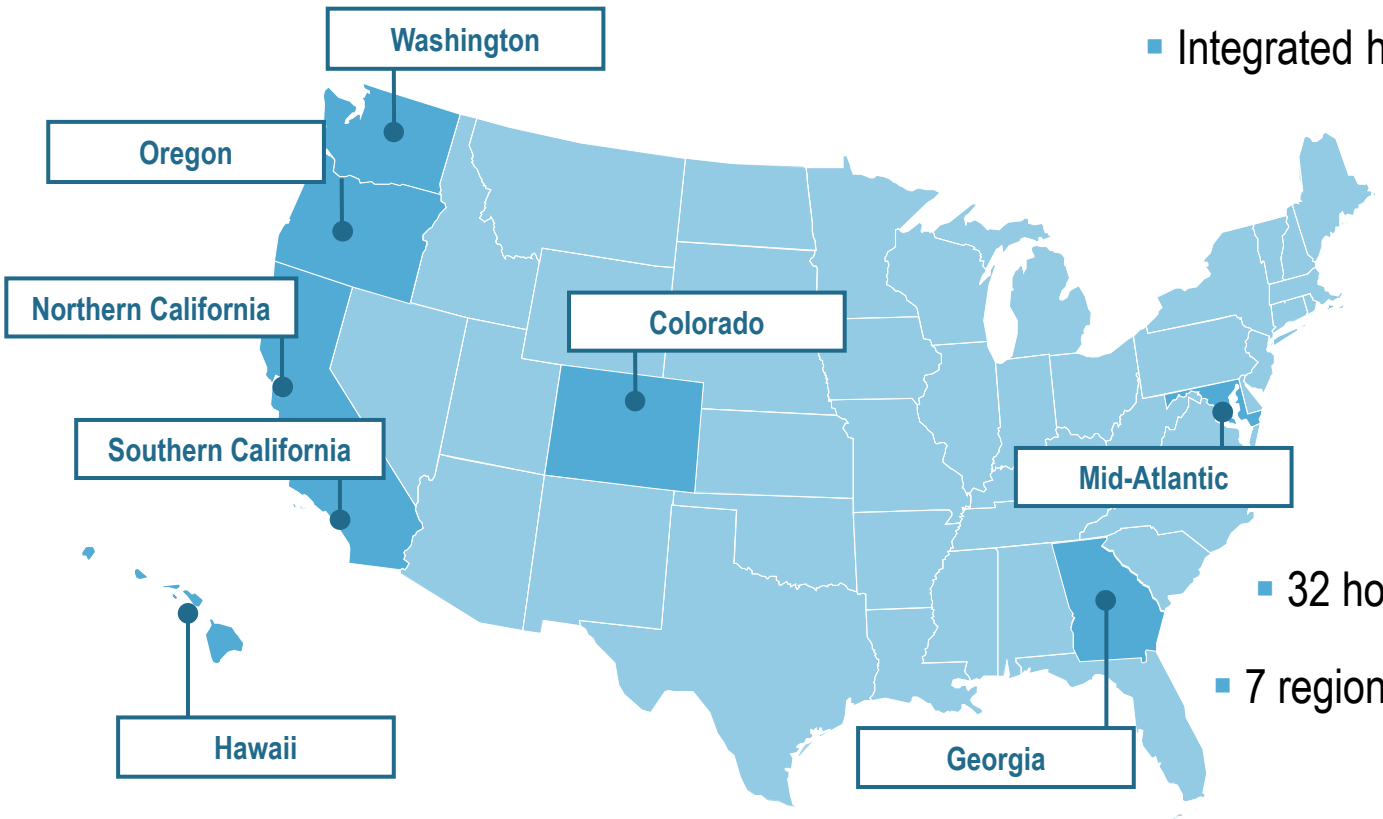
Kaiser Permanente Total Joint Registry: Enhancing Quality, Patient Safety & Cost Effectiveness



RIAP Conference
July 2016

Liz Paxton
Director Kaiser Permanente National Implant Registries

About Kaiser Permanente



- Nation's largest nonprofit health plan
- Integrated health care delivery system
- 9 million members
- 12,000+ physicians
- 140,000+ employees
- 430+ medical offices
- 32 hospitals and medical centers
- 7 regions serving 8 states and D.C.

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A Learning Health Care System

Information-rich, patient focused enterprises

Evidence is continually refined as a byproduct of care delivery

Information and evidence transform interactions from reactive to proactive (benefits and harms)

From "A Learning Health Care System for Cancer Care" by Carolyn Clancy, MD, Agency for Healthcare Research and Quality

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Goals Kaiser Permanente Registries

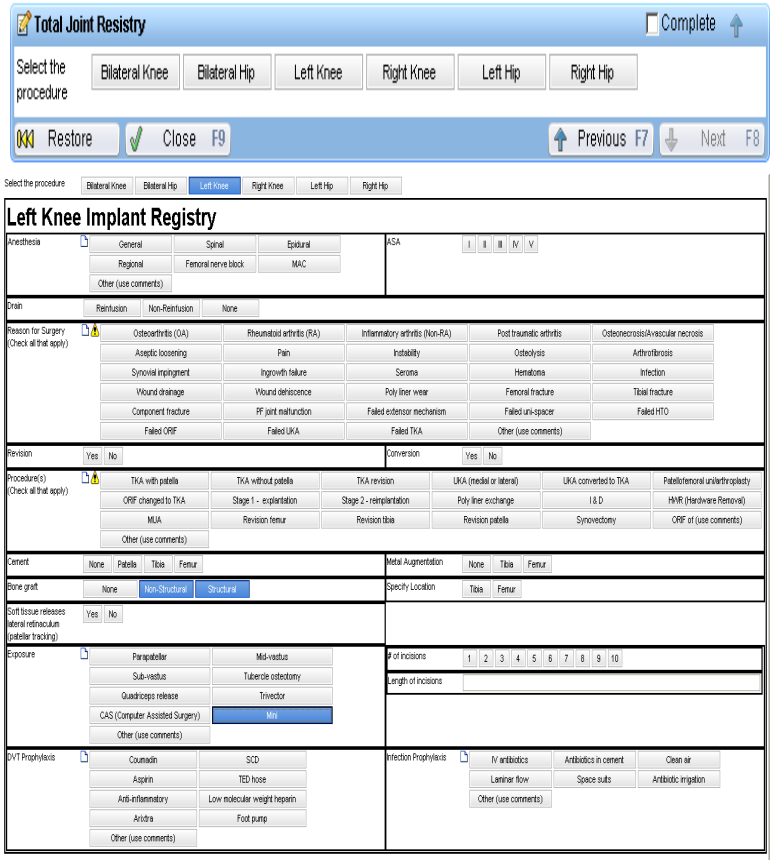
- Identify patients at risk for poor outcomes
- Identify clinical best practices for quality improvement
- Identify best performing/outlier devices for our patients
- Device recalls/notifications
- Comparative effectiveness research

Orthopedic Registries	
Total Joint	250,000
Hip Fracture	28,000
ACLR	30,300
Spine	19,500
Shoulder	9,400

Cardiac/Vascular	
ICDS	30,900
Pacemakers	69,000
Leads	140,120
Heart Valve	24,500
EVAR	3,260

Kaiser Permanente Registries

- Developed in 2001
- Modeled after Swedish Hip Register
- Methods
  - Standardized documentation
  - Leveraging existing EHR data
    - Patient information
    - Procedures/diagnoses
    - Implant data and clinical attributes library
    - Labs
    - Medications
  - Adverse event electronic screening methods
  - Stringent quality control processes
  - Chart review validation of outcomes (Revision, Infection, DVT, PE)



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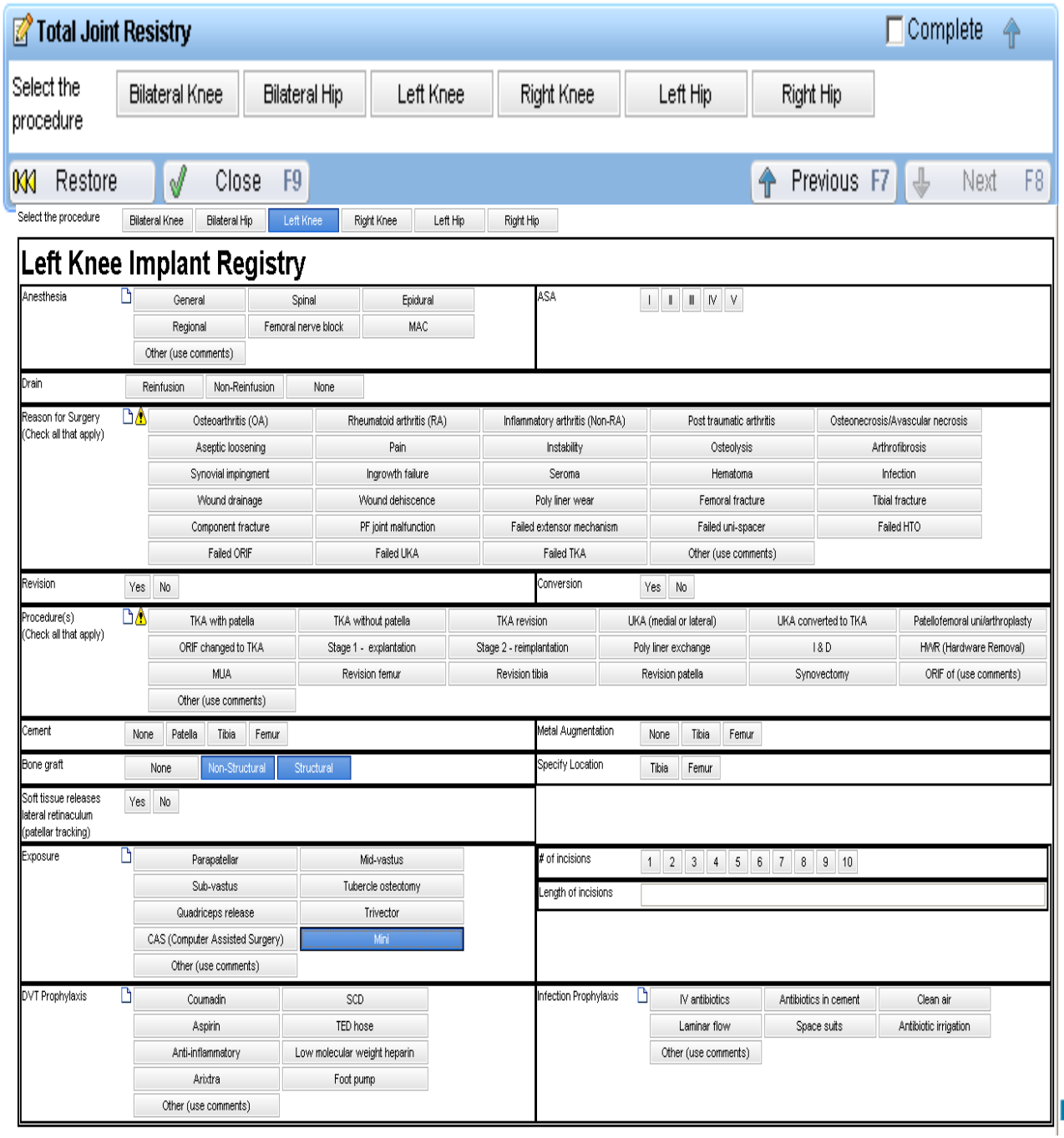


NENTE. thrive

Implant Data Elements Extracted from EHR

Optime Company	Optime Catalog #	Optime LotNo	Optime ImplantName	Optime Qty	Optime Laterality
ZIMMER	00595001506	59998478	COMPONENT FEMORAL E- L68 MM X W59.4 MM RIGHT KNEE CEMENTED CRUCIATE RETAINING NEXGEN CR-FLEX ZIMALOY PRECOAT STERILE - LOG319457	1	RIGHT
ZIMMER	00595203010	62283716	SURFACE ARTICULAR YELLOW L66 MM X W42 MM NEXGEN CR-FLEX 10 C-H 3-4 STANDARD TIBIAL KNEE PROLONG UHMW POLYETHYLENE CRUCIATE RETAINING STERILE - LOG319457	1	RIGHT

Implant Components

Company Name
Catalog #
Lot/Serial #
Quantity
Material
Fixation
Size
Mobility
Stability

Catalog #

Registry SQL Database

Implant Reference Library

COMPANY NAME	CATALOG #	DESCRIP-TION	IMPLANT NAME	CATE-GORY	INSERT MATERIAL	FEMORAL MATERIAL	CEMENT FIXATION	SIZE	STABILITY	MOBIL-ITY
ZIMMER	00595001506	NEXGEN CR FLEX FEM COMP PRECOAT	NEXGEN	FEMORAL		COCR	CEMENTED	SIZE E	MINIMALLY STABILISED	
ZIMMER	00595203010	ZIMMER ARTICULAR SURFACE CR PROLONG	ZIMMER	INSERT	HIGHLY CROSS-LINKED			SIZE 2	MINIMALLY STABILISED	FIXED

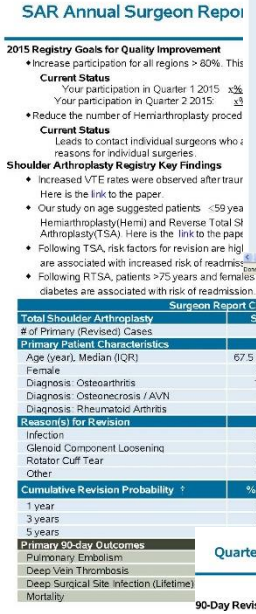
	Data Acquisition and quality control	Data aggregation and storage	Data Integration and analyses	Information delivery systems
 EHR  Claims GEMS Mortality	Extract Transfer load Data cleaning and quality control checks Electronic screening algorithms Chart review validation of adverse events	KAISER PERMANENTE **TOTAL JOINT Registry**  Patient characteristics Implants Surgical techniques Validated outcomes	Data extraction Data queries Data mining Machine learning Predictive modeling Survival analyses	Annual report Risk adjusted medical center reports Personalized surgeon profiles Recalls/advisories Identification of outlier implants Identification of variation and clinical best practices Comparative effectiveness studies

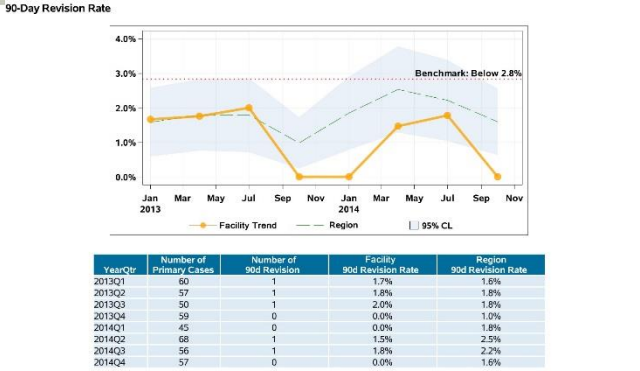
Identification of Variation

Patient	Implant	Surgeon	Medical Center
• Individual risk • Subgroups at risk	• Outliers (best/worst)	• Individual performance • Clinical best practices	• Medical center performance

KP Tools for Enhancing Quality & Patient care

- Medical center reports
- Individualized surgeon profiles
- Quarterly quality reports
- Patient risk calculators
- Outlier implant reports
- Recall/advisory identification/tracking
- Newsletters/meetings/conferences
- Publications





YearQtr	Number of Primary Cases	Number of 90d Revision	Facility 90d Revision Rate	Region 90d Revision Rate
2013Q1	60	1	1.7%	1.6%
2013Q2	57	1	1.8%	1.8%
2013Q3	50	1	2.0%	1.8%
2013Q4	59	0	0.0%	1.0%
2014Q1	45	0	0.0%	1.8%
2014Q2	68	1	1.5%	2.5%
2014Q3	56	1	1.8%	2.2%
2014Q4	57	0	0.0%	1.6%

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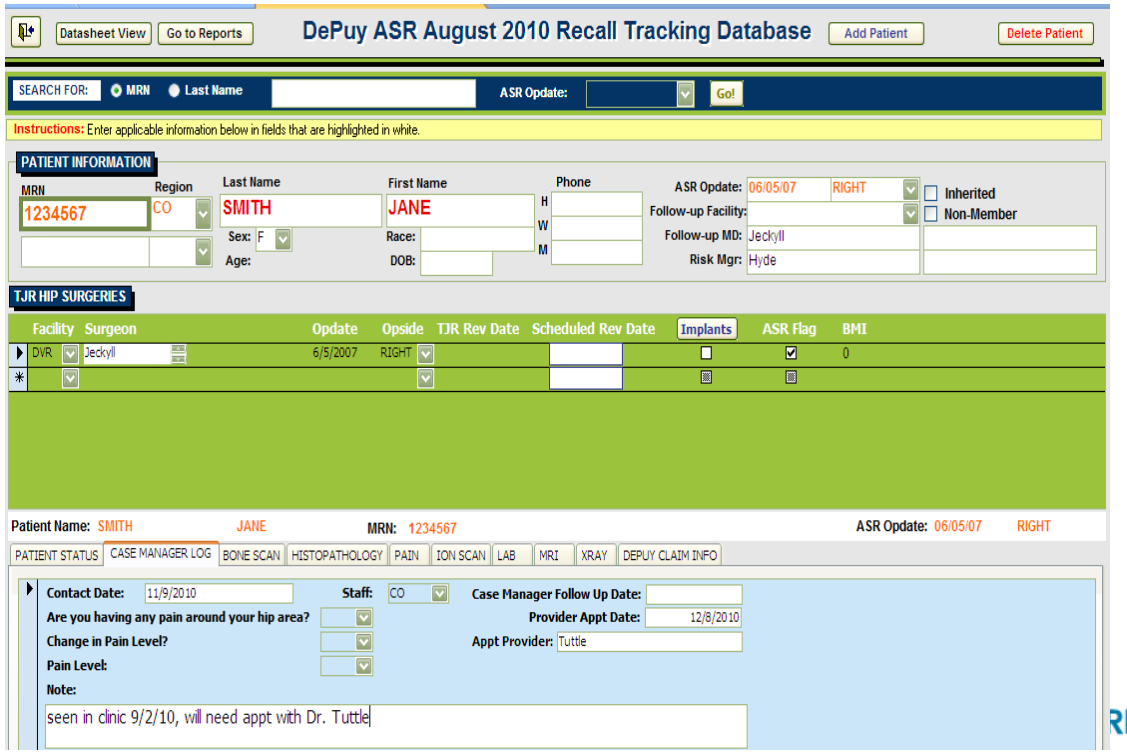
Identifying Patient Risk Factors

Implant Recalls/Advisories

- 14,000 patients with enhanced surveillance due to 17 recalls in 2014-2015 alone
- Allows immediate notification of patients and lists to surgeons
- Provides a mechanism to monitor patient follow-up related to recall



RMANENTE. thrive

Risk Factors for Revisions and Complications

Revision Total Hip Arthoplasty: Factors Associated with Re-Revision Surgery

Monti Khatod, MD, Guy Cafri, PhD, Maria C.S. Inacio, PhD, Alan L. Schepps, MS, Elizabeth W. Paxton, MA, and Stefano A. Bini, MD

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

ELSEVIER

Risk factors for Total Hip Arthroplasty Aseptic Revision

Monti Khatod, MD [a], Guy Cafri, PhD [b], Robert S. Namba, MD [c], Maria C.S. Inacio, PhD [b], Elizabeth W. Paxton, MA [b]

Clin Orthop Relat Res
DOI 10.1007/s11999-015-4278-x

Clinical Orthopaedic and Related Research

SYMPOSIUM: 2014 MEETING OF INTERNATIONAL SOCIETY OF ARTHROPLASTY REGISTERS

Are There Modifiable Risk Factors for Hospital Readmission After Total Hip Arthroplasty in a US Healthcare System?

Elizabeth W. Paxton MA, Maria C. S. Inacio PhD, Jasvinder A. Singh MD, MPH, Rebecca Love MPH, RN, Stefano A. Bini MD, Robert S. Namba MD

Risk Factors Associated with Deep Surgical Site Infections After Primary Total Knee Arthroplasty

An Analysis of 56,216 Knees

Robert S. Namba, MD, Maria C.S. Inacio, MS, and Elizabeth W. Paxton, MA

Contents lists available at SciVerse ScienceDirect

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Risk Factors for Total Knee Arthroplasty Aseptic Revision

Robert S. Namba, MD [a], Guy Cafri, PhD [b], Monti Khatod, MD [c], Maria C.S. Inacio, PhD [b], Timothy W. Brox, MD [d], Elizabeth W. Paxton, MA [b]

Clin Orthop Relat Res
DOI 10.1007/s11999-015-4263-4

and Related Research

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SYMPOSIUM: 2014 MEETING OF INTERNATIONAL SOCIETY OF ARTHROPLASTY REGISTERS

Association of Bisphosphonate Use and Risk of Revision After THA: Outcomes From a US Total Joint Replacement Registry

Monti Khatod MD, Maria C. S. Inacio PhD, Richard M. Dell MD, Stefano A. Bini MD, Elizabeth W. Paxton MA, Robert S. Namba MD

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Patient Risk Calculators

Clin Orthop Relat Res
DOI 10.1007/s11999-015-4506-4

Clinical Orthopaedics and Related Research®
A Publication of The Association of Bone and Joint Surgeons®

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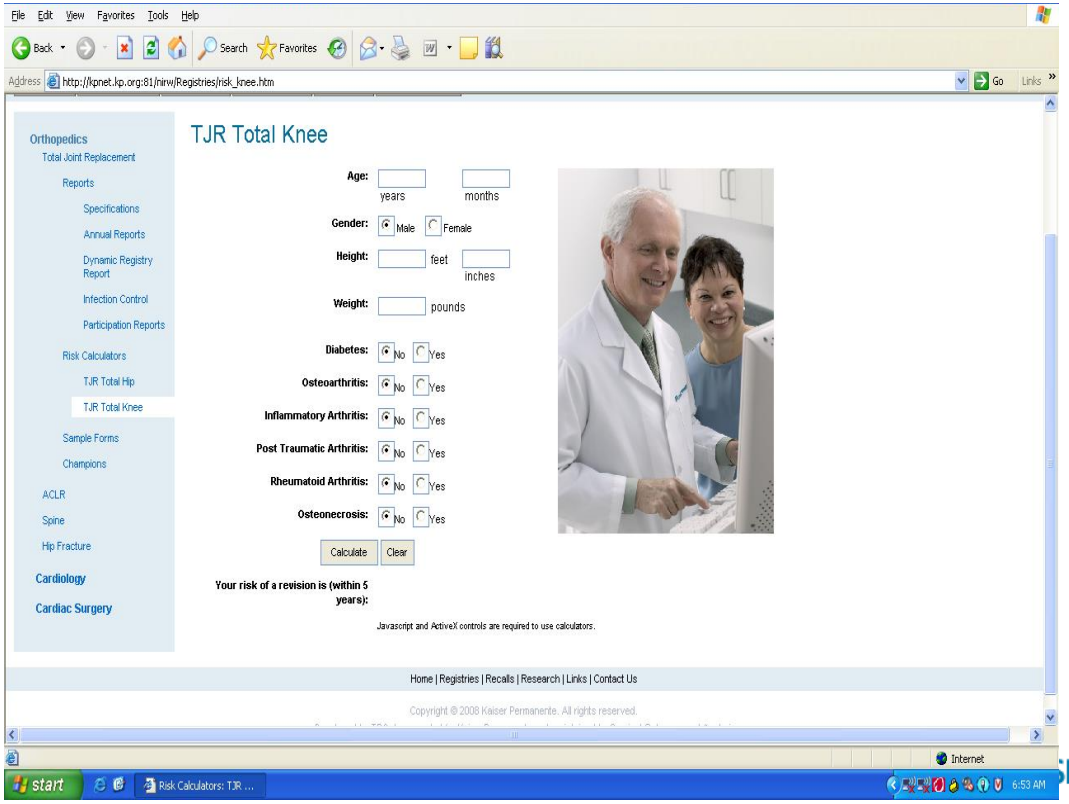
CLINICAL RESEARCH

Risk Calculators Predict Failures of Knee and Hip Arthroplasties: Findings from a Large Health Maintenance Organization

Elizabeth W. Paxton MA, Maria C. S. Inacio PhD, Monti Khatod MD, Eric Yue MD, Tadashi Funahashi MD, Thomas Barber MD



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Identifying Clinical Best Practices and Providing Surgeon Feedback

Identification of Clinical Best Practices

Clin Orthop Relat Res
DOI 10.1007/s11999-015-4230-0

Clinical Orthopaedics and Related Research®
A Publication of The Association of Bone and Joint Surgeons®

SYMPOSIUM: 2014 MEETING OF INTERNATIONAL SOCIETY OF ARTHROPLASTY REGISTERS

Anterior and Anterolateral Approaches for THA Are Associated With Lower Dislocation Risk Without Higher Revision Risk

Dhiren Sheth MD, Guy Cafri PhD, Maria C. S. Inacio PhD, Elizabeth W. Paxton MA, Robert S. Namba MD

Pulmonary Embolism Prophylaxis in More Than 30, 000 Total Knee Arthroplasty Patients: Is There a Best Choice?
Monti Khatod, MD,* Maria C.S. Inacio, MS, Stefa and Elizabeth W. Paxton, MA

Antibiotic cement was associated with half the risk of re-revision in 1,154 aseptic revision total knee arthroplasties

Stefano A Bini, Priscilla H Chan, Maria C S Inacio, Elizabeth W Paxton & Monti Khatod

Acta Orthopaedica
2014; 85 (1): x–x

Can total knee arthroplasty be safely performed in patients with chronic renal disease? An evaluation of perioperative morbidity in 2,686 procedures from a Total Joint Replacement Registry
Alexander Miric, Maria CS Inacio, and Robert S Namba

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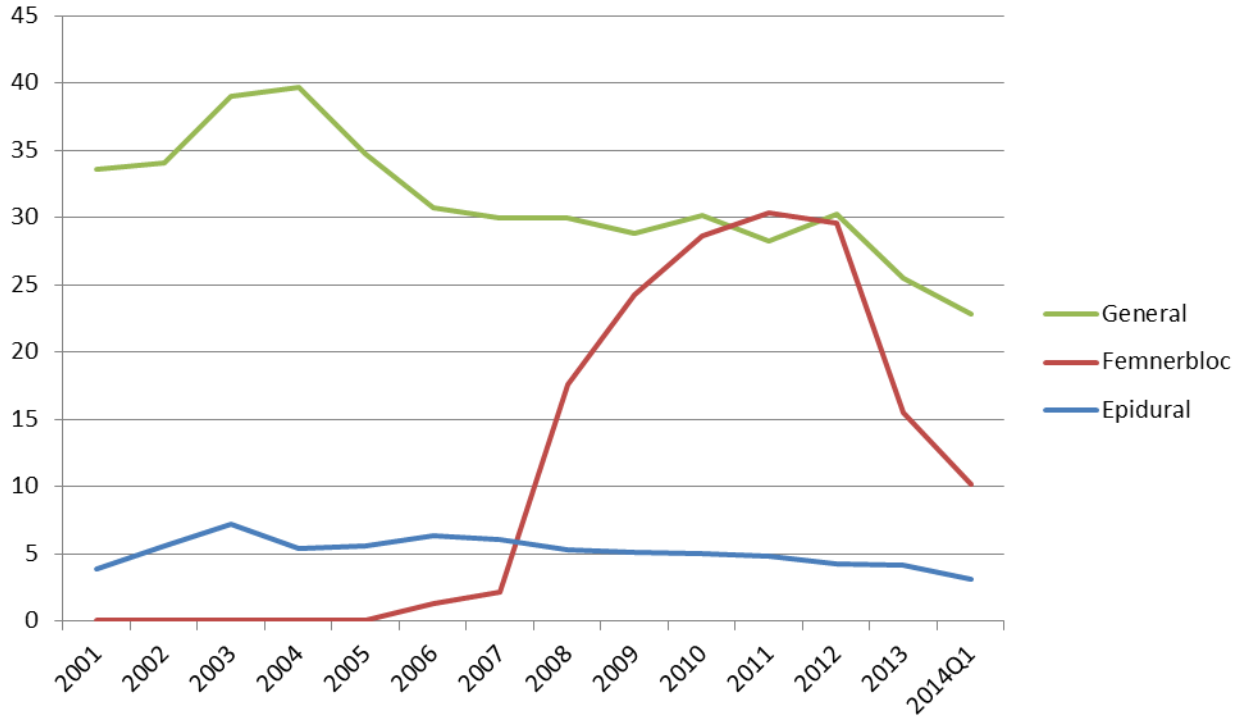
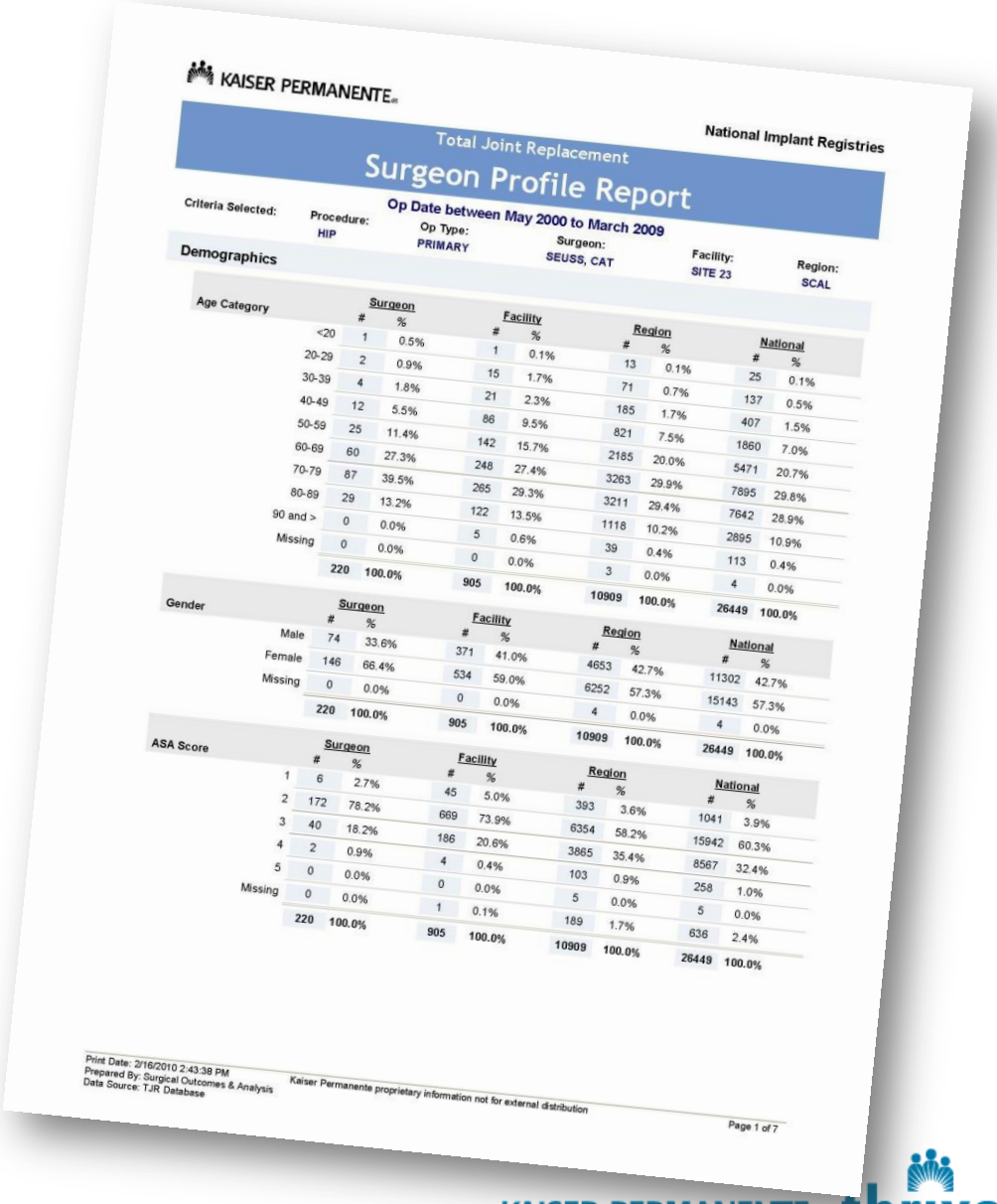
TKA General Anesthesia

- General anesthesia found to be a significant risk factor for PE compared to non–general anesthesia, increasing the odds of an event by 67% (95% CI, 14%-144%; P =.009)



Confidential Surgeon Profiles

- Personal practice profiles to allow surgeons to compare their patient demographics, implants, techniques and outcomes to others in their medical center, region, and nationwide



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National Implant Registries

Total Joint Replacement

Surgeon Profile Report

Criteria Selected: Procedure: HIP; Op Type: PRIMARY; Op Date between May 2000 to March 2009; Surgeon: SEUSS, CAT; Facility: SITE 23; Region: SCAL

Demographics

Age Category	Surgeon #	Surgeon %	Facility #	Facility %	Region #	Region %	National #	National %
<20	1	0.5%	1	0.1%	13	0.1%	25	0.1%
20-29	2	0.9%	15	1.7%	71	0.7%	137	0.5%
30-39	4	1.8%	21	2.3%	185	1.7%	407	1.5%
40-49	12	5.5%	86	9.5%	821	7.5%	1860	7.0%
50-59	25	11.4%	142	15.7%	2185	20.0%	5471	20.7%
60-69	60	27.3%	248	27.4%	3263	29.9%	7895	29.8%
70-79	87	39.5%	265	29.3%	3211	29.4%	7642	28.9%
80-89	29	13.2%	122	13.5%	1118	10.2%	2895	10.9%
90 and >	0	0.0%	5	0.6%	39	0.4%	113	0.4%
Missing	0	0.0%	0	0.0%	3	0.0%	4	0.0%
	220	100.0%	905	100.0%	10909	100.0%	26449	100.0%

Gender	Surgeon #	Surgeon %	Facility #	Facility %	Region #	Region %	National #	National %
Male	74	33.6%	371	41.0%	4653	42.7%	11302	42.7%
Female	146	66.4%	534	59.0%	6252	57.3%	15143	57.3%
Missing	0	0.0%	0	0.0%	4	0.0%	4	0.0%
	220	100.0%	905	100.0%	10909	100.0%	26449	100.0%

ASA Score	Surgeon #	Surgeon %	Facility #	Facility %	Region #	Region %	National #	National %
1	6	2.7%	45	5.0%	393	3.6%	1041	3.9%
2	172	78.2%	669	73.9%	6354	58.2%	15942	60.3%
3	40	18.2%	186	20.6%	3865	35.4%	8567	32.4%
4	2	0.9%	4	0.4%	103	0.9%	258	1.0%
5	0	0.0%	0	0.0%	5	0.0%	5	0.0%
Missing	0	0.0%	1	0.1%	189	1.7%	636	2.4%
	220	100.0%	905	100.0%	10909	100.0%	26449	100.0%

Print Date: 2/16/2010 2:43:38 PM
Prepared By: Surgical Outcomes & Analysis
Data Source: TJR Database

Kaiser Permanente proprietary information not for external distribution

Page 1 of 7

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Identifying the Best Implants For Our Patients

Outlier Implants

Screening for Outliers

- Flag implants with revision rate (per 100 component years) 2 times that of its group, e.g. THA, BHR, TKA, UKA

Risk-Adjustment

- Risk-adjusted by diagnosis, gender, and age
- Focus on implants with > 500 cases
- Survival analysis

Follow-up and Dissemination

- Monitor outliers with short-term follow-up and small Ns
- Confirmatory analyses with other national registries
- Share findings with surgeons

Device Comparative Effectiveness

Clin Orthop Relat Res
DOI 10.1007/s11999-014-4046-3

SYMPOSIUM: ADVANCES IN UHMWPE BIOMATERIALS

Is There a Difference in Total Knee Arthroplasty Risk of Revision in Highly Crosslinked versus Conventional Polyethylene?

Elizabeth W. Paxton MA, Maria C. S. Inacio PhD,
Steven Kurtz PhD, Rebecca Love MPH, RN,
Guy Cafri PhD, Robert S. Namba MD

Clin Orthop Relat Res
DOI 10.1007/s11999-014-4105-9

SYMPOSIUM: ADVANCES IN UHMWPE BIOMATERIALS

Metal-on-conventional Polyethylene Total Hip Arthroplasty Bearing Surfaces Have a Higher Risk of Revision Than Metal-on-highly Crosslinked Polyethylene: Results From a US Registry

Elizabeth W. Paxton MA, Maria C. S. Inacio PhD,
Robert S. Namba MD, Rebecca Love MPH, RN,
Steven M. Kurtz PhD

Acta Orthopaedica 2013; 84 (5): x–x

■ KNEE

Increased risk of revision for high flexion total knee replacement with thicker tibial liners

Monoblock all-polyethylene tibial components have a lower risk of early revision than metal-backed modular components

A registry study of 27,657 primary total knee arthroplasties

ıria C S Inacio[2], Robert S Namba[1], Dhiren Sheth[1], and Elizabeth W Paxton[2]

■ KNEE

Does pre-coating total knee tibial implants affect the risk of aseptic revision?

ORIGINAL ARTICLE

Evaluation of total hip arthroplasty devices using a total joint replacement registry

Elizabeth W. Paxton*, Christopher F. Ake, Maria C.S. Inacio, Monti Khatod, Danica Marinac-Dabic and Art Sedrakyan

Acta Orthopaedica
2013; 84 (2): x–x

Alternative bearings in total knee arthroplasty: risk of early revision compared to traditional bearings An analysis of 62,177 primary cases

Maria C S Inacio, Guy Cafri, Elizabeth W Paxton, Steven M Kurts, and Robert S Namba

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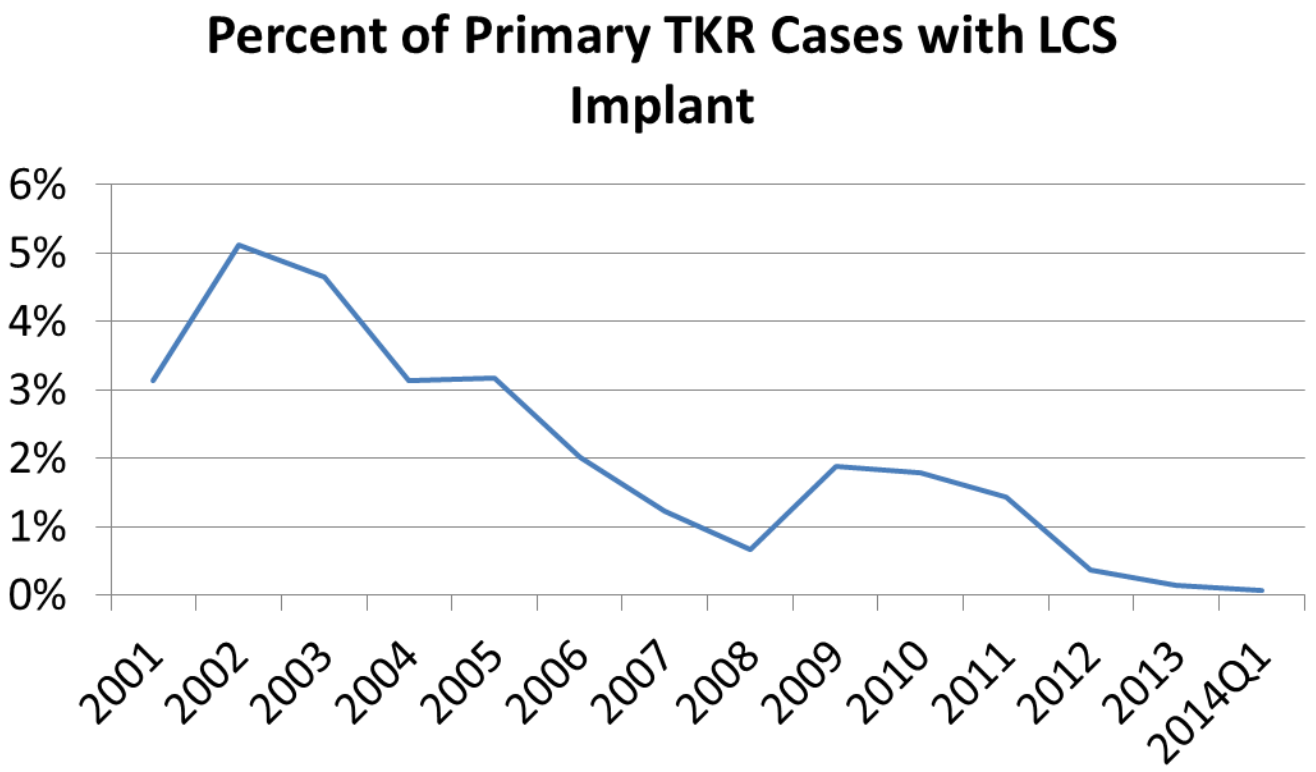
Total Knee Arthroplasty LCS Implant



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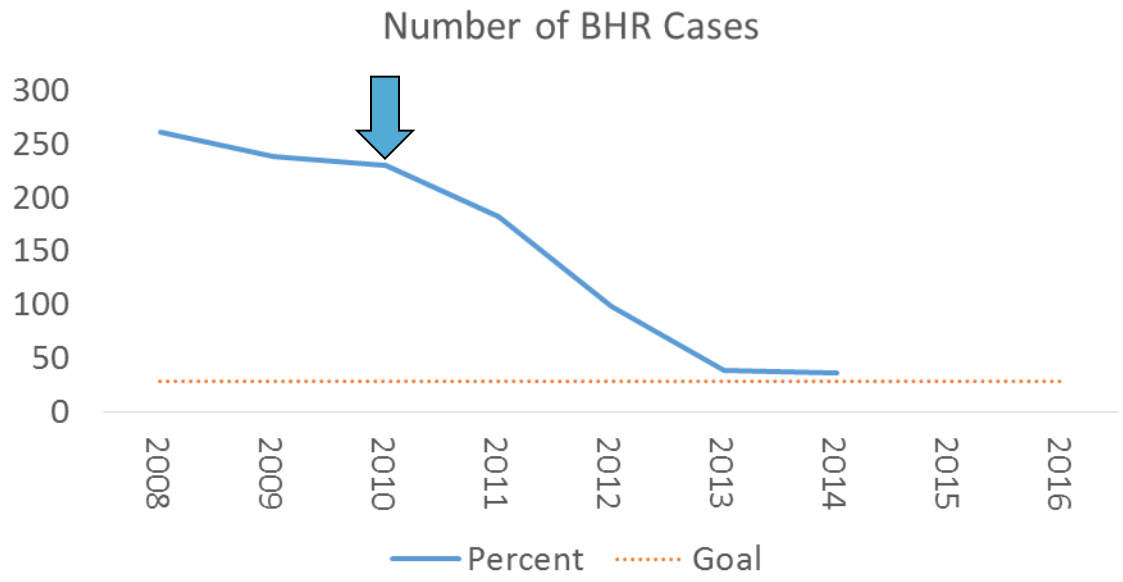
Early Identification of Outlier Devices and Changes in Clinical Practice

- Registry findings:
  - HRs had a higher risk of revision than THA (HR=3.51, 2.02-6.10), p<.001
- Reduction in HR program-wide



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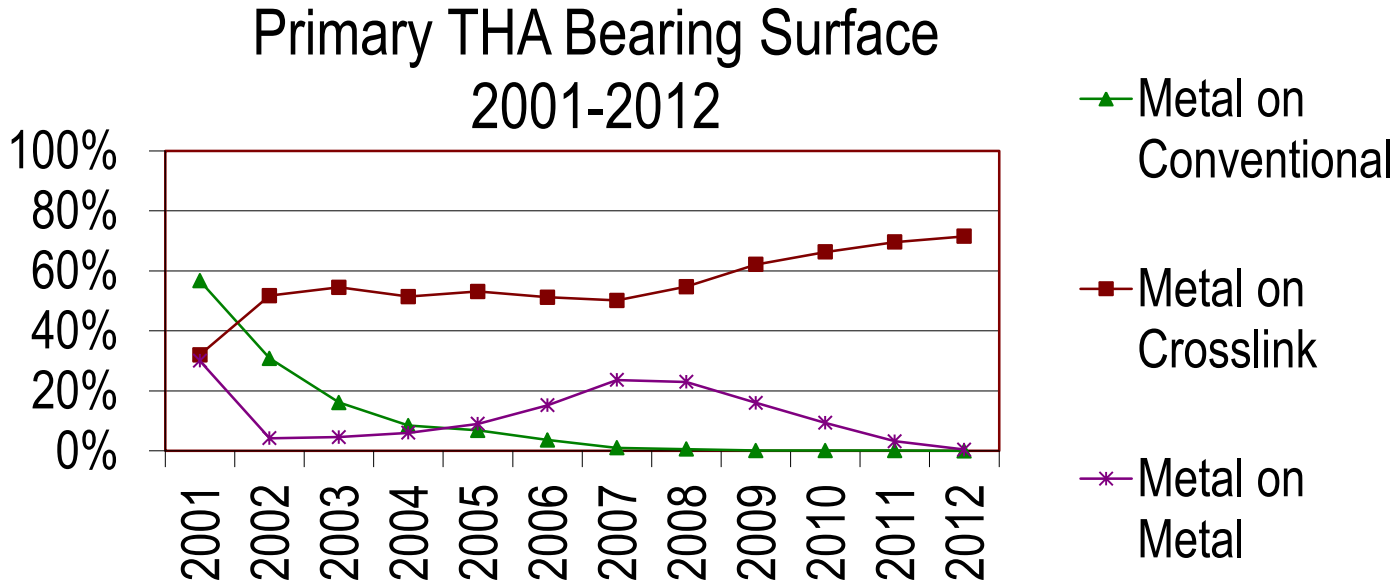
Total Hip Arthroplasty Bearing Surface

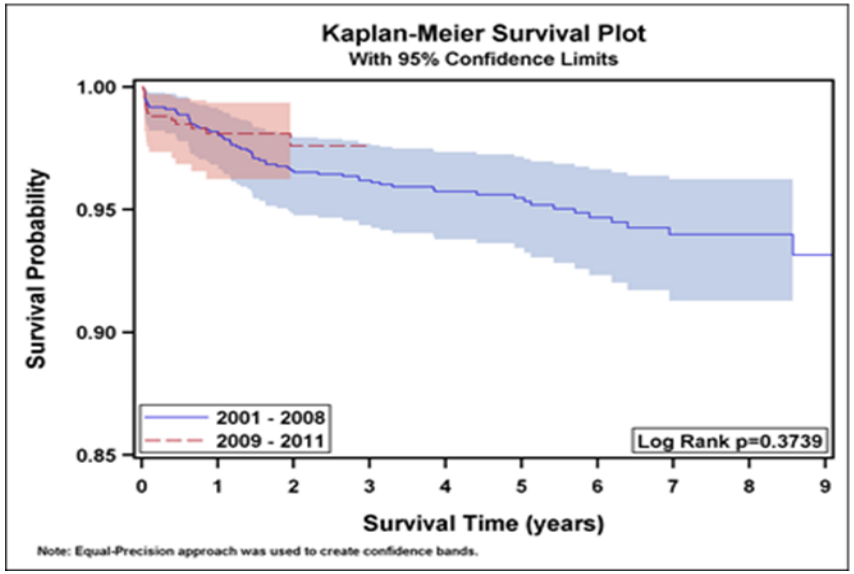
- Metal-on-conventional polyethylene and metal-on-metal shown to have higher risk of revision and are decreasing in use
- Metal-on-highly crosslinked polyethylene has a lower risk of revision than other bearing surfaces and use is increasing

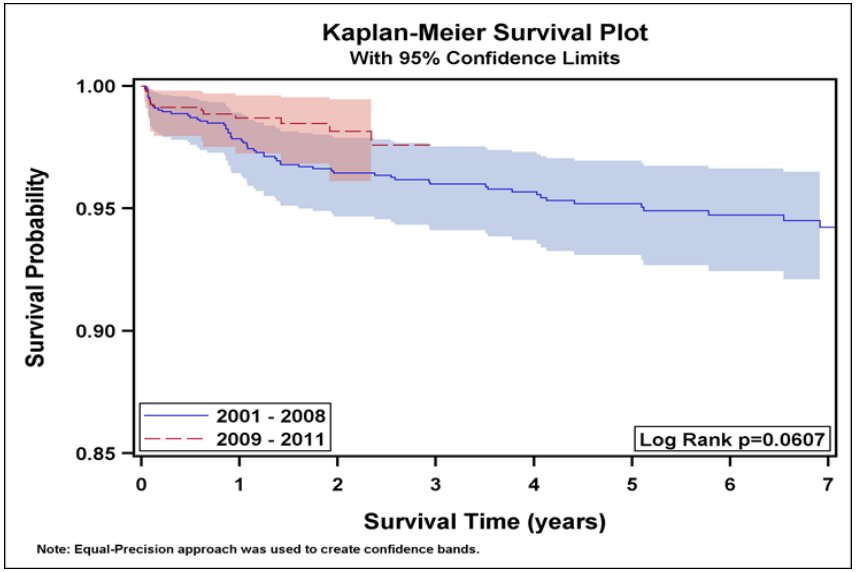


Identifying Hospital Variation and Best Practices

Hospital Variation and Improvement

- Methods
  - Observed vs expected risk adjusted revision rate for THR/TKR
  - Limited to facilities performing 500 total joints per year
  - 5 medical centers (out of 35) were identified as outliers
  - Independent, outside orthopedic surgeons reviewed two sites
    - Radiologic and chart review of ALL revisions was done
    - All total joint surgeons attended presentation of recommendations
- Results: Four of the medical centers improved their revision rates



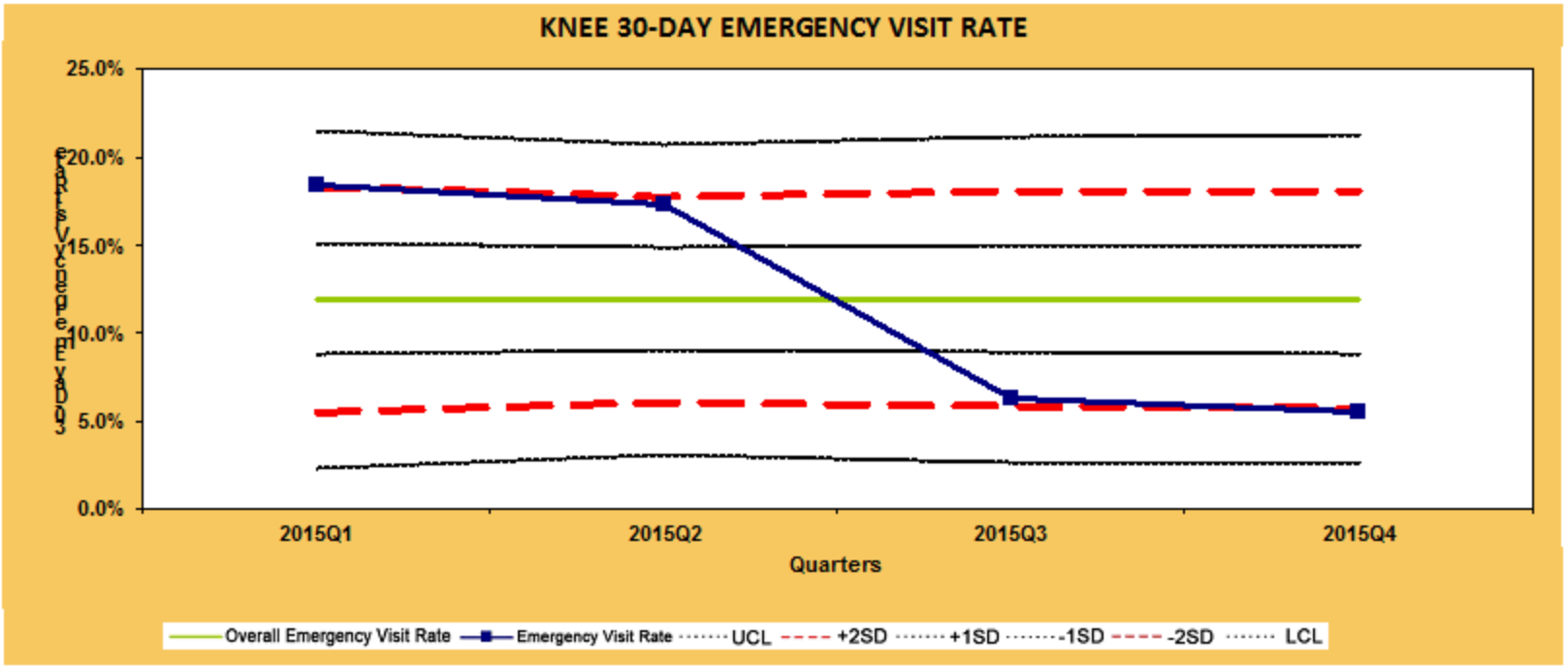


Quarterly Quality Reports

90-Day Deep Infection Rate	90-Day DVT Rate	90-Day PE Rate	90-Day Mortality Rate	30-Day UNPLANNED Inpatient Readmission Rate	30-Day Emergency Visit Rate	Length of Stay (Median)
<=1.5%	<=1.0%	<=0.5%	<=1.0%	<=5.0%	<=10.0%	<=60
>1.5%	>1.0%	>0.5%	>1.0%	>5.0%	>10.0%	>60
0.3%	0.6%	0.4%	0.3%	3.2%	7.8%	53.9
0.4%	0.9%	0.5%	0.2%	2.7%	7.8%	55.1
0.0%	0.0%	1.1%	0.0%	0.0%	0.0%	48.0
0.6%	1.2%	0.6%	0.5%	3.5%	9.2%	40.4
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	54.0
0.4%	0.4%	0.0%	0.0%	3.3%	7.7%	51.8
1.7%	0.7%	0.7%	0.0%	3.4%	9.4%	36.6
0.0%	0.0%	0.0%	2.0%	2.1%	0.0%	72.0
0.0%	1.2%	0.0%	0.0%	1.2%	6.7%	56.7
0.0%	0.0%	0.0%	0.0%	0.0%	25.0%	55.0
0.0%	1.1%	0.3%	0.3%	2.5%	7.1%	56.4
0.0%	0.0%	0.0%	0.0%	0.7%	6.6%	55.5
0.0%	0.4%	0.8%	0.0%	1.9%	7.2%	55.8
0.0%	0.5%	0.0%	0.0%	4.9%	8.2%	56.3
0.0%	1.3%	0.8%	0.0%	2.7%	8.4%	60.1
0.4%	2.0%	0.4%	0.7%	2.8%	8.1%	55.0
1.6%	0.5%	0.5%	1.4%	3.7%	12.6%	48.5

Changes in Practice and Improved Patient Outcomes

Overall 30-Day Emergency Visit Rate: *11.94%*



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Cost effectiveness

- Identify best performing implants for national contracting decisions
- Evaluate expensive new technology claims
- Early identification and prevention of inferior implants
- Reduce revisions associated with less successful techniques/implants
  - Complicated revisions $100,000 USD

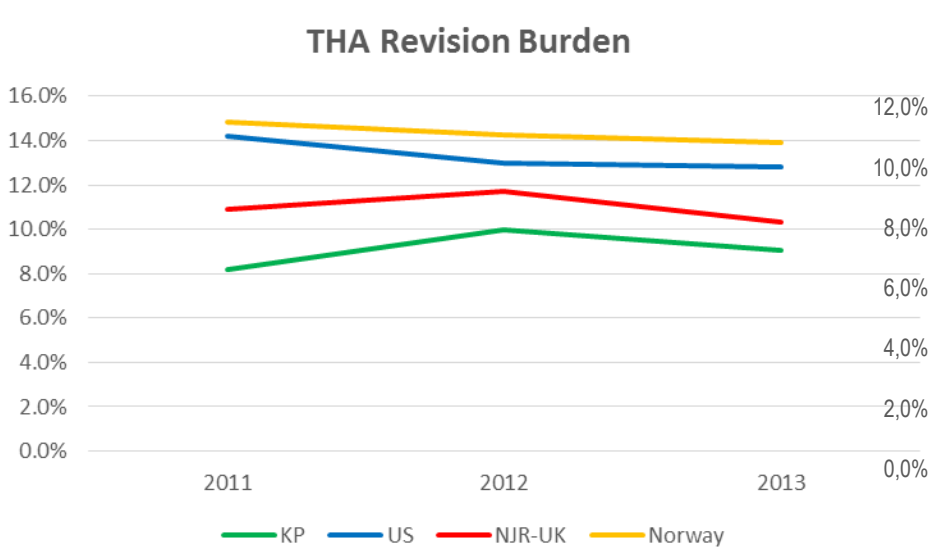
Total joint Replacement Outcomes

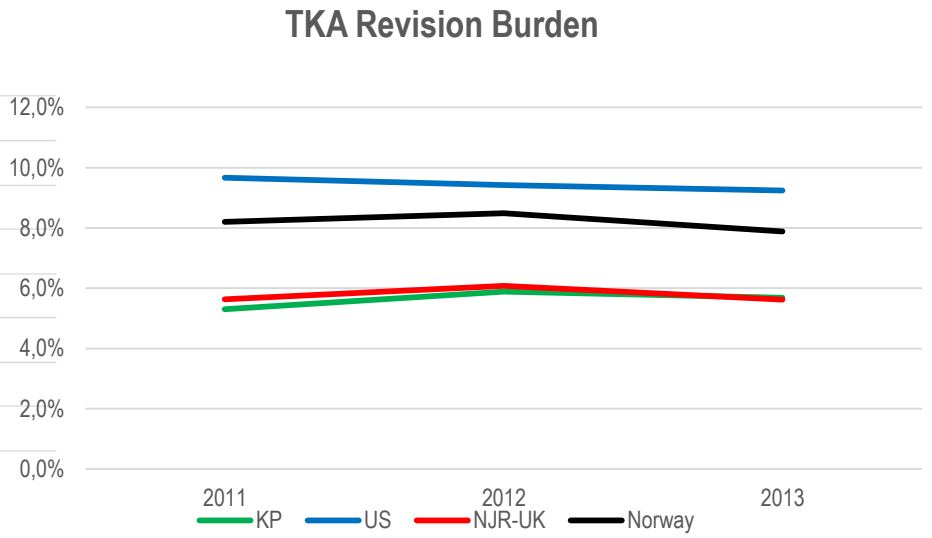
Total Joint Complications

	Primary Total Hips	Revision Total Hips
Deep SSI	.5%	1.8%
DVT	.7%	.8%
PE	.5%	.4%

	Primary Total Knees	Revision Total Knees
Deep SSI	.7%	1.7%
DVT	.6%	.4%
PE	.6%	.4%

Revision Burden





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Longitudinal Tracking of Procedures/Devices

	Total Joint Replacement 10-year Survival % (CI)	
Registry	Hip	Knee
KP (2001-2013)	95.4 (95.1-95.7)	95.4 (95.2-95.6)
Australia (1999-2013)	93.2 (93.1-93.4)	94.4 (94.3-94.6)
Sweden (2003-2012)	94.6 (94.3-94.9)	94.6 (94.3-94.9)
New Zealand (1999-2013)	93.10%	95.7
NJR (2002-2013)	94.25 (94.09-94.45)	96.7 (96.6-96.8) uncemented

Value of Registries

- Provide quality, relevant clinical information to physicians, hospitals, patients, industry, regulators in real time based on real world experience
- Continuous Quality Improvement
  - Identification of variation in practices and outcomes
  - Identification and dissemination of clinical best practices
  - Clinician ownership is a critical factor in change
- Patient Safety
  - Identification of patient risk factors
  - Useful for recalls, advisories, and adverse event surveillance
- Comparative effectiveness

Conclusions

- Registries are vital for patient safety, quality improvement and cost-effectiveness
- A variety of quality improvement tools can be used to provide feedback to patients, surgeons, and hospitals
- Feedback on clinical best practices results in quality improvement and enhanced clinical outcomes for total joint replacement