ACORN

Arthroplasty Clinical Outcomes Registry

Final Report 2013-2018

Ingham Institute
Applied Medical Research

UNSW
AUSTRALIA

WHITLAM
Orthopaedic Research Centre

ACORN

Arthroplasty Clinical Outcomes Registry National

Final Report (2013-2018)

1st January 2013 to 31st December 2018

THIS REPORT has been prepared by Tim Churches, Justine Naylor and Ian Harris on behalf of the ACORN Steering Committee.

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PARTICIPATING HOSPITALS

ACORN wishes to acknowledge the members of the Steering Committee and the support of the orthopaedic departments at all participating hospitals. Special thanks are extended to the Site Coordinators, who have taken responsibility for the collection and submission of data and who are vital to the success of ACORN. Thanks are also given to Shirley Cross, Michelle Jones, Gursharan Singh, Cheryl Ryce, Eunice Raymond and Anne Sinclair for participant follow-up and administrative support.

Hospital	**Co-ordinator**	**Role**
Canterbury Hospital	Vanessa Falzon	Admissions Office Supervisor, Admissions Office
Coffs Harbour Health Campus	Andrew Wong	Physiotherapy Orthopaedic Care Coordinator
Fairfield Hospital	Susan Dietsch	Orthopaedic Clinical Nurse Consultant, Orthopaedics
Liverpool Hospital	Christopher Saliba	Senior Outpatients Physiotherapist
Nepean Hospital	Jennifer Smith	Orthopaedic Clinical Nurse Consultant, Surgery and Anaesthetics
Sutherland Hospital	Kiran Singh	Clinical Support Officer, Orthopaedics and Surgery
Bowral Hospital	Loretta Andersen	Head, Physiotherapy
Southern Highlands Private Hospital	Melissa Hennessy	Practice Manager, Orthopaedics and Surgery
Launceston General Hospital	Maree Manley	Clinical Co-ordinator, Orthopaedic Clinic
Calvary Health Care Tasmania St Luke's Campus	Natalie Byram	Orthopaedics Practice Manager

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Executive Summary

The Arthroplasty Clinical Outcomes Registry, National (ACORN) was established in 2012 to improve the quality and effectiveness of arthroplasty surgery by monitoring, evaluating and reporting clinical outcomes. By producing an Annual Report on the effectiveness of this common and resource-intensive procedure that is available to patients, surgeons, and hospital departments, the registry aims to inform future decision-making in order to improve the outcomes after hip and knee arthroplasty surgery.

This is the final Annual Report for ACORN as all partipating sites transitioned to the Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR) PROMs Program in 2018. Continuity of data has been maintained by the use of similar outcomes in both systems and all ACORN data has been made available to the AOANJRR.

ACORN covers all hip and knee replacement (arthroplasty) surgery performed as an elective procedure in participating institutions. The outcomes measured include general health and measures of pain and function in the hip or knee. The registry also reports on complications (such as readmission, reoperation, infection and blood clot), patient satisfaction and patient-rated recovery.

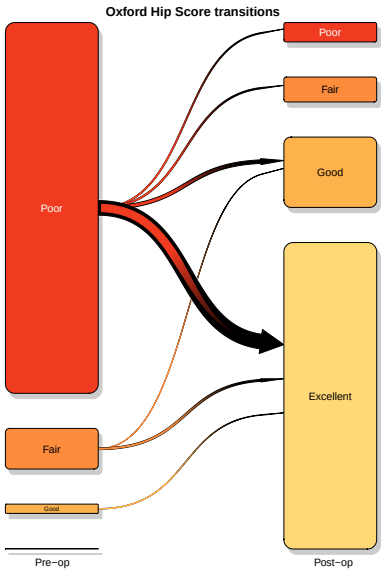
Many clinical units in Australia see significant value from the measurement of clinical outcomes for the interventions they provide and have instituted their own follow-up of people who undergo surgery at their units. The value of ACORN is the provision of a standardised and centralised collection of patient-reported outcomes and complications after arthroplasty. The benefit of this method of data collection is that the analysis and reporting from multiple units provides the ability to undertake comparisons of institutions and surgeons.

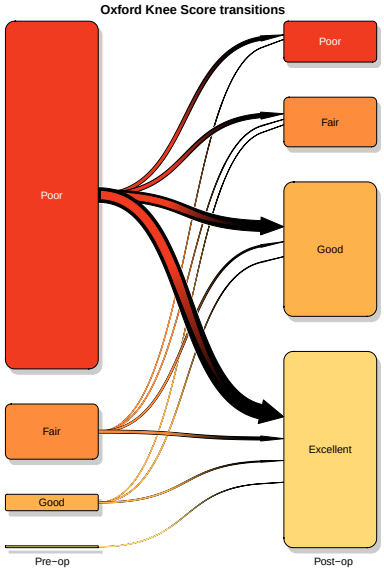
This report uses data from nine institutions. The report is restricted to reporting on sites with outcome data for the 2013 to 2018 calendar years. The report includes data on 9145 elective hip and knee arthroplasty procedures. As reflected in other reports, knee arthroplasty outnumbered hip arthroplasty by over two to one. Revision surgeries made up only a small proportion of all procedures recorded.

Overall, satisfaction and success after hip and knee arthroplasty were high, although patient-reported satisfaction was higher after primary hip arthroplasty than after knee arthroplasty. There was also substantial improvement in pain and function, as measured by the Oxford Hip or Knee Score, and in health-related quality of life. As for satisfaction, these improvements were greater in people who had a primary hip arthroplasty compared to primary knee arthroplasty.

However, the proportion of people reporting no problems with mobility, self-care, their usual activities, pain or discomfort, and anxiety or depression, increased after surgery at similar levels for primary hip and knee arthroplasty. Health improvements and satisfaction after revision surgery were less than for primary surgery.

This report contains only summary data. Reports providing hospital comparisons are made available to individual departments every six months, and surgeon level reports are available to participating surgeons on an *ad hoc* basis. Furthermore, statistical analyses of predictors of outcome are withheld from this report but several research publications have been produced and several are currently in preparation, specifically relating to outcome prediction.





The charts on the right of this page show the changes in Oxford hip and knee scores from pre-operatively to six months post-operatively, for primary hip and knee arthroplasty patients, respectively. The height of each box indicates the proportion of patients in that Oxford joint score category, pre- and post-operatively, and the thickness of the arrows is proportional to the number of patients in each pre-operative Oxford score category undergoing the transition indicated by the arrow.

2
Introduction

Arthroplasty (joint replacement) surgery has been shown to be an effective intervention to improve pain, function, and quality of life in people with severe joint disease of the hip or knee. Currently, more than 100,000 primary and revision hip and knee arthroplasties are undertaken in Australia each year, and these two procedures each account for more health system spending than any other procedure, totalling over 2 billion dollars per year[1].

[1] Australian Commission for Safety and Quality in Healthcare. Prioritisation of clinical quality registries - discussion paper. Table 8, p21. Sydney, March 2016.

Two of the primary reasons for a person to choose hip or knee arthroplasty are increasing pain and decreasing functional ability. In the Australian context, measurement of the effectiveness of surgery in addressing these indicators was not undertaken in a standardised, systematic way across multiple centres prior to the establishment of ACORN. While patient-reported measures are considered subjective, they constitute the most direct measurement of the achievement of the goals of surgery. Internationally, there has been an increasing emphasis on the inclusion of patient reported outcomes or experiences after hip and knee arthroplasty. Most notably, Sweden, England, New Zealand, and USA, have developed and implemented methods to measure the impact of arthroplasty from the perspective of the person who has undergone the procedure.

Domestically, the Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR) is a recognised leader in the surveillance of procedures and implants used in arthroplasty. The AOANJRR uses revision surgery (re-operation) as the primary indicator of surgical failure and this has led to improvements by the identification of poorly performing prostheses. It is acknowledged that avoidance of surgical revision is important, however re-operation does not provide a complete picture of the effectiveness of arthroplasty with respect to relief of pain, functional improvement, and improvements in quality of life for the recipient.

ACORN (Arthroplasty Clinical Outcomes Registry National) was formed to address the gap in clinical outcome measurement after hip and knee arthroplasty, and to use that information to drive improvements

in the clinical outcomes being measured. The outcomes measured by ACORN can be broadly grouped into general health, joint pain and function, patient-rated satisfaction, and complications.

In 2018, the AOANJRR launched a pilot program to collect PROMs data. This program was successful in gathering detailed pre- and post-operative patient reported outcomes from over 40 institutions across Australia. As a result of this success, ACORN ceased patient recruitment in 2018 as each site transitioned to the AOANJRR PROMs program. The outcome tools are similar across both systems, allowing continuity of outcome measurement for ACORN sites. To assist with this continuity, the governing ethics committee and each ACORN site have agreed to have the ACORN data stored within the AOANJRR.

This final Annual Report contains all ACORN data from 2013 to 2018 inclusive and maintains the template established in the previous reports. The aim is to make the report accessible for all stakeholders, including members of the public. We have done this by avoiding medical jargon where possible and by restricting reporting of statistical methods to the minimum required for an understanding of the data presented.

2.1 Background

In 2012, a multidisciplinary team of health care professionals initiated the ACORN project to pilot the feasibility of monitoring, evaluating, and reporting outcomes after hip and knee arthroplasty surgery. The project was titled "Arthroplasty Clinical Outcomes Registry National"[2] to provide a reminder of the project vision: an Australian clinical outcomes registry that will be able to provide the patient's perspective of their recovery after hip or knee arthroplasty and by doing so, contribute to improved outcomes in the future.

[2] Note that most ACORN sites are in NSW.

In 2012, existing post-arthroplasty outcomes registries, such as England's PROMs program and the New Zealand Joint Registry, were reviewed as well as other Australian outcome registries and this provided a foundation for the development of ACORN. In addition, the work of the Australian Commission of Safety and Quality in Health Care in developing standards[3] provided guidance towards the development of systematic collection of outcome data after hip and knee arthroplasty. A Steering Committee with defined terms of reference[4] was established to oversee the development, implementation, and growth of ACORN. The committee members include arthroplasty surgeons, senior nursing managers, allied health clinicians, and researchers, with processes developed for consultation with consumer organisations and health service executives where required.

[3] National Operating Principles and Technical Standards for Australian Clinical Quality Registries

[4] Appendix 1 of the ACORN annual report.

The Hunter-New England Human Research Ethics Committee provided ethics approval for ACORN and site-specific approvals from the relevant

Research Governance Offices were received prior to the project commencing at any site. To protect the privacy of participants, all records are securely stored and only accessed by approved staff. In addition, policies and procedures have been developed to ensure compliance with the new Australian Privacy Principles relating to the collection, storage, access to, and use of personal information.

ACORN has been supported by the collaborative efforts of several government, non-government, and research organisations. These organisations include UNSW South Western Sydney Clinical School, the Ingham Institute for Applied Medical Research, Nepean Blue Mountains Local Health District, South Eastern Sydney Local Health District, South Western Sydney Local Health District, Sydney Local Health District, Mid North Coast Local Health District, Tasmanian Health Service (Northern Region), Calvary Health (St Luke's) and the Whitlam Orthopaedic Research Centre.

2.2 How does ACORN function?

2.2.1 Participation

Participation in ACORN is open to all hospitals that perform hip and/or knee arthroplasty. Participation is voluntary and agreement of all surgeons within the orthopaedic department of each participating hospital is required in addition to in-principle support for participation in the registry from the hospital executive. ACORN utilises an opt-out consent process and hospitals nominate a specific person to act as the Site Coordinator, who is responsible for: provision of patient information sheets to all eligible people; explanation of the purpose of ACORN; and data collection in the preoperative and perioperative stages of surgery. Eligible participants are identified during the pre-operative admission process, which occurs up to eight weeks prior to a patient's admission for surgery. Inclusion is based first on the principal arthroplasty procedure for a specific hospital admission (see Appendix 2 of the ACORN annual report) and then on the criteria set out below.

ACORN Inclusion Criteria

- Person aged 18 years of age or over
- Planned (elective) primary or revision hip or knee arthroplasty
- Surgery is undertaken at a hospital participating in ACORN

ACORN Exclusion Criteria

- Surgery is unplanned, such as hip arthroplasty for acute fracture
- Person is cognitively impaired or is unable to understand the process for participation

During the pre-admission process, preoperative data are prospectively collected and the Site Coordinator securely stores the data until matched with the perioperative data on completion of a patient's admission. The Head of Orthopaedics and the Site Coordinator determine the data collection process suited to their individual context. This usually requires contributions by two or three clinicians across the continuum of care, with the Coordinator taking overall responsibility for data completeness and accuracy. Site Coordinators forward records to the registry at the end of each calendar month and the records are entered into the registry to enable six-month follow-up to be undertaken.

2.2.2 Overview of the Data Set

For each person included in ACORN, the data collected include:

- Identifiable demographic information used for follow-up, data quality processes, and any linkage with other data sets;
- Baseline clinical status including expectations and co-morbid conditions;
- A condition-specific measure of joint pain and function completed preoperatively and at six-months post-surgery;
- A generic measure of self-reported health status completed preoperatively and at six-months post- surgery;
- Global perceptions of recovery and the impact of surgery;
- Acute surgical complications and post-discharge complications and re-admissions in the six months post-surgery.

ACORN does not collect data on the specific types of prosthesis used.

2.2.3 Data Collection and Verification

Site Coordinator training is provided to ensure consistent, complete, and accurate data collection between sites, and one-to-one on-site training is included as part of the hospital participation process.

ACORN has developed processes for checking data completeness and accuracy when sites submit their data centrally, and since November 2015, has provided data completeness reports for each new batch of data submitted by participating sites. This ensures that the data captured and held by the registry are as complete and accurate as possible. Accuracy of the data collected by the registry has been previously reported[5].

[5] Seagrave K, Naylor JM, Armstrong E, Leong KM, Descallar J, Harris IA. Data quality audit of the arthroplasty clinical outcomes registry NSW. BMC Health Services Research 2014, 14:512

2.2.4 Follow-up Data Collection

The follow-up of participants is undertaken by telephone at six months ($\pm$ one month) by ACORN. The option of using postal follow-up is available, however this is only used after up to six telephone attempts have been exhausted. Six months was determined as the best balance between stabilised clinical recovery and minimisation of loss to follow-up.

The following survey instruments are used to measure Patient-Reported Outcomes (PROMs):

Pain and Function Measure

Oxford Hip or Knee Score (OHS, OKS)

Health-Related Quality of Life

EuroQol Health-Related Quality of Life: 5-Dimensions and Visual Analogue Scale (VAS)

Satisfaction and Success

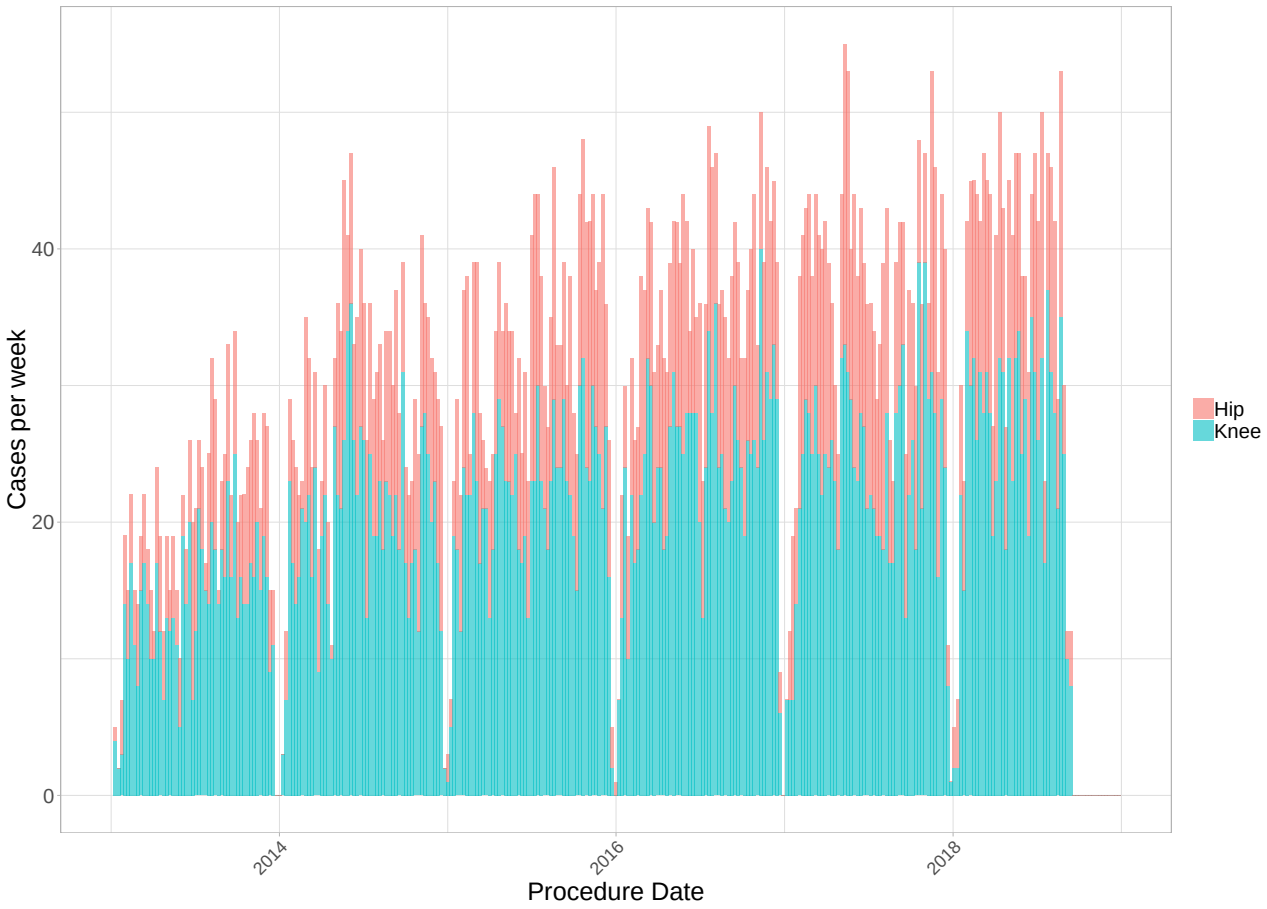
UK PROMs satisfaction and success questions

Person Perceived Problems

Re-admission, Re-operation, Complications

3

Data Submission and Patient Follow-up



3.1 Six Months PROMs Follow-up

The table below shows the numbers and percentage of cases lost to follow-up, and the number of cases followed up within or outside the follow-up window of five to seven months (nominally six months) post-surgery. The graph at right shows the considerable improvement in the loss to follow-up rate since the inception of the registry.

Figure 3.1: Percentage lost to follow-up, January 2013 to December 2018

- *n* lost, % lost = number and percentage lost to follow-up
- Attempts, Lost attempts = Mean number of follow-up attempts in those not lost to follow-up and in those lost to follow-up
- <5m = percentage with follow-up completed < 5 mths post-op
- 5-7m = percentage with follow-up completed between 5 and 7 mths post-op
- 8m = percentage with follow-up completed 8 mths post-op
- >8m = percentage with follow-up completed > 8 mths post-op

Year	Qtr	*n*	*n* lost	% lost	Attempts	Lost attempts	% <5m	% 5-7m	% 8m	% >8m
2013	1	173	27	15.7	1.9	4.0	0.0	76.5	3.6	3.6
2013	2	231	38	16.5	2.0	4.4	0.0	65.4	13.4	1.7
2013	3	331	56	16.9	1.8	3.0	0.0	44.8	29.1	7.3
2013	4	269	14	5.2	2.6	4.4	0.0	91.1	3.0	0.0
2014	1	286	25	8.8	2.2	1.7	2.5	84.9	1.8	0.7
2014	2	427	42	9.9	2.0	3.2	0.2	54.0	29.0	5.0
2014	3	422	22	5.2	1.9	3.2	0.5	38.8	43.8	4.0
2014	4	348	16	4.6	2.1	6.4	0.6	87.6	4.3	2.3
2015	1	350	18	5.2	2.1	3.4	20.3	65.9	1.1	0.6
2015	2	408	6	1.5	2.2	8.0	2.9	91.4	0.0	0.2
2015	3	480	10	2.1	2.7	5.2	0.4	61.8	26.7	2.1
2015	4	438	9	2.1	2.7	5.4	0.0	92.6	3.9	0.5
2016	1	383	16	4.2	2.7	8.1	7.9	82.5	0.3	0.0
2016	2	488	22	4.5	2.6	8.0	0.2	88.2	5.2	1.6
2016	3	501	30	6.1	2.4	8.8	0.2	86.4	5.7	0.6
2016	4	456	21	4.7	2.7	5.4	0.2	90.0	4.0	0.7
2017	1	430	21	4.9	2.9	7.2	0.7	91.6	2.3	0.0
2017	2	522	22	4.2	3.0	9.6	0.4	91.6	3.1	0.4
2017	3	448	14	3.1	2.6	9.1	0.4	95.5	0.2	0.4
2017	4	459	13	2.8	2.9	11.5	0.0	96.1	0.7	0.4
2018	1	446	15	3.4	3.1	10.2	8.1	88.1	0.2	0.0
2018	2	538	28	5.2	2.7	6.2	0.2	84.7	8.4	0.6
2018	3	387	23	6.0	2.5	6.5	0.0	72.5	14.5	3.1

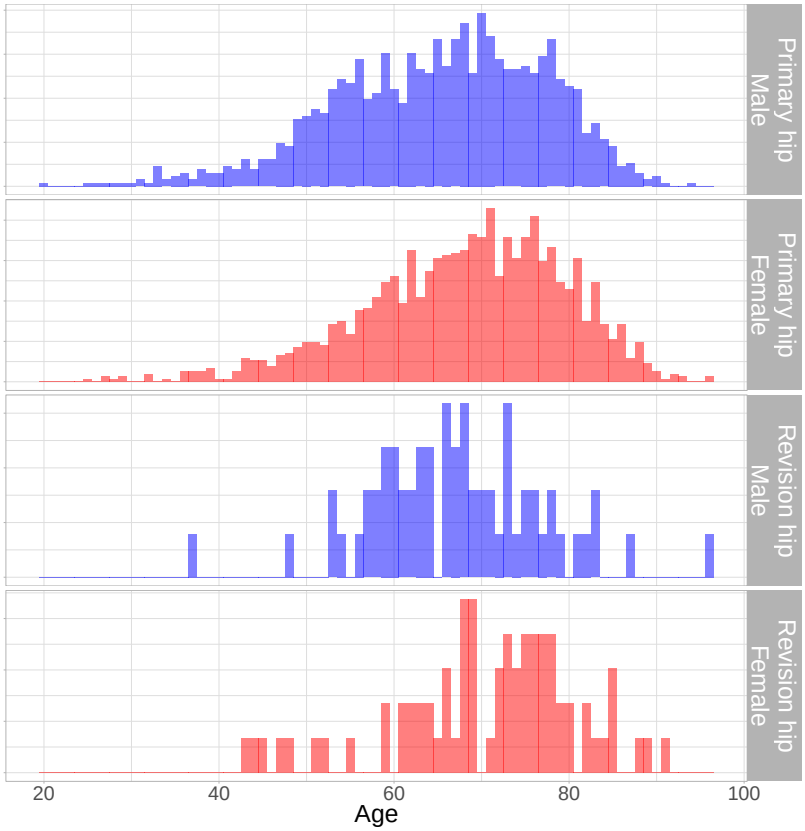
4
Hip Arthroplasty

Hip arthroplasties are either an initial (primary) procedure on a joint, or they are a subsequent (revision) surgery on a previously replaced joint. ACORN collects information on primary total hip arthroplasty and revision hip arthroplasty. A primary total hip arthroplasty involves replacing both surfaces of the hip joint and revision hip arthroplasty surgery is where one or more of the previously implanted components are removed and/or replaced. ACORN only collects information on *elective* primary and revision total hip arthroplasty procedures — therefore procedures performed as treatment for hip fractures are not included.

Between January 2013 and December 2018, primary total hip arthroplasty surgery accounted for 95% of hip arthroplasty procedures reported by participating hospitals. The average age of all people having a hip procedure was 67 years. The most common reason for primary surgery was osteoarthritis. Hip arthroplasty surgery was more common in women (53.8%).

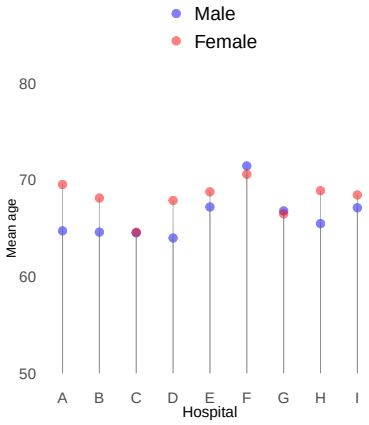
4.1 Demographic Profile

4.1.1 Age Distribution



The average age of hip arthroplasty patients is around the mid 60s, with the average age for males about three years less than the average age for females. About one-fifth of the males in the ACORN registry undergoing hip replacement are aged less than 55 years, compared to about one-eighth of the women.

The chart below shows the variation in the mean age of primary hip arthroplasty patients between ACORN hospitals. The order of hospitals and their labels is random.



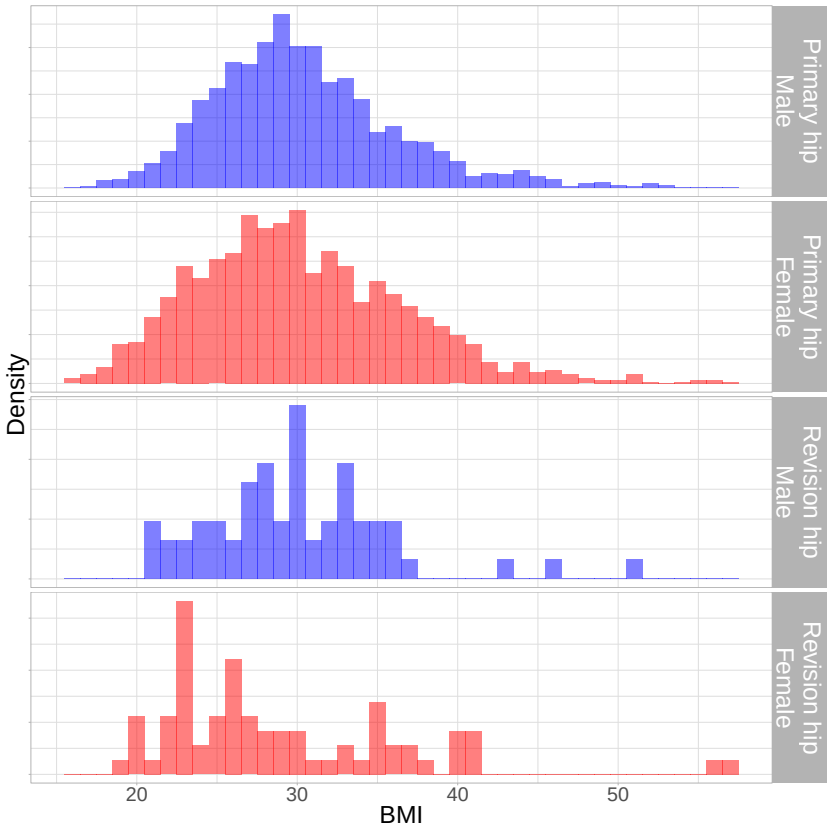
AGE OF PATIENTS — PRIMARY HIPS

	n	%	**Mean**	StdDev	Min	Max	<55	55-64	65-74	75-84	≥ 85
Male	1322	46.2	**65.3**	11.94	20.1	93.8	20%	25%	31%	22%	2.3%
Female	1541	53.8	**68.2**	11.41	24.6	96.2	13%	23%	33%	26%	4.8%
Persons	**2864**	**100.0**	**66.9**	**11.75**	**20.1**	**96.2**	**16%**	**24%**	**32%**	**24%**	**3.7%**

AGE OF PATIENTS — REVISION HIPS

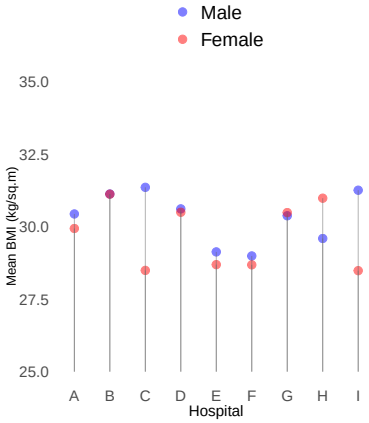
	n	%	**Mean**	StdDev	Min	Max	<55	55-64	65-74	75-84	≥ 85
Male	63	46.0	**67.2**	9.91	36.5	95.9	7.9%	33%	40%	16%	3.2%
Female	74	54.0	**70.4**	10.68	42.6	90.5	9.5%	15%	39%	31%	5.4%
Persons	**137**	**100.0**	**68.9**	**10.42**	**36.5**	**95.9**	**8.8%**	**23%**	**39%**	**24%**	**4.4%**

4.1.2 *Body Mass Index (BMI)*



The average Body Mass Index (BMI) of patients undergoing primary hip arthroplasty is about 30 in both sexes, with a wide range and spread of BMI values in both sexes.

The chart below shows the variation in the mean BMI of primary hip arthroplasty patients between ACORN hospitals. The order of hospitals and their labels is random.



Body Mass Index (BMI) — Primary hips

	n	Missing		**Mean**	StdDev	Min	Max
Male	1322	38	3.0%	**30.5**	5.72	16.8	53.1
Female	1541	62	4.2%	**30.2**	6.61	16	56.9
Persons	**2864**	**100**	**3.6%**	**30.3**	**6.21**	**16**	**56.9**

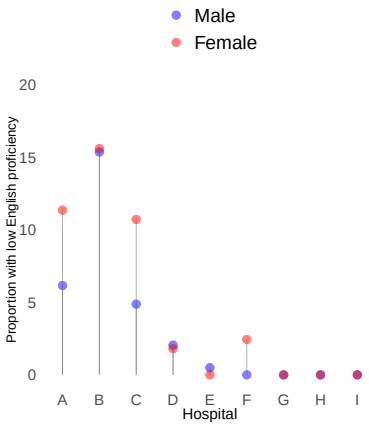
Body Mass Index (BMI) — Revision hips

	n	Missing		**Mean**	StdDev	Min	Max
Male	63	1	1.6%	**30.1**	5.65	21.3	51.3
Female	74	2	2.8%	**29.1**	7.67	19.5	56.7
Persons	**137**	**3**	**2.2%**	**29.5**	**6.81**	**19.5**	**56.7**

4.1.3 *English Proficiency*

ENGLISH PROFICIENCY — PRIMARY & REVISION HIPS

	n	Missing		High		Low	
Male	1385	52	3.8%	1245	89.9%	88	6.4%
Female	1615	77	4.8%	1413	87.5%	125	7.7%
Persons	**3001**	**129**	**4.3%**	**2659**	**88.6%**	**213**	**7.1%**



4.1.4 *Level of Education*

SCHOOL EDUCATION — PRIMARY & REVISION HIPS

	n	Missing		No schooling		Yr 9 or below		Yrs 10 or 11		Yr 12	
Male	1385	96	6.9%	13	0.94%	351	25%	634	46%	291	21%
Female	1615	132	8.2%	31	1.9%	418	26%	702	43%	332	21%
Persons	**3001**	**228**	**7.6%**	**44**	**1.5%**	**769**	**26%**	**1337**	**45%**	**623**	**21%**

POST-SCHOOL EDUCATION — PRIMARY & REVISION HIPS

	n	Missing		None		Cert/Diploma		Bachelor		Postgrad	
Male	1385	118	8.5%	682	49%	456	33%	63	4.55%	66	4.8%
Female	1615	170	11%	1015	63%	210	13%	80	5%	140	8.7%
Persons	**3001**	**288**	**9.6%**	**1698**	**57%**	**666**	**22%**	**143**	**4.8%**	**206**	**6.9%**

4.2 Patient Medical & Surgical Characteristics

4.2.1 Comorbidities

PRE-OPERATIVE COMORBIDITIES — PRIMARY HIPS

	n	Low back pain		Other lower limb arthritis		Heart disease		Hypertension	
Male	1322	500	38%	383	29%	429	32%	643	49%
Female	1541	660	43%	505	33%	486	32%	798	52%
Persons	**2864**	**1160**	**41%**	**888**	**31%**	**916**	**32%**	**1442**	**50%**

	n	Diabetes		Gastrointestinal disease		Respiratory disease		Renal disease	
Male	1322	212	16%	195	15%	162	12%	81	6%
Female	1541	234	15%	310	20%	260	17%	77	5%
Persons	**2864**	**447**	**16%**	**505**	**18%**	**423**	**15%**	**158**	**6%**

	n	Hepatic disease		Neurological disease		Anxiety/ depression	
Male	1322	28	2%	72	5%	177	13%
Female	1541	33	2%	81	5%	329	21%
Persons	**2864**	**61**	**2%**	**153**	**5%**	**506**	**18%**

	n	No comorbs		1 comorb		2 comorbs		$\geq$ 3 comorbs	
Male	1322	215	16%	268	20%	321	24%	518	39%
Female	1541	199	13%	282	18%	354	23%	706	46%
Persons	**2864**	**414**	**14%**	**550**	**19%**	**675**	**24%**	**1225**	**43%**

PRE-OPERATIVE COMORBIDITIES — REVISION HIPS

	n	Low back pain		Other lower limb arthritis		Heart disease		Hypertension	
Male	63	18	29%	17	27%	21	33%	29	46%
Female	74	35	47%	21	28%	35	47%	38	51%
Persons	**137**	**53**	**39%**	**38**	**28%**	**56**	**41%**	**67**	**49%**

	n	Diabetes		Gastrointestinal disease		Respiratory disease		Renal disease	
Male	63	9	14%	13	21%	12	19%	5	8%
Female	74	9	12%	20	27%	7	9%	6	8%
Persons	**137**	**18**	**13%**	**33**	**24%**	**19**	**14%**	**11**	**8%**

	n	Hepatic disease		Neurological disease		Anxiety/ depression	
Male	63	2	3%	5	8%	10	16%
Female	74	0	0%	6	8%	15	20%
Persons	**137**	**2**	**1%**	**11**	**8%**	**25**	**18%**

	n	No comorbs		1 comorb		2 comorbs		$\geq$ 3 comorbs	
Male	63	10	16%	12	19%	14	22%	27	43%
Female	74	11	15%	9	12%	15	20%	39	53%
Persons	**137**	**21**	**15%**	**21**	**15%**	**29**	**21%**	**66**	**48%**

4.2.2 *ASA Physical Status Classification*

ASA — Primary hips

	n	Missing		ASA 1		ASA 2	
Males	1322	176	13%	82	6%	654	49%
Females	1541	212	14%	71	5%	742	48%
Persons	2864	388	14%	153	5%	1396	49%

	n	ASA 3		ASA 4		ASA 5	
Males	1322	399	30%	11	0.8%	0	0%
Females	1541	498	32%	18	1%	0	0%
Persons	2864	898	31%	29	1%	0	0%

The ASA scoring system categorises patients into the following categories of pre-operative physical status, as an approximate estimate of anaesthetic risk:

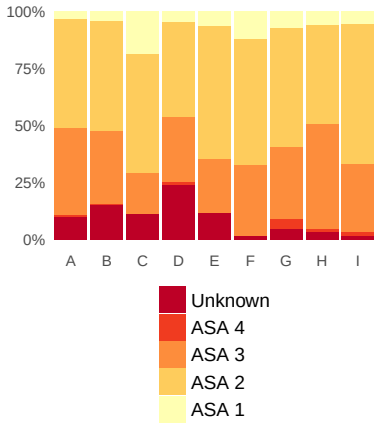
1. a normal healthy person
2. a person with mild systemic disease
3. a person with severe systemic disease
4. a person with severe systemic disease that is a constant threat to life
5. a moribund person who is not expected to survive

ASA — Revision hips

	n	Missing		ASA 1		ASA 2	
Males	63	12	19%	3	5%	19	30%
Females	74	20	27%	1	1%	25	34%
Persons	137	32	23%	4	3%	44	32%

	n	ASA 3		ASA 4		ASA 5	
Males	63	28	44%	1	2%	0	0%
Females	74	27	36%	1	1%	0	0%
Persons	137	55	40%	2	1%	0	0%

The chart below shows the variation in the proportion of hip arthroplasty patients in each ASA category between ACORN hospitals. The order of hospitals and their labels is random.



4.2.3 *Type & Laterality of Surgery*

Type & Laterality — Primary & revision hips

Type	*n*	Missing		Left		Right		Bilateral	
Primary	2864	2	0.07%	1255	44%	1563	55%	44	2%
Revision	137	1	0.7%	64	47%	72	53%	0	0%

4.2.4 *Principal Reason for Surgery*

Reason for Surgery — Primary hips

	n	OA		RA		DDH	
Male	1322	1200	91%	3	0.2%	6	0.5%
Female	1541	1408	91%	18	1%	17	1%
Persons	2864	2609	91%	21	0.7%	23	0.8%

	n	Oth arth		ON/AVN		Tumour	
Male	1322	1	0.08%	77	6%	0	0%
Female	1541	10	0.6%	48	3%	0	0%
Persons	2864	11	0.4%	125	4%	0	0%

	n	Other		Missing	
Male	1322	22	2%	13	1%
Female	1541	24	2%	16	1%
Persons	2864	46	2%	29	1%

OA
: osteoarthritis

RA
: rheumatoid arthritis

DDH
: developmental dysplasia of the hips

Oth arth
: other inflammatory arthritis

ON/AVN
: osteonecrosis/avascular necrosis

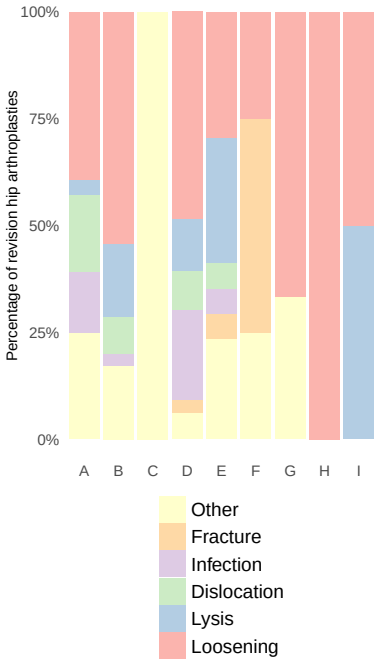
Reason for Surgery — Revision hips

	n	Loosening		Lysis		Dislocation	
Male	63	26	41%	5	8%	5	8%
Female	74	33	45%	12	16%	7	9%
Persons	137	59	43%	17	12%	12	9%

	n	Implant break		Infection		Fracture	
Male	63	0	0%	10	16%	2	3%
Female	74	2	3%	3	4%	2	3%
Persons	137	2	1%	13	9%	4	3%

	n	Other		Missing	
Male	63	13	21%	2	3%
Female	74	10	14%	5	7%
Persons	137	23	17%	7	5%

The chart below shows the variation in reasons for **revision** in hip arthroplasty patients between ACORN hospitals. Revisions are relatively uncommon, and thus many of the differences may be random variation, but some systematic variation between hospitals may be present. More data would be needed to investigate this. The order of hospitals and their labels is random.



4.3 Acute Care Measures

During the admitted period of care, the specific acute care measures collected by ACORN are: any requirement for a high care bed and whether this was a planned or unplanned admission to that bed; any complication experienced during the admitted acute care stay; the need for a blood transfusion; and discharge destination from the acute care ward.

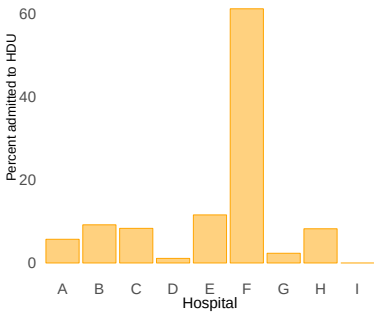
Complications are required to have been documented in the medical record. They include delirium, surgical site infection (SSI), deep venous thrombosis (DVT), pulmonary embolus (PE), respiratory infection, cardiovascular events, dislocation, fracture, nerve injury, bladder infection or retention, wound dehiscence, and death.

4.3.1 High Care Bed Utilisation

HIGH CARE BED UTILISATION — PRIMARY HIPS

	n	Missing		High Care Bed		Unplanned*	
Male	1322	1	0.08%	115	9%	83	72%
Female	1541	0	0%	108	7%	66	61%
Persons	2864	1	0.03%	223	8%	149	67%

The chart below shows the variation in high care bed utilisation following **primary** hip arthroplasty between ACORN hospitals. The labelling and order of hospitals is randomised.



HIGH CARE BED UTILISATION — REVISION HIPS

	n	Missing		High Care Bed		Unplanned*	
Male	63	0	0%	15	24%	9	60%
Female	74	0	0%	14	19%	9	64%
Persons	137	0	0%	29	21%	18	62%

* Percentage of admissions to high care beds which were unplanned.

4.3.2 *Peri-operative Blood Transfusion*

Blood Transfusion — Primary hips

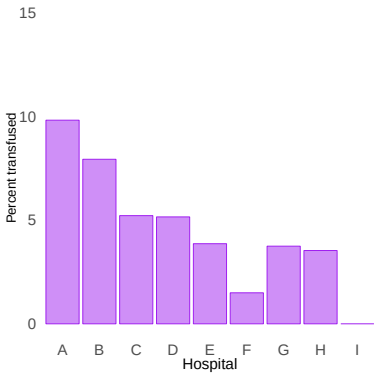
	n	Missing		Transfused		Mean units
Male	1322	5	0.4%	48	4%	2
Female	1541	8	0.5%	137	9%	2
Persons	2864	13	0.5%	185	6%	2

Blood Transfusion — Revision hips

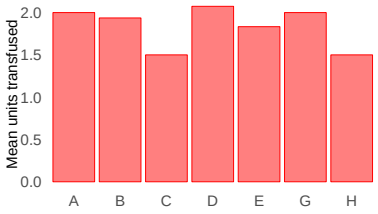
	n	Missing		Transfused		Mean units
Male	63	4	6%	15	24%	3.5
Female	74	1	1%	16	22%	2.2
Persons	137	5	4%	31	23%	2.9

* percentages are of patients who received transfusions.

The chart below shows the variation in blood transfusion utilisation following **primary** hip arthroplasty between ACORN hospitals. The labelling and order of hospitals is randomised.



The variation between hospitals in the mean number of units transfused (in those patients receiving a transfusion) for primary hip arthroplasty patients is shown below.



4.3.3 *Complications during Index Admission*

COMPLICATIONS (ANY) DURING ADMISSION — PRIMARY HIPS

	n	1 or more		None		Unk/NS	
Males	1322	158	(12%)	1153	(87%)	11	(0.8%)
Females	1541	194	(13%)	1333	(87%)	11	(0.7%)
Persons	2864	352	(12%)	2487	(87%)	22	(0.8%)

COMPLICATIONS (DETAILS) DURING ADMISSION — PRIMARY HIPS

Complications	Males		Females		Persons	
Drug reaction	0	0%	0	0%	0	0%
Delirium	18	1.4%	10	0.65%	28	0.98%
SSI requiring oral antibiotics	0	0%	1	0.065%	1	0.035%
SSI requiring IV antibiotics	1	0.076%	0	0%	1	0.035%
SSI requ surg c̄ prosth removal	0	0%	0	0%	0	0%
SSI requ surg s̄ prosth removal	0	0%	0	0%	0	0%
Deep vein thrombosis	2	0.15%	2	0.13%	4	0.14%
Pulmonary embolus	1	0.076%	3	0.19%	4	0.14%
Fat emboli	0	0%	0	0%	0	0%
Respiratory infection	11	0.83%	12	0.78%	23	0.8%
CVS	19	1.4%	23	1.5%	42	1.5%
Dislocation	2	0.15%	6	0.39%	8	0.28%
Fracture	7	0.53%	16	1%	23	0.8%
Nerve injury	1	0.076%	7	0.45%	8	0.28%
Urinary tract infection	8	0.61%	17	1.1%	25	0.87%
Urinary retention	27	2%	10	0.65%	37	1.3%
Wound dehiscence	5	0.38%	5	0.32%	10	0.35%
Reoperation during index adm	2	0.15%	5	0.32%	7	0.24%
Pressure area	0	0%	1	0.065%	1	0.035%
Fall	0	0%	3	0.19%	3	0.1%
Hypotension	15	1.1%	35	2.3%	50	1.7%
Cellulitis	1	0.076%	1	0.065%	2	0.07%
Death	1	0.076%	0	0%	1	0.035%
Other	48	3.6%	53	3.4%	101	3.5%

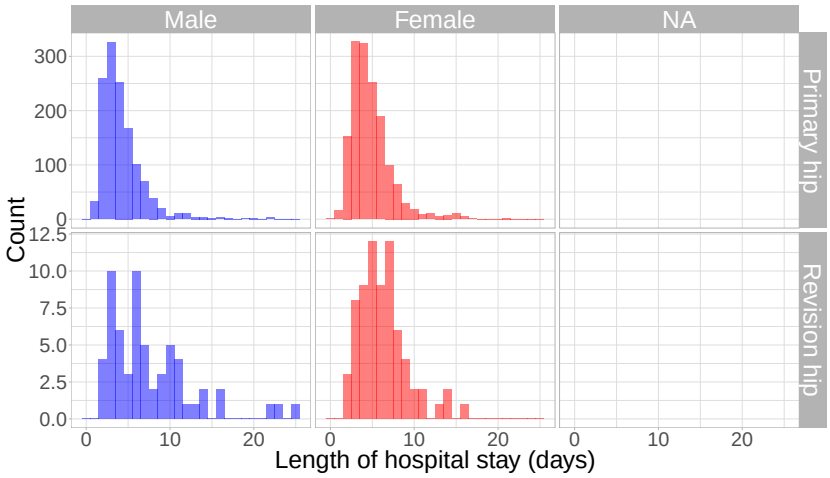
Complications (any) during Admission — Revision hips

	n	1 or more		None		Unk/NS	
Males	63	12	(19%)	51	(81%)	0	(0%)
Females	74	19	(26%)	54	(73%)	1	(1%)
Persons	137	31	(23%)	105	(77%)	1	(0.7%)

Complications (details) during Admission — Revision hips

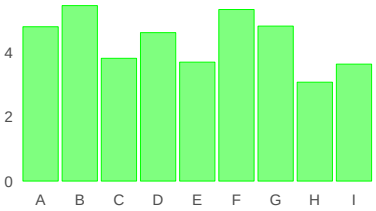
Complications	Males		Females		Persons	
Drug reaction	0	0%	0	0%	0	0%
Delirium	0	0%	0	0%	0	0%
SSI requiring oral antibiotics	0	0%	0	0%	0	0%
SSI requiring IV antibiotics	0	0%	0	0%	0	0%
SSI requ surg c̄ prosth removal	0	0%	0	0%	0	0%
SSI requ surg s̄ prosth removal	0	0%	0	0%	0	0%
Deep vein thrombosis	0	0%	1	1.4%	1	0.73%
Pulmonary embolus	0	0%	0	0%	0	0%
Fat emboli	0	0%	0	0%	0	0%
Respiratory infection	0	0%	1	1.4%	1	0.73%
CVS	1	1.6%	0	0%	1	0.73%
Dislocation	3	4.8%	0	0%	3	2.2%
Fracture	1	1.6%	2	2.7%	3	2.2%
Nerve injury	0	0%	1	1.4%	1	0.73%
Urinary tract infection	0	0%	1	1.4%	1	0.73%
Urinary retention	0	0%	1	1.4%	1	0.73%
Wound dehiscence	2	3.2%	0	0%	2	1.5%
Reoperation during index adm	0	0%	1	1.4%	1	0.73%
Pressure area	0	0%	0	0%	0	0%
Fall	0	0%	2	2.7%	2	1.5%
Hypotension	1	1.6%	2	2.7%	3	2.2%
Cellulitis	0	0%	0	0%	0	0%
Death	0	0%	0	0%	0	0%
Other	1	1.6%	7	9.5%	8	5.8%

4.3.4 *Length of Stay in Hospital*



The plot at left excludes 16 cases in which the length of stay in hospital was greater than 25 days.

The variation between hospitals in the mean length of stay (in days) for primary hip arthroplasty patients is shown below.



Length of Stay in Hospital — Primary hips

	n		Missing		Mean	Median	75th %ile	95th %ile
Male	1322	46%	4	0.3%	4.3	4	5	9
Female	1541	54%	4	0.3%	5.2	4	6	10
Persons	2864	100%	8	0.3%	4.8	4	6	9

Length of Stay in Hospital — Revision hips

	n		Missing		Mean	Median	75th %ile	95th %ile
Male	63	46%	0	0%	9.2	6	10	23
Female	74	54%	0	0%	7.8	6	8	15
Persons	137	100%	0	0%	8.4	6	9	22

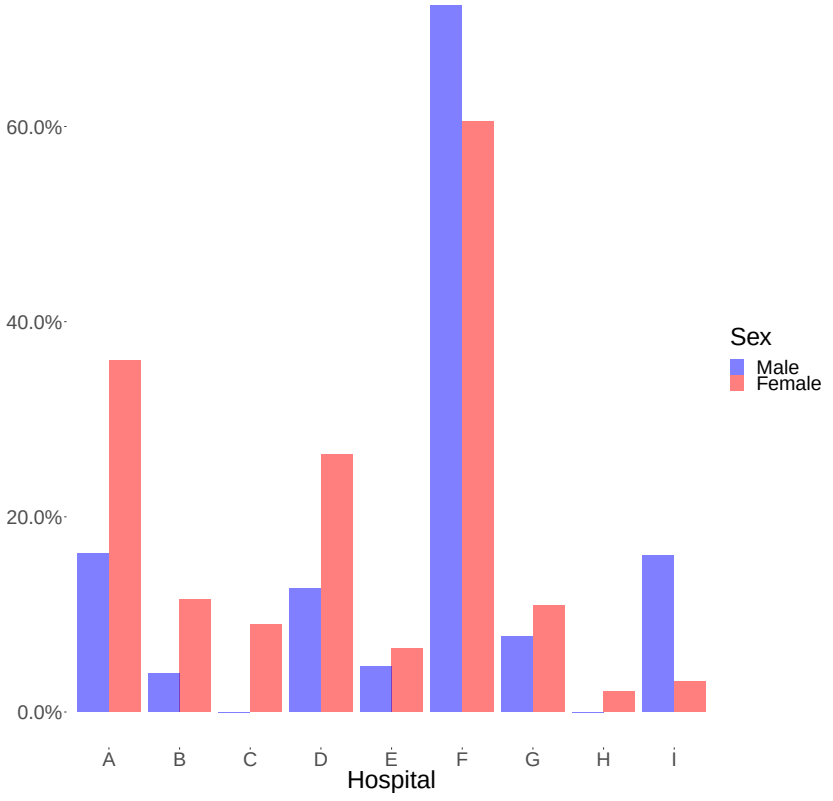
4.3.5 *Discharge Destination*

DISCHARGE DESTINATION — PRIMARY HIPS

	n	Unk/NS		Usual residence		Inpatient rehab		Other	
Male	1322	9	0.7%	1173	89%	129	10%	11	0.8%
Female	1541	11	0.7%	1220	79%	301	20%	9	0.6%
Persons	2864	20	0.7%	2394	84%	430	15%	20	0.7%

DISCHARGE DESTINATION — REVISION HIPS

	n	Unk/NS		Usual residence		Inpatient rehab		Other	
Male	63	2	3%	44	70%	14	22%	3	5%
Female	74	3	4%	45	61%	25	34%	1	1%
Persons	137	5	4%	89	65%	39	28%	4	3%



Women are considerably more likely to be discharged to inpatient rehabilitation than men. However, there is considerable variation between hospitals in the proportion of hip arthroplasty patients who are discharged to inpatient rehabilitation. The graph at left demonstrates this variation for primary hip arthroplasty patients. Hospital identities have been randomised.

4.4 Patient-Reported Outcome Measures (PROMs)

Patient-reported outcome measures (PROMs) are measures of health status collected directly from the person. In ACORN, they provide a personal perspective of the impact of surgery by comparing health status at two different points in time, therefore allowing comparison of not only clinical measures but also the perceptions of the individual.

Since March 2013, ACORN has included measures of the individual's expectations of surgical outcome. Prior to admission, each person is asked "what are your expectations of your hip/knee pain six months after your surgery?" and "what are your expectations of your functional ability six months after your surgery?" At follow-up, questions to measure perceived satisfaction and success are asked. These replicate the questions used by the PROMs programme in England and Wales. They have been incorporated into ACORN's post-operative follow-up with permission from the National Joint Registry (NJR) England & Wales.

For satisfaction, the question asked is "how would you describe the results of your operation?" with five options provided: excellent; very good; good; fair; or poor.

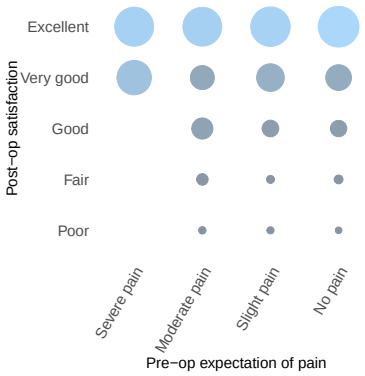
For success, the question asked is "overall, how are the problems now with your hip/knee on which you had surgery, compared to before your operation?" This question also allows the person to choose one of five options: much better; a little better; about the same; a little worse; and much worse.

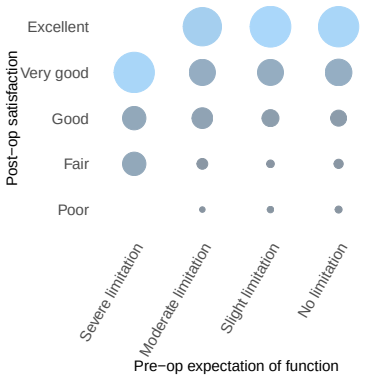
In addition, ACORN asks participants whether they have been re-admitted to hospital since discharge, had another operation on the joint that was replaced six months earlier, and whether they have experienced any other problem not requiring re-admission or re-operation. By asking this additional question about problems not requiring re-admission or re-operation, ACORN is able to capture those outcomes that continue to impact the individual or have resulted in additional services being utilised in the primary or community care setting, although they have not resulted in additional utilisation of admitted hospital services.

The Oxford Hip Score (OHS) and the Oxford Knee Score (OKS) are 12-item, person-reported instruments developed to assess pain and function in people undergoing hip or knee arthroplasty. The questionnaires explore a person's perception of their pain and functional impairment in tasks of daily living over the previous four weeks. The least difficulty undertaking tasks or the least severity of symptoms scores four points, and the most severe symptoms and dysfunction scores zero. The individual scores are summed to achieve a single score, with the highest attainable score of 48 indicating a person who experiences no functional impairment and no pain. The lowest score of 0 means the person has severe pain and functional impairment as a result of their joint problems. In reporting the

A person's pre-operative expectations of their post-operative pain and function are considered to be important predictors of the outcome of joint replacement surgery.

The charts below illustrate this relationship between pre-operative expectation of pain following surgery and 6-month satisfaction rating (top chart), and pre-operative expectation of joint function following surgery and 6-month satisfaction rating (lower chart) for **primary hip arthroplasty** patients. The area of each circle indicates the proportion of patients in each pre-operative expectation category who end up in each the 6-month post-operative satisfaction categories.





Oxford Hip and Knee Scores, outcomes are additionally grouped into four score categories, as reported by the New Zealand Joint Registry. Prior to surgery, the surveys are patient-completed. After surgery, an interviewer completes the surveys by the telephone.

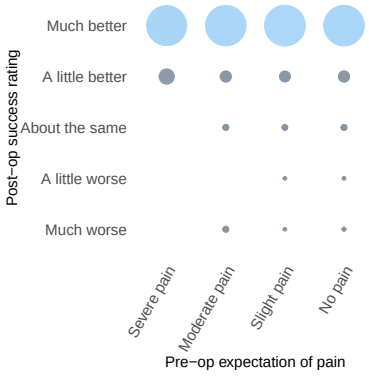
The EQ-VAS records a person's self-rated health on a 20 cm vertical scale with 0 at the bottom representing "worst health imaginable" and 100 at the top representing "best health imaginable". Prior to surgery, the surveys are patient-completed. After surgery, the surveys are completed over the telephone by an interviewer.

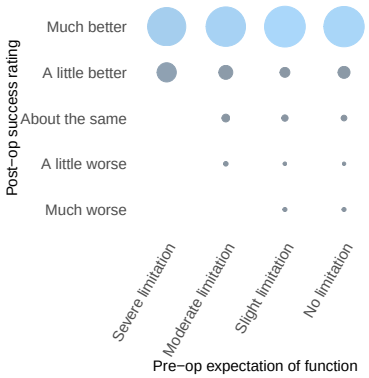
The EQ-5D-5L is a descriptive system of five dimensions of a person's general health. The dimensions are Mobility, Self-care, Usual Activities, Pain or Discomfort, and Anxiety or Depression. Each dimension has five levels: no problems, slight problems, moderate problems, severe problems, or extreme problems. A person is asked to indicate his/her health state by marking the box beside the most appropriate statement in each of the five dimensions on the day the survey is administered. Prior to surgery, the surveys are completed by patients on paper. After surgery, the surveys are completed over the telephone by an interviewer.

Please note: Only those patients for whom 6 month follow-up is complete or who have been declared lost to follow-up appear in the tables and graphs below that show 6 month follow-up data.

The EQ-5D quality of life scores provide a measure of the overall effect of the procedure on a person's health and well-being. They also allow different types of procedures to be compared.

The charts below illustrate this relationship between pre-operative expectation of pain following surgery and 6-month patient rating of success (top chart), and pre-operative expectation of joint function following surgery and 6-month patient rating of success (lower chart) for **primary hip arthroplasty** patients. The area of each circle indicates the proportion of patients in each pre-operative expectation category who end up in each the 6-month post-operative success rating categories.





4.4.1 *Pre-op Expectation of Pain at 6 months post-op*

EXPECTATION OF PAIN — PRIMARY HIPS

	n	Unknown/ Not stated		No pain		Slight pain		Moderate pain		Severe pain	
Male	1322	185	14%	790	60%	280	21%	60	5%	7	0.5%
Female	1541	253	16%	857	56%	372	24%	49	3%	10	0.6%
Persons	2864	438	15%	1647	58%	653	23%	109	4%	17	0.6%

EXPECTATION OF PAIN — REVISION HIPS

	n	Unknown/ Not stated		No pain		Slight pain		Moderate pain		Severe pain	
Male	63	13	21%	30	48%	16	25%	3	5%	1	2%
Female	74	27	36%	32	43%	10	14%	5	7%	0	0%
Persons	137	40	29%	62	45%	26	19%	8	6%	1	0.7%

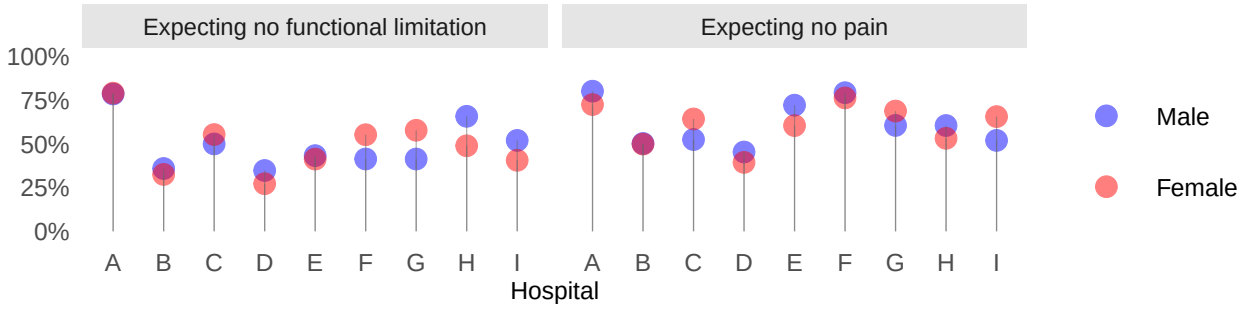
4.4.2 *Pre-op Expectation of Function at 6 months post-op*

EXPECTATION OF FUNCTION — PRIMARY HIPS

	n	Unknown/ Not stated		No limitation		Slight limitation		Moderate limitation		Severe limitation	
Male	1322	190	14%	618	47%	461	35%	52	4%	1	0.08%
Female	1541	258	17%	687	45%	541	35%	51	3%	4	0.3%
Persons	2864	448	16%	1305	46%	1003	35%	103	4%	5	0.2%

EXPECTATION OF FUNCTION — REVISION HIPS

	n	Unknown/ Not stated		No limitation		Slight limitation		Moderate limitation		Severe limitation	
Male	63	13	21%	20	32%	25	40%	4	6%	1	2%
Female	74	27	36%	23	31%	22	30%	2	3%	0	0%
Persons	137	40	29%	43	31%	47	34%	6	4%	1	0.7%



Please note: The data shown in the remainder of this PROMs section of the report only include those patients for whom six month follow-up is complete or who were deemed lost to follow-up.

4.4.3 Satisfaction at 6 months post-op

SATISFACTION AT 6 MONTHS POST-OP — PRIMARY HIPS

	n	Unk/NS		Poor		Fair		Good		Very good		Excellent	
Male	1320	83	6%	17	1%	37	3%	116	9%	299	23%	768	58%
Female	1541	71	5%	33	2%	41	3%	170	11%	375	24%	851	55%
Persons	2861	154	5%	50	2%	78	3%	286	10%	674	24%	1619	57%

SATISFACTION AT 6 MONTHS POST-OP — REVISION HIPS

	n	Unk/NS		Poor		Fair		Good		Very good		Excellent	
Male	63	11	17%	4	6%	3	5%	9	14%	15	24%	21	33%
Female	73	5	7%	0	0%	3	4%	16	22%	22	30%	27	37%
Persons	136	16	12%	4	3%	6	4%	25	18%	37	27%	48	35%

4.4.4 Patient-perceived Success at 6 months post-op

SUCCESS AT 6 MONTHS POST-OP — PRIMARY HIPS

	n	Unk/NS		much worse		a little worse		about the same		a little better		much better	
Male	1320	83	6%	10	0.8%	7	0.5%	19	1%	75	6%	1126	85%
Female	1541	70	5%	16	1%	11	0.7%	34	2%	115	7%	1295	84%
Persons	2861	153	5%	26	0.9%	18	0.6%	53	2%	190	7%	2421	85%

SUCCESS AT 6 MONTHS POST-OP — REVISION HIPS

	n	Unk/NS		much worse		a little worse		about the same		a little better		much better	
Male	63	12	19%	2	3%	2	3%	4	6%	7	11%	36	57%
Female	73	4	5%	2	3%	1	1%	6	8%	12	16%	48	66%
Persons	136	16	12%	4	3%	3	2%	10	7%	19	14%	84	62%

4.4.5 Complications in the 6 months post-op

Post-Discharge Complications (any) — Primary hips

	n	None		1		2		3 or more		Number unknown	
Male	1320	305	23%	241	18%	78	6%	34	3%	662	50%
Female	1541	352	23%	326	21%	123	8%	66	4%	674	44%
Persons	2861	657	23%	567	20%	201	7%	100	3%	1336	47%

Post-Discharge Complications (any) — Revision hips

	n	None		1		2		3 or more		Number unknown	
Male	63	16	25%	18	29%	5	8%	3	5%	21	33%
Female	73	16	22%	19	26%	4	5%	2	3%	32	44%
Persons	136	32	24%	37	27%	9	7%	5	4%	53	39%

Post-Discharge Complications (details) in the 6 months post-op — Primary & revision hips

	Primary hips (*n*=2861)		Revision hips (*n*=136)	
SSI requiring oral antibiotics	44	1.5%	5	3.7%
SSI requiring IV antibiotics	5	0.17%	0	0%
DVT index leg	14	0.49%	0	0%
DVT other leg	2	0.07%	0	0%
DVT both legs	2	0.07%	0	0%
Pulmonary embolus	6	0.21%	0	0%
Dislocation	3	0.1%	2	1.5%
Joint stiffness	244	8.5%	13	9.6%
Bladder infection or retention	31	1.1%	1	0.74%
Fracture	10	0.35%	0	0%
Unexpected pain	153	5.3%	4	2.9%
Cardiac	6	0.21%	0	0%
Stroke	1	0.035%	0	0%
Leg length discrepancy	197	6.9%	11	8.1%
Joint or lower limb swelling	129	4.5%	8	5.9%
Paraesthesia or numbness	149	5.2%	5	3.7%
Cellulitis	10	0.35%	0	0%
Neuropathy	17	0.59%	1	0.74%
Muscle weakness	64	2.2%	4	2.9%
Respiratory infection	5	0.17%	0	0%
Other	121	4.2%	7	5.1%

Combined Complications (details) in the 6 months post-op — Primary & revision hips

	Primary hips (*n*=2862)		Revision hips (*n*=136)	
SSI requiring oral antibiotics	45	1.6%	5	3.7%
SSI requiring IV antibiotics	6	0.21%	0	0%
SSI requ surg c̄ prosth removal	0	0%	0	0%
SSI requ surg s̄ prosth removal	0	0%	0	0%
Deep vein thrombosis	22	0.77%	1	0.74%
Pulmonary embolus	10	0.35%	0	0%
Fat emboli	0	0%	0	0%
Drug reaction	0	0%	0	0%
Delirium	28	0.98%	0	0%
Hypotension	50	1.7%	2	1.5%
CVS	49	1.7%	1	0.74%
Respiratory infection	28	0.98%	1	0.74%
Urinary tract infection or retention	82	2.9%	3	2.2%
Wound dehiscence	10	0.35%	2	1.5%
Pressure area	1	0.035%	0	0%
Fall	3	0.1%	2	1.5%
Cellulitis	12	0.42%	0	0%
Death	10	0.35%	0	0%
Dislocation	11	0.38%	4	2.9%
Fracture	33	1.2%	3	2.2%
Joint stiffness	244	8.5%	13	9.6%
Unexpected pain	153	5.3%	4	2.9%
Leg length discrepancy	197	6.9%	11	8.1%
Joint or lower limb swelling	129	4.5%	8	5.9%
Nerve injury†	163	5.7%	6	4.4%
Muscle weakness	64	2.2%	4	2.9%
Re-operation	56	2%	8	5.9%
Other	213	7.4%	15	11%

This table combines complications which occurred during the hospital admission in which joint replacement surgery was performed, and complications which occurred following discharge from hospital but within six months after surgery.

SSI Surgical Site Infection

CVS Cardiovascular system

* including paraesthesia & numbness

4.4.6 Re-admission in the 6 months post-op

RE-ADMISSION — PRIMARY HIPS

	n	Missing		Re-admission due to arthroplasty		Re-admission for other reasons		Total re-admissions	
Male	1316	74	6%	48	4%	112	9%	157	12%
Female	1536	64	4%	59	4%	135	9%	186	12%
Persons	2852	138	5%	107	4%	247	9%	343	12%

RE-ADMISSION — REVISION HIPS

	n	Missing		Re-admission due to arthroplasty		Re-admission for other reasons		Total re-admissions	
Male	63	11	17%	8	13%	5	8%	13	21%
Female	73	4	5%	7	10%	10	14%	17	23%
Persons	136	15	11%	15	11%	15	11%	30	22%

REASONS FOR RE-ADMISSION — PRIMARY & REVISION HIPS

	Primary (*n*=343)		Revision (*n*=30)	
Reasons related to arthroplasty				
DVT	4	1%	0	0%
Pulmonary embolus	5	1%	0	0%
MUA	0	0%	0	0%
Dislocation	14	4%	9	31%
Surgical site infection	43	13%	5	17%
Wound dehiscence	1	0.3%	0	0%
Index joint revision	4	1%	0	0%
Other	34	10%	1	3%
Reasons unrelated to arthroplasty				
Cardiac	38	11%	0	0%
Renal/urinary tract	23	7%	2	7%
Cancer	8	2%	0	0%
Other	177	52%	12	41%

4.4.7 *Re-operation in the 6 months post-op*

RE-OPERATION — PRIMARY HIPS

	n	Re-operation due to arthroplasty	
Male	1320	20	2%
Female	1541	31	2%
Persons	2861	51	2%

RE-OPERATION — REVISION HIPS

	n	Re-operation due to arthroplasty	
Male	63	3	5%
Female	73	4	5%
Persons	136	7	5%

REASON FOR RE-OPERATION — PRIMARY HIPS

	Males (*n*=20)		Females (*n*=31)		Persons (*n*=51)	
SSI requiring surgery with no prosthesis removal	9	45%	10	32%	19	37%
SSI requiring surgery with prosthesis removal	5	25%	5	16%	10	20%
Dislocation	2	10%	6	19%	8	16%
Joint stiffness	0	0%	0	0%	0	0%
Periprosthetic fracture	0	0%	4	13%	4	8%
Implant fracture	0	0%	1	3%	1	2%
Bleeding	1	5%	1	3%	2	4%
Other	2	10%	3	10%	5	10%
Unknown/NS	1	5%	1	3%	2	4%

REASON FOR RE-OPERATION — REVISION HIPS

	Males (*n*=3)		Females (*n*=4)		Persons (*n*=7)	
SSI requiring surgery with no prosthesis removal	0	0%	2	50%	2	29%
SSI requiring surgery with prosthesis removal	1	33%	0	0%	1	14%
Dislocation	2	67%	2	50%	4	57%
Joint stiffness	0	0%	0	0%	0	0%
Periprosthetic fracture	0	0%	0	0%	0	0%
Implant fracture	0	0%	0	0%	0	0%
Bleeding	0	0%	0	0%	0	0%
Other	0	0%	0	0%	0	0%
Unknown/NS	0	0%	0	0%	0	0%

SSI = Surgical Site Infection

4.4.8 Deaths in the 6 months post-op

POST-DISCHARGE DEATH — PRIMARY HIPS

	n	Unknown/ not stated		Died in hospital		Total deaths at 6 mths post-op	
Male	1321	52	4%	1	0.08%	7	0.5%
Female	1541	51	3%	0	0%	4	0.3%
Persons	2862	103	4%	1	0.03%	11	0.4%

POST-DISCHARGE DEATH — REVISION HIPS

	n	Unknown/ not stated		Died in hospital		Total deaths at 6 mths post-op	
Male	63	3	5%	0	0%	0	0%
Female	73	6	8%	0	0%	0	0%
Persons	136	9	7%	0	0%	0	0%

Please note: The data shown in the following EQ-5D and EQ-VAS graphs and tables only refer to those patients for whom six month follow-up is complete. In the tables which follow in this section, "post-op" means at the follow-up contact, which occurs approximately six months post-operatively.

4.4.9 *EuroQoL EQ-5D Measures*

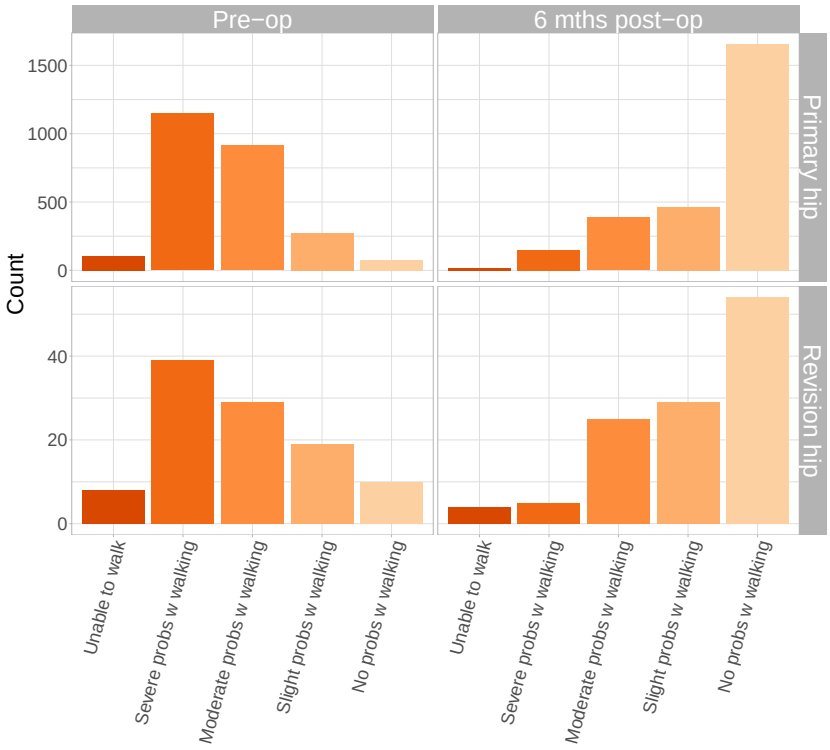


Figure 4.1: Hip Arthroplasties: Distribution of EQ-5D Mobility, pre-op versus post-op

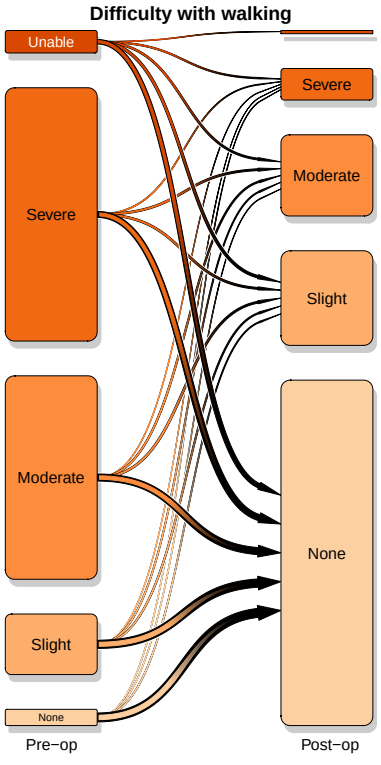
EQ-5D Mobility — Primary hips

	Pre-op		Post-op	
Unable to walk	103	4%	18	0.6%
Severe problems with walking	1148	41%	151	5%
Moderate problems with walking	913	32%	386	14%
Slight problems with walking	272	10%	464	16%
No problems with walking	78	3%	1655	59%
Unknown/Not stated	306	11%	146	5%

EQ-5D Mobility — Revision hips

	Pre-op		Post-op	
Unable to walk	8	6%	4	3%
Severe problems with walking	39	30%	5	4%
Moderate problems with walking	29	22%	25	19%
Slight problems with walking	19	15%	29	22%
No problems with walking	10	8%	54	41%
Unknown/Not stated	26	20%	14	11%

The chart below shows the transition in mobility difficulty in **primary hip arthroplasty** patients, from pre-operatively on the left to six months post-operatively on the right.



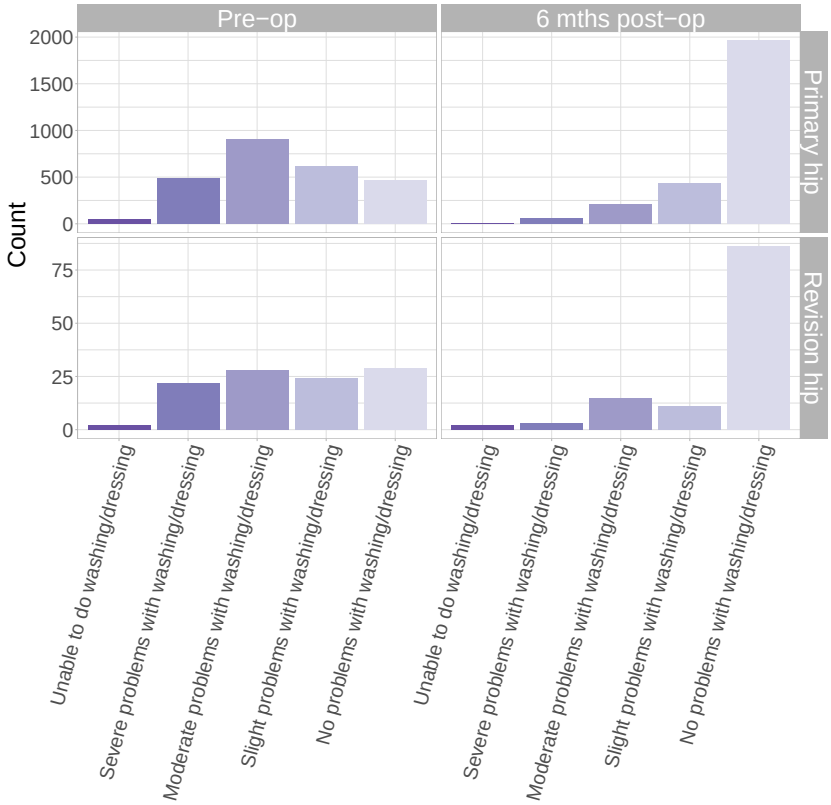


Figure 4.2: Hip Arthroplasties: Distribution of EQ-5D Personal Care, pre-op versus post-op

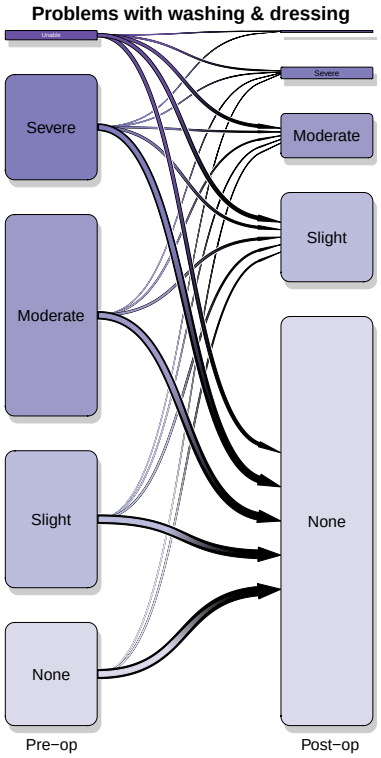
EQ-5D Personal Care — Primary hips

	Pre-op		Post-op	
Unable to do washing/dressing	46	2%	10	0.4%
Severe problems washing/dressing	491	17%	57	2%
Mod. problems washing/dressing	907	32%	213	8%
Slight problems washing/dressing	611	22%	433	15%
No problems washing/dressing	461	16%	1961	70%
Unknown/Not stated	305	11%	147	5%

EQ-5D Personal Care — Revision hips

	Pre-op		Post-op	
Unable to do washing/dressing	2	2%	2	2%
Severe problems washing/dressing	22	17%	3	2%
Mod. problems washing/dressing	28	21%	15	11%
Slight problems washing/dressing	24	18%	11	8%
No problems washing/dressing	29	22%	86	66%
Unknown/Not stated	26	20%	14	11%

The chart below shows the transition in difficulty with washing and dressing in **primary hip arthroplasty** patients, from pre-operatively on the left to six months post-operatively on the right.



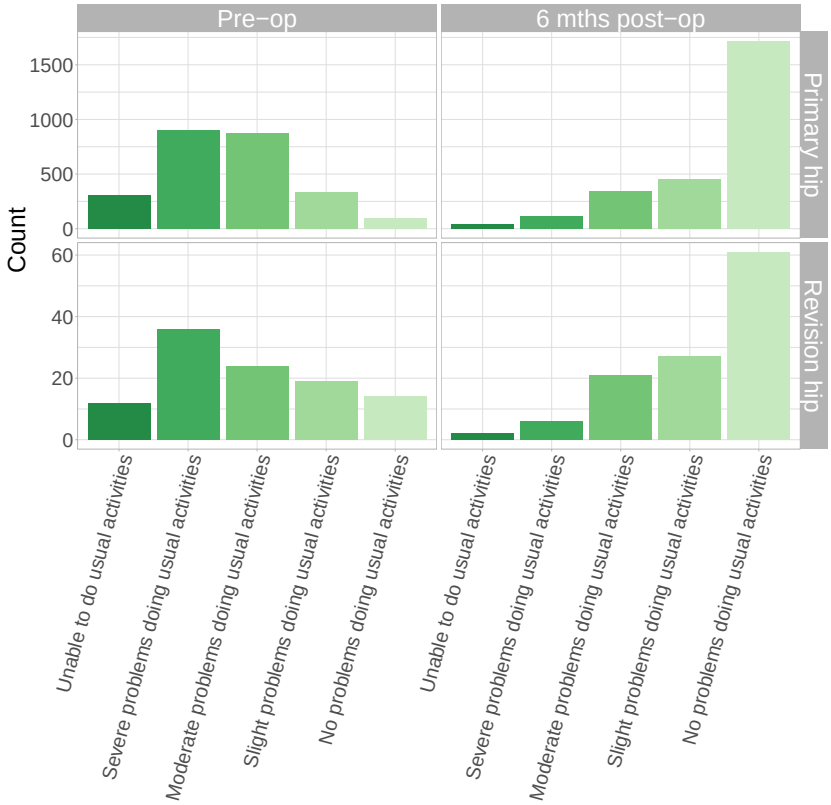


Figure 4.3: Hip Arthroplasties: Distribution of EQ-5D Usual Activities, pre-op versus post-op

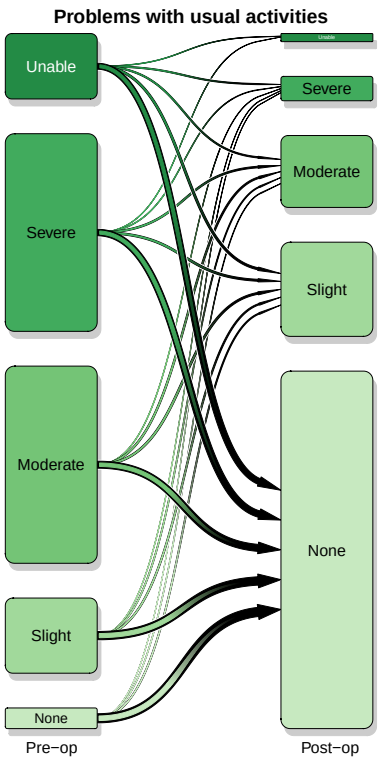
EQ-5D Usual Activites — Primary hips

	Pre-op		Post-op	
Unable to do usual activities	306	11%	42	1%
Severe problems c̄ usual activities	900	32%	115	4%
Mod. problems c̄ usual activities	877	31%	343	12%
Slight problems c̄ usual activities	337	12%	456	16%
No problems c̄ usual activities	94	3%	1718	61%
Unknown/Not stated	307	11%	147	5%

EQ-5D Usual Activites — Revision hips

	Pre-op		Post-op	
Unable to do usual activities	12	9%	2	2%
Severe problems c̄ usual activities	36	27%	6	5%
Mod. problems c̄ usual activities	24	18%	21	16%
Slight problems c̄ usual activities	19	15%	27	21%
No problems c̄ usual activities	14	11%	61	47%
Unknown/Not stated	26	20%	14	11%

The chart below shows the transition in difficulty with usual activities in **primary hip arthroplasty** patients, from pre-operatively on the left to six months post-operatively on the right.



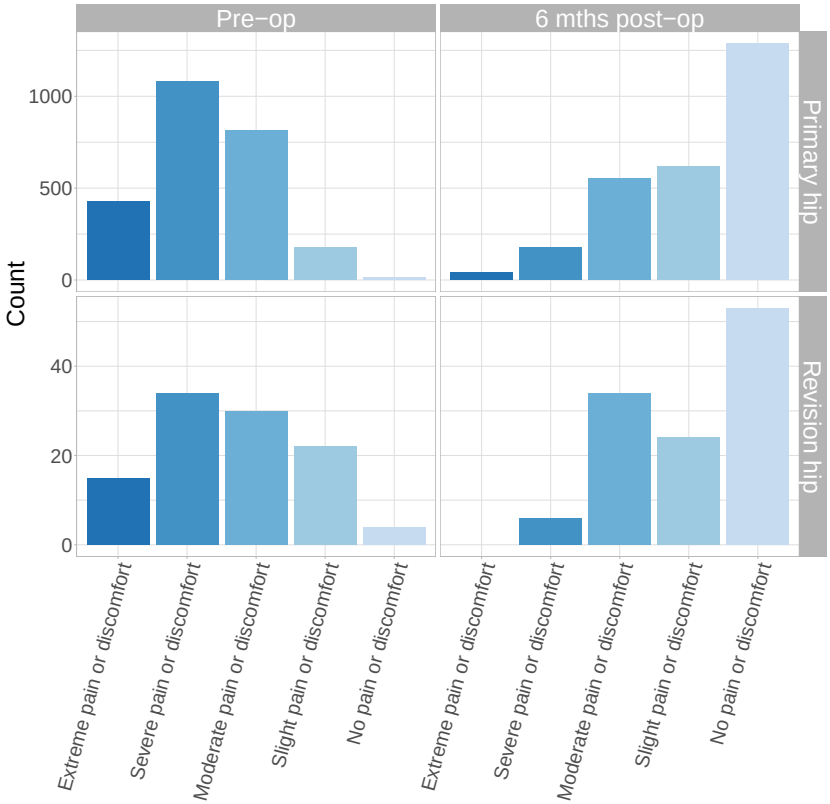


Figure 4.4: Hip Arthroplasties: Distribution of EQ-5D Discomfort, pre-op versus post-op

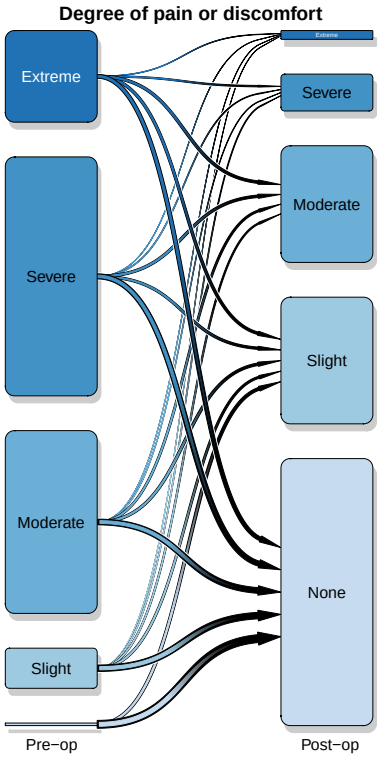
EQ-5D Discomfort — Primary hips

	Pre-op		Post-op	
Extreme pain or discomfort	425	15%	40	1%
Severe pain or discomfort	1081	38%	177	6%
Moderate pain or discomfort	816	29%	550	20%
Slight pain or discomfort	178	6%	619	22%
No pain or discomfort	13	0.5%	1288	46%
Unknown/not stated	307	11%	146	5%

EQ-5D Discomfort — Revision hips

	Pre-op		Post-op	
Extreme pain or discomfort	15	11%	0	0%
Severe pain or discomfort	34	26%	6	5%
Moderate pain or discomfort	30	23%	34	26%
Slight pain or discomfort	22	17%	24	18%
No pain or discomfort	4	3%	53	40%
Unknown/not stated	26	20%	14	11%

The chart below shows the transition in the degree of pain or discomfort in **primary hip arthroplasty** patients, from pre-operatively on the left to six months post-operatively on the right.



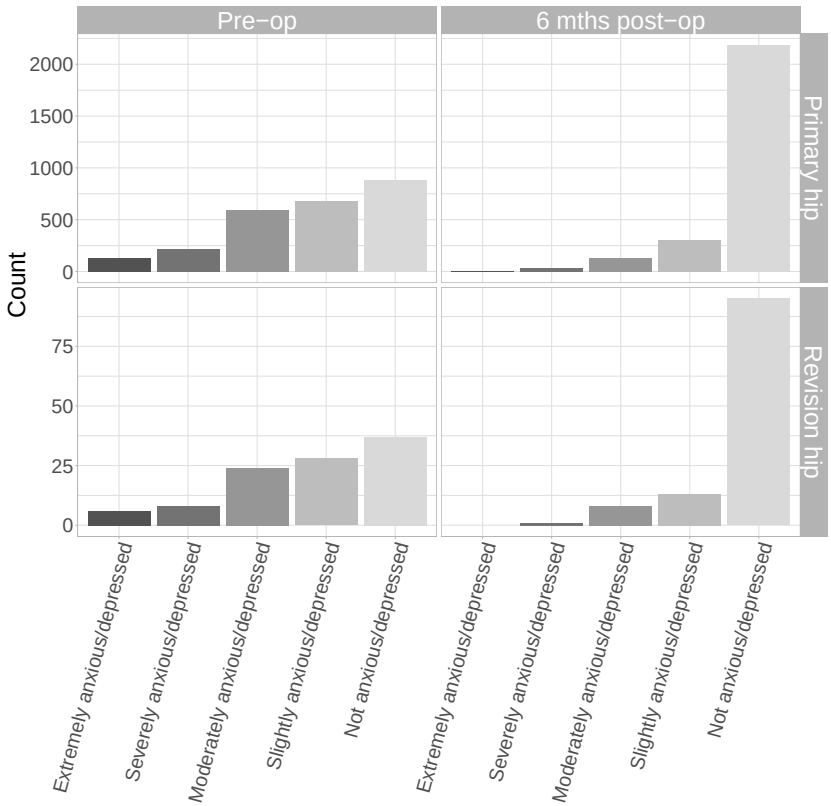


Figure 4.5: Hip Arthroplasties: Distribution of EQ-5D Anxiety/Depression, pre-op versus post-op

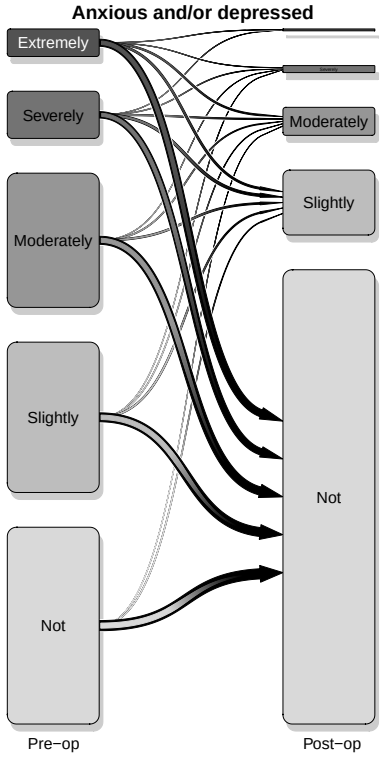
EQ-5D Anxiety/Depression — Primary hips

	Pre-op		Post-op	
Extremely anxious/depressed	130	5%	9	0.3%
Severely anxious/depressed	215	8%	36	1%
Moderately anxious/depressed	598	21%	132	5%
Slightly anxious/depressed	684	24%	301	11%
Not anxious/depressed	880	31%	2187	78%
Unknown/not stated	313	11%	155	5%

EQ-5D Anxiety/Depression — Revision hips

	Pre-op		Post-op	
Extremely anxious/depressed	6	5%	0	0%
Severely anxious/depressed	8	6%	1	0.8%
Moderately anxious/depressed	24	18%	8	6%
Slightly anxious/depressed	28	21%	13	10%
Not anxious/depressed	37	28%	95	73%
Unknown/not stated	28	21%	14	11%

The chart below shows the transition in the degree of anxiety/depression in **primary hip arthroplasty** patients, from pre-operatively on the left to six months post-operatively on the right.



4.4.10 *EuroQoL Visual Analogue Scale (EQ-VAS)*

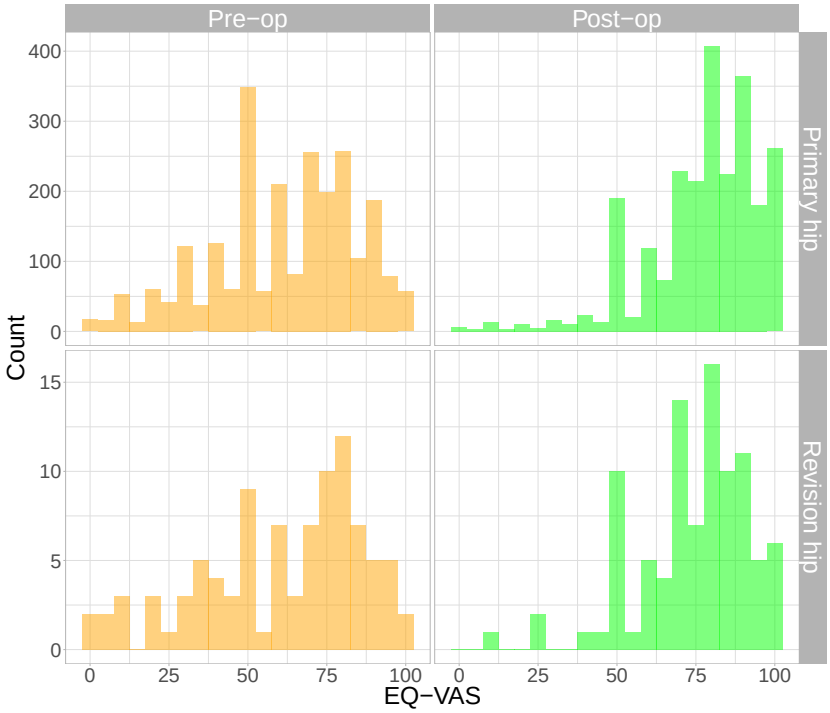


Figure 4.6: Hip Arthroplasties: Distribution of EQ-VAS, pre-op versus post-op

HIP ARTHROPLASTIES: DISTRIBUTION OF EQ-VAS, PRE-OP VERSUS POST-OP

Procedure	Sex	Timing	*n**	Mean	5th %ile	Median	95th %ile
Primary hip	Males	Pre-op	1279	59.8	15.0	60	95.0
		Post-op	1279	76.9	50.0	80	100.0
Primary hip	Females	Pre-op	1109	63.3	20.0	70	95.0
		Post-op	1109	78.3	50.0	80	100.0
Primary hip	Persons	Pre-op	2388	61.5	20.0	65	95.0
		Post-op	2388	77.6	50.0	80	100.0
Revision hip	Males	Pre-op	51	60.1	9.0	60	95.0
		Post-op	51	75.0	47.5	80	98.5
Revision hip	Females	Pre-op	43	61.8	20.0	70	85.0
		Post-op	43	72.8	50.0	75	94.5
Revision hip	Persons	Pre-op	94	60.9	9.3	70	95.0
		Post-op	94	74.0	48.2	79	98.3

* Number of cases with both pre-op and 6 months post-op EQ-VAS data available.

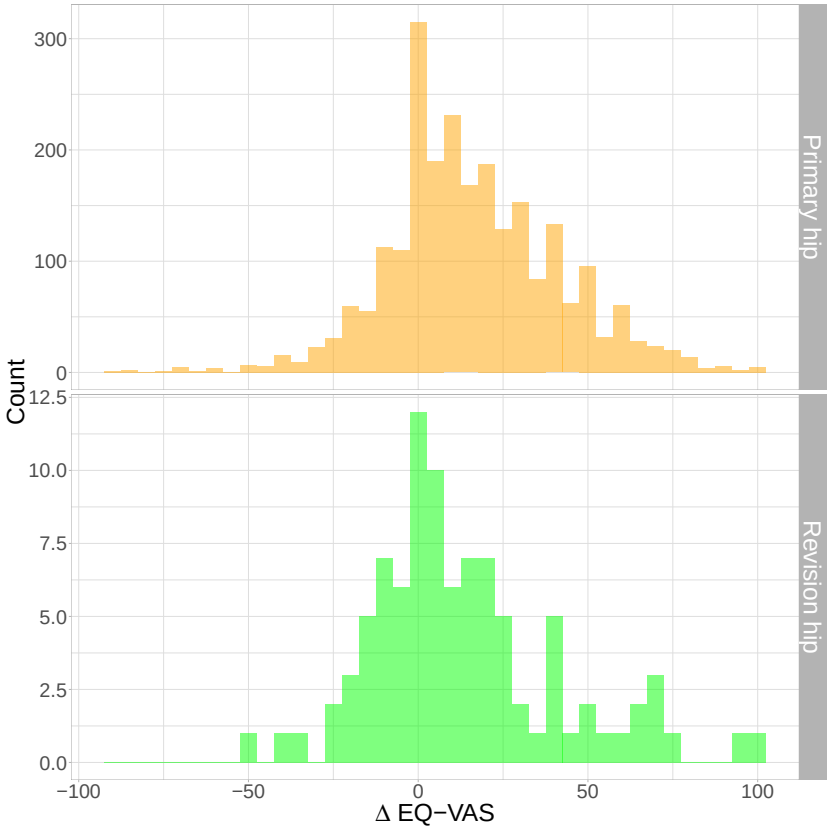


Figure 4.7: Hip Arthroplasties: Change in EQ-VAS, pre-op versus post-op

4.4.11 *Oxford Hip Scores*

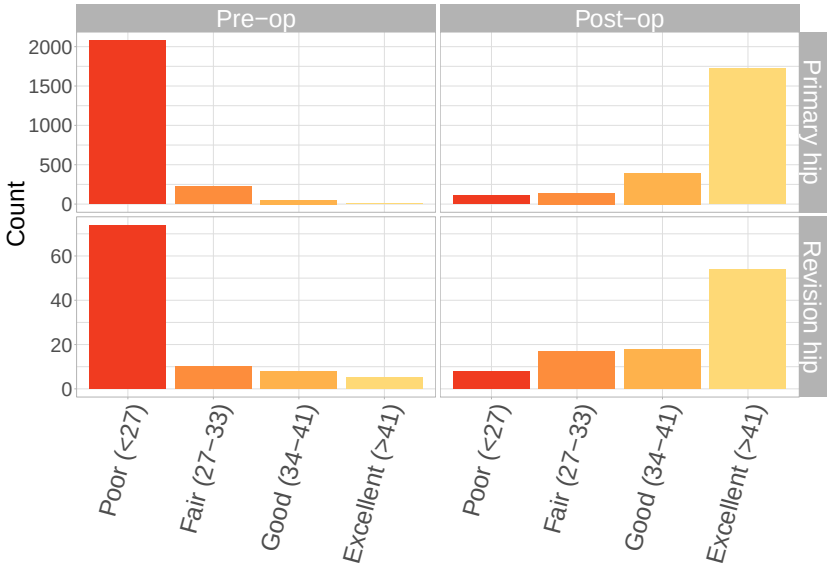


Figure 4.8: Hip Arthroplasties: Distribution of grouped total Oxford Hip Scores, pre-op to post-op

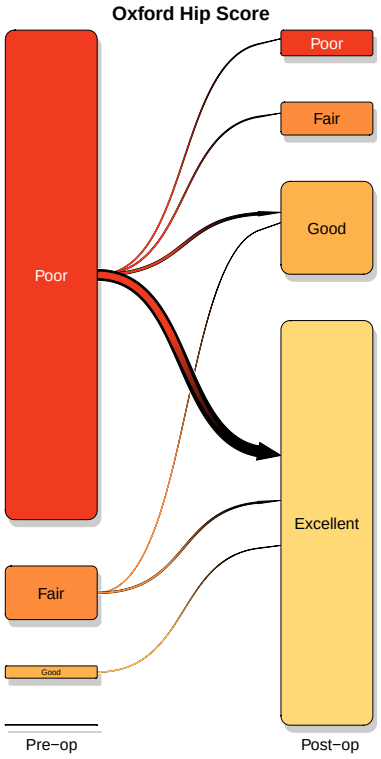
Partitioned total Oxford Hip Scores, pre-op and post-op — Primary hips

Total Oxford score	Pre-op		Post-op	
Poor (<27)	2082	88%	109	5%
Fair (27-33)	228	10%	140	6%
Good (34-41)	52	2%	395	17%
Excellent (>41)	3	0.1%	1721	73%

Partitioned total Oxford Hip Scores, pre-op and post-op — Revision hips

Total Oxford score	Pre-op		Post-op	
Poor (<27)	74	76%	8	8%
Fair (27-33)	10	10%	17	18%
Good (34-41)	8	8%	18	19%
Excellent (>41)	5	5%	54	56%

The chart below shows the transition in Oxford Hip Scores in **primary hip arthroplasty** patients, from pre-operatively on the left to six months post-operatively on the right.



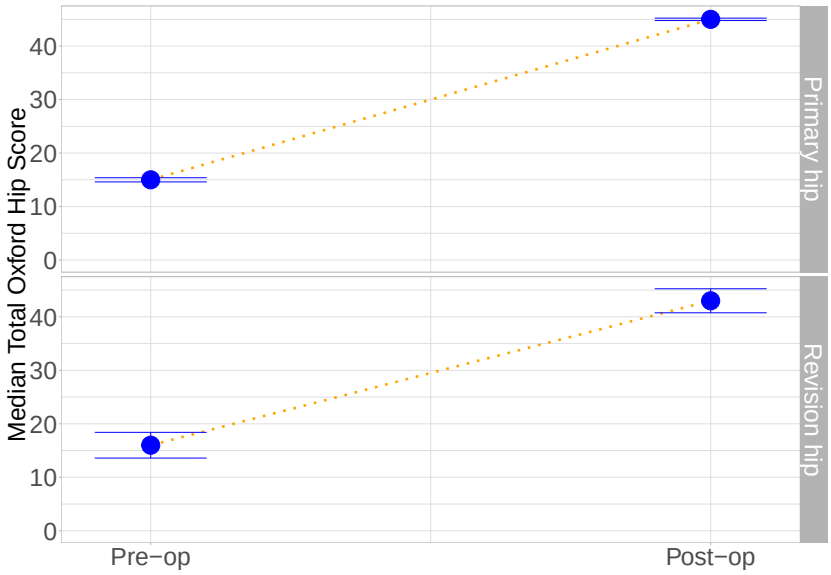


Figure 4.9: Domino plot of median Pre-op and Post-op Oxford Hip Scores

Explanatory note: In this "domino" plot, the central dot indicates the median Oxford Hip Score (OHS) for each group of patients (means and medians for each group are also shown in the tables on the pages which immediately follow this graph). The upper and lower horizontal lines are positioned at $\frac{1.58*IQR}{\sqrt{n}}$ (where IQR is the inter-quartile range), which represents an approximate 95% confidence interval around the median OHS. If these confidence intervals do not overlap, then the difference between the medians is almost certainly statistically significant.

Table 4.2: Hip Arthroplasties: Distribution of total Oxford Hip Scores, pre-op versus post-op

Procedure	Sex	Timing*	*n***	Mean	5th %ile	Median	95th %ile	IQRÂ¶
Primary hip	Males	Pre-op	1257	14.5	3.0	13.0	30.0	12.0
		Post-op	1257	42.0	26.0	45.0	48.0	7.0
	Females	Pre-op	1108	17.2	5.0	16.0	32.0	12.0
		Post-op	1108	43.6	30.0	46.0	48.0	6.0
	Persons	Pre-op	2365	15.8	4.0	15.0	31.0	12.0
		Post-op	2365	42.8	27.0	45.0	48.0	7.0
Revision hip	Males	Pre-op	53	18.4	4.2	15.0	39.6	15.0
		Post-op	53	39.1	19.6	42.0	48.0	12.0
	Females	Pre-op	44	19.9	5.1	19.5	41.0	14.2
		Post-op	44	38.8	14.8	44.0	48.0	14.2
	Persons	Pre-op	97	19.1	5.0	16.0	41.2	15.0
		Post-op	97	39.0	15.6	43.0	48.0	14.0

* "Post-op" means 6 months post-operative.

** Number of cases with both pre-op and 6 months post-op Oxford Hip Score data available.

¶ Inter-quartile range.

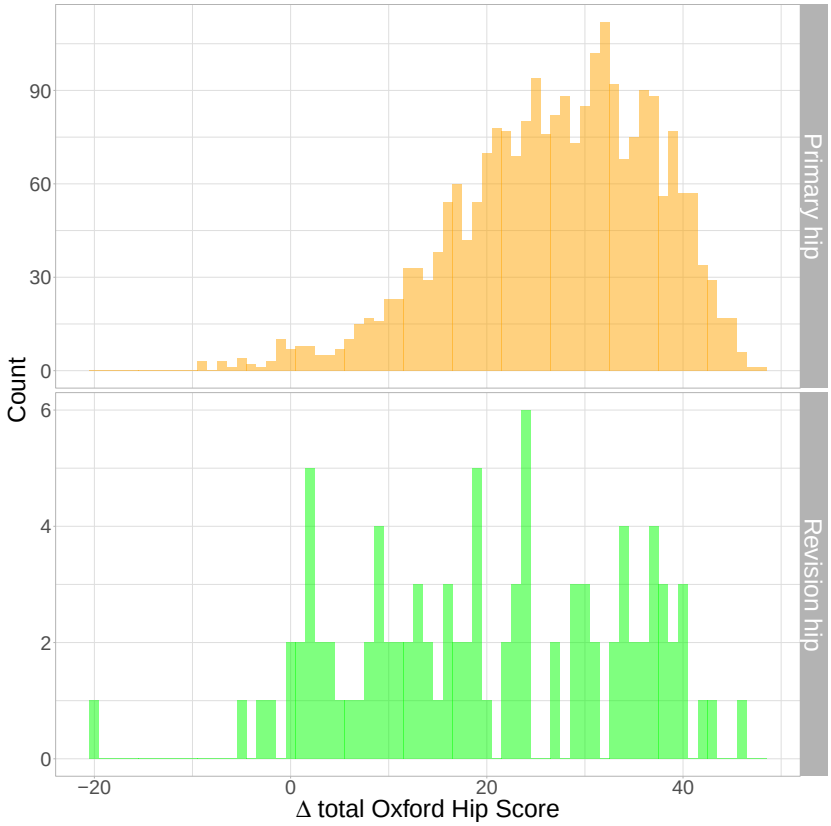


Figure 4.10: Change in total Oxford hip scores, pre-op to post-op

Table 4.3: Hip Arthroplasties: Change in total Oxford Hip Score, pre-op to post-op

	Procedure	Sex	*n**	Mean change	5th %ile	Median	95th %ile
2	Primary hip	Males	1257	27.5	9.0	29	42.0
1		Females	1108	26.4	10.0	27	41.0
5		Persons	2365	27.0	9.0	28	41.0
4	Revision hip	Males	53	20.7	0.6	22	39.4
3		Females	44	18.9	0.3	19	39.6
6		Persons	97	19.9	0.0	19	40.0

* Number of cases with both pre-op and 6 months post-op Oxford Hip Score data available.

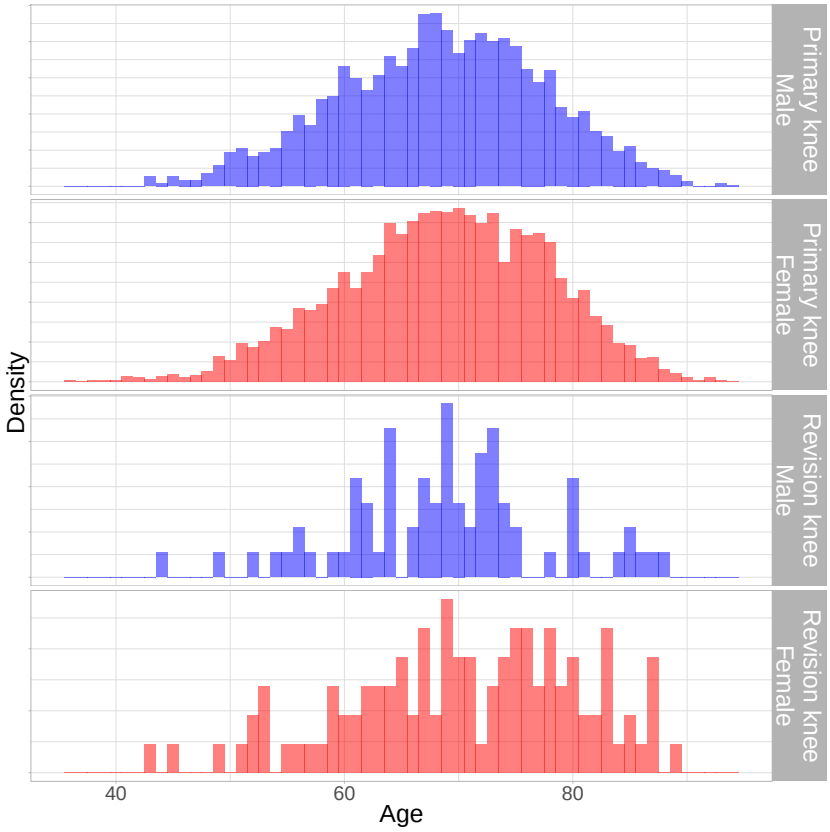
5
Knee Arthroplasty

Knee arthroplasties are either an initial (primary) procedure on a joint or they are a subsequent (revision) procedure on a previously replaced joint. ACORN collects information on primary total or partial knee arthroplasties and revision knee arthroplasties. A primary total knee arthroplasty involves replacing both surfaces of the knee joint with or without resurfacing of the patella, and a partial arthroplasty involves arthroplasty of only part of the joint. Revision knee arthroplasty surgery is where one or more of the components are removed and/or replaced.

Between January 2013 and December 2018, primary total knee arthroplasty surgery accounted for 97% of knee arthroplasty procedures. The average age of all people having a knee procedure was 68.7 years. The most common reason for primary surgery was osteoarthritis. Knee arthroplasty surgery was more common in women (62%).

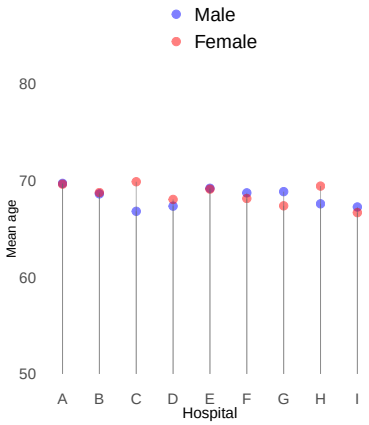
5.1 Demographic Profile

5.1.1 Age Distribution



The average age of knee arthroplasty patients is around the late 60s, with the average age for males about the same as the average age for females (*cf* hip arthroplasties, in which the male patients are on average 3 years younger then the female patients). About one-twelfth of the males and females in the ACORN registry undergoing knee replacement are aged less than 55 years.

The chart below shows the variation in the mean age of primary knee arthroplasty patients between ACORN hospitals. The order of hospitals and their labels is random.



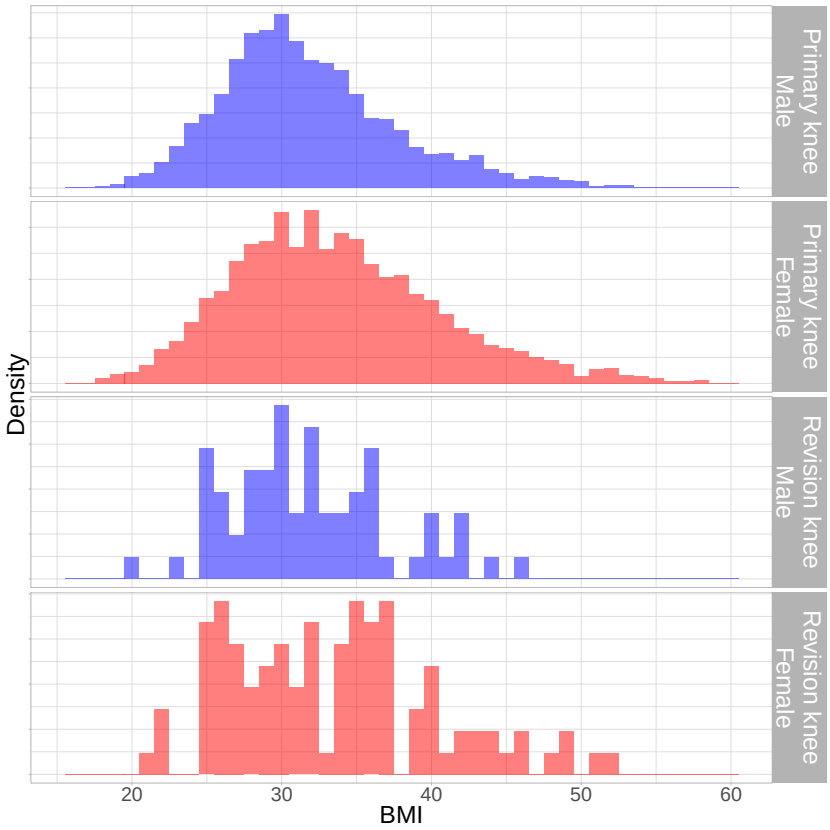
AGE OF PATIENTS — PRIMARY KNEES

	n	%	**Mean**	StdDev	Min	Max	<55	55-64	65-74	75-84	≥ 85
Male	2254	37.9	**68.5**	9.03	42.6	94.3	7.4%	27%	41%	22%	2.9%
Female	3692	62.1	**68.8**	9.00	36.2	92.8	7.5%	26%	40%	24%	2.5%
Persons	**5946**	**100.0**	**68.7**	**9.01**	**36.2**	**94.3**	**7.4%**	**26%**	**40%**	**23%**	**2.7%**

AGE OF PATIENTS — REVISION KNEES

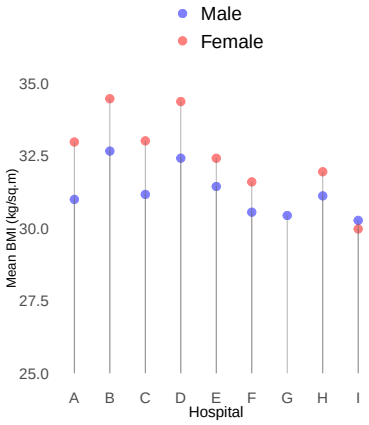
	n	%	**Mean**	StdDev	Min	Max	<55	55-64	65-74	75-84	≥ 85
Male	73	40.6	**68.7**	8.97	43.5	87.9	5.5%	27%	51%	11%	5.5%
Female	107	59.4	**70.5**	10.26	42.5	89.2	8.4%	21%	34%	31%	6.5%
Persons	**180**	**100.0**	**69.8**	**9.77**	**42.5**	**89.2**	**7.2%**	**23%**	**41%**	**23%**	**6.1%**

5.1.2 *Body Mass Index (BMI)*



The average Body Mass Index (BMI) of patients undergoing primary knee arthroplasty is about 33 in both sexes, with a wide range and spread of BMI values in both sexes.

The chart below shows the variation in the mean BMI of primary knee arthroplasty patients between ACORN hospitals. The order of hospitals and their labels is random.



Body Mass Index (BMI) — Primary knees

	n	Missing		**Mean**	StdDev	Min	Max
Male	2254	75	3.4%	**31.8**	5.82	17.7	53
Female	3692	154	4.4%	**33.8**	6.99	15.9	59.6
Persons	**5946**	**229**	**4.0%**	**33**	**6.64**	**15.9**	**59.6**

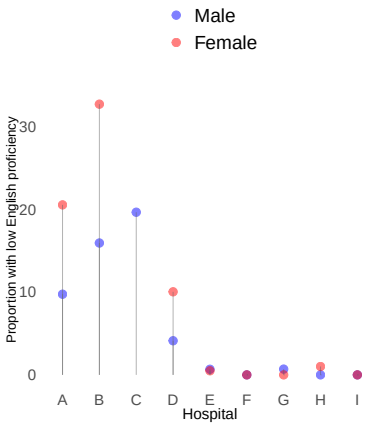
Body Mass Index (BMI) — Revision knees

	n	Missing		**Mean**	StdDev	Min	Max
Male	73	4	5.8%	**32**	5.38	20	46.2
Female	107	3	2.9%	**33.5**	6.95	21.3	52.1
Persons	**180**	**7**	**4.0%**	**32.9**	**6.4**	**20**	**52.1**

5.1.3 *English Proficiency*

ENGLISH PROFICIENCY — PRIMARY & REVISION KNEES

	n	Missing		High		Low	
Male	2327	94	4.1%	2039	87.6%	194	8.3%
Female	3799	169	4.5%	2909	76.6%	721	19.0%
Persons	6126	263	4.3%	4948	80.8%	915	14.9%



5.1.4 *Level of Education*

SCHOOL EDUCATION — PRIMARY & REVISION KNEES

	n	Missing		No schooling		Yr 9 or below		Yrs 10 or 11		Yr 12	
Male	2327	184	7.9%	38	1.6%	739	32%	931	40%	435	19%
Female	3799	266	7%	175	4.6%	1246	33%	1497	39%	615	16%
Persons	6126	450	7.3%	213	3.5%	1985	32%	2428	40%	1050	17%

POST-SCHOOL EDUCATION — PRIMARY & REVISION KNEES

	n	Missing		None		Cert/Diploma		Bachelor		Postgrad	
Male	2327	235	10%	1153	50%	775	33%	78	3.35%	86	3.7%
Female	3799	383	10%	2602	68%	435	11%	118	3.1%	261	6.9%
Persons	6126	618	10%	3755	61%	1210	20%	196	3.2%	347	5.7%

5.2 Patient Medical & Surgical Characteristics

5.2.1 Comorbidities

PRE-OPERATIVE COMORBIDITIES — PRIMARY KNEES

	n	Low back pain		Other lower limb arthritis		Heart disease		Hypertension	
Male	2254	610	27%	615	27%	851	38%	1258	56%
Female	3692	1342	36%	1136	31%	1381	37%	2313	63%
Persons	**5946**	**1952**	**33%**	**1751**	**29%**	**2232**	**38%**	**3571**	**60%**

	n	Diabetes		Gastrointestinal disease		Respiratory disease		Renal disease	
Male	2254	514	23%	393	17%	338	15%	123	5%
Female	3692	850	23%	906	25%	609	16%	205	6%
Persons	**5946**	**1364**	**23%**	**1299**	**22%**	**947**	**16%**	**328**	**6%**

	n	Hepatic disease		Neurological disease		Anxiety/ depression	
Male	2254	46	2%	96	4%	259	11%
Female	3692	99	3%	193	5%	805	22%
Persons	**5946**	**145**	**2%**	**289**	**5%**	**1064**	**18%**

	n	No comorbs		1 comorb		2 comorbs		$\geq$ 3 comorbs	
Male	2254	10	14%	12	20%	14	25%	27	41%
Female	3692	11	10%	9	15%	15	23%	39	52%
Persons	**5946**	**21**	**11%**	**21**	**17%**	**29**	**24%**	**66**	**48%**

PRE-OPERATIVE COMORBIDITIES — REVISION KNEES

	n	Low back pain		Other lower limb arthritis		Heart disease		Hypertension	
Male	73	22	30%	17	23%	25	34%	44	60%
Female	107	43	40%	32	30%	41	38%	65	61%
Persons	**180**	**65**	**36%**	**49**	**27%**	**66**	**37%**	**109**	**61%**

	n	Diabetes		Gastrointestinal disease		Respiratory disease		Renal disease	
Male	73	16	22%	22	30%	9	12%	4	5%
Female	107	23	21%	27	25%	16	15%	7	7%
Persons	**180**	**39**	**22%**	**49**	**27%**	**25**	**14%**	**11**	**6%**

	n	Hepatic disease		Neurological disease		Anxiety/ depression	
Male	73	0	0%	4	5%	6	8%
Female	107	3	3%	9	8%	27	25%
Persons	**180**	**3**	**2%**	**13**	**7%**	**33**	**18%**

	n	No comorbs		1 comorb		2 comorbs		$\geq$ 3 comorbs	
Male	73	10	15%	12	19%	14	26%	27	40%
Female	107	11	8%	9	17%	15	22%	39	52%
Persons	**180**	**21**	**11%**	**21**	**18%**	**29**	**24%**	**66**	**47%**

5.2.2 *ASA Physical Status Classification*

ASA — Primary knees

	n	Missing		ASA 1		ASA 2	
Males	2254	350	16%	96	4%	1112	49%
Females	3692	594	16%	122	3%	1807	49%
Persons	5946	944	16%	218	4%	2919	49%

	n	ASA 3		ASA 4		ASA 5	
Males	2254	673	30%	22	1%	1	0.04%
Females	3692	1143	31%	26	0.7%	0	0%
Persons	5946	1816	31%	48	0.8%	1	0.02%

The ASA scoring system categorises patients into the following categories of pre-operative physical status, as an approximate estimate of anaesthetic risk:

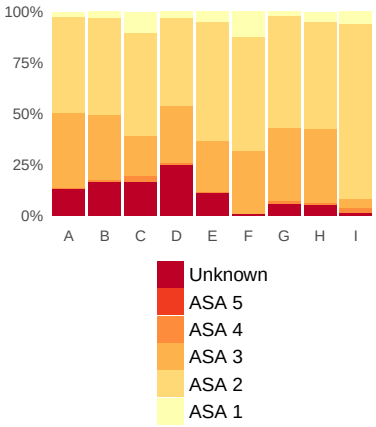
1. a normal healthy person
2. a person with mild systemic disease
3. a person with severe systemic disease
4. a person with severe systemic disease that is a constant threat to life
5. a moribund person who is not expected to survive

ASA — Revision knees

	n	Missing		ASA 1		ASA 2	
Males	73	18	25%	2	3%	26	36%
Females	107	10	9%	0	0%	53	50%
Persons	180	28	16%	2	1%	79	44%

	n	ASA 3		ASA 4		ASA 5	
Males	73	27	37%	0	0%	0	0%
Females	107	43	40%	1	0.9%	0	0%
Persons	180	70	39%	1	0.6%	0	0%

The chart below shows the variation in the proportion of knee arthroplasty patients in each ASA category between ACORN hospitals. The order of hospitals and their labels is random.



5.2.3 *Type & Laterality of Surgery*

Type & Laterality — Primary & revision knees

Type	*n*	Missing		Left		Right		Bilateral	
Primary	5946	1	0.02%	2631	44%	2919	49%	395	7%
Revision	180	1	0.6%	71	39%	108	60%	0	0%

Please note: In the interest of brevity, each joint in the primary bilateral knee arthroplasties recorded by the ACORN registry are not reported separately in this document — only data for the index joint (generally the right) of a bilateral procedure is included in this report. Future iterations of this report may provide additional details of each joint in bilateral procedures.

5.2.4 *Principal Reason for Surgery*

Reason for Surgery — Primary knees

	n	OA		RA		DDH	
Male	2254	2192	97%	7	0.3%	0	0%
Female	3692	3562	96%	38	1%	0	0%
Persons	5946	5754	97%	45	0.8%	0	0%

	n	Oth arth		ON/AVN		Tumour	
Male	2254	2	0.09%	5	0.2%	0	0%
Female	3692	7	0.2%	8	0.2%	0	0%
Persons	5946	9	0.2%	13	0.2%	0	0%

	n	Other		Missing	
Male	2254	20	0.9%	28	1%
Female	3692	22	0.6%	55	1%
Persons	5946	42	0.7%	83	1%

OA
: osteoarthritis

RA
: rheumatoid arthritis

DDH
: developmental dysplasia of the hips

Oth arth
: other inflammatory arthritis

ON/AVN
: osteonecrosis/avascular necrosis

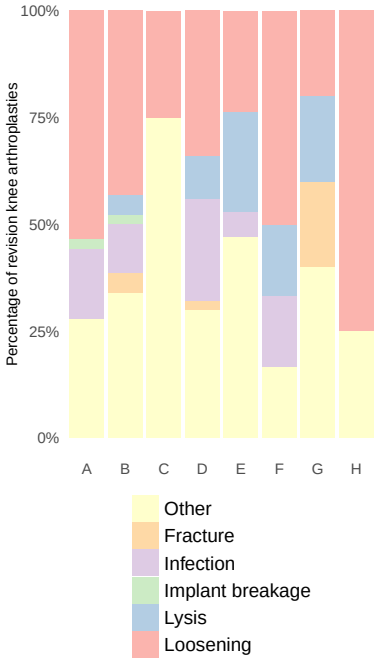
Reason for Surgery — Revision knees

	n	Loosening		Lysis		Dislocation	
Male	73	22	30%	7	10%	0	0%
Female	107	49	46%	6	6%	0	0%
Persons	180	71	39%	13	7%	0	0%

	n	Implant break		Infection		Fracture	
Male	73	1	1%	15	21%	0	0%
Female	107	1	0.9%	11	10%	4	4%
Persons	180	2	1%	26	14%	4	2%

	n	Other		Missing	
Male	73	25	34%	3	4%
Female	107	32	30%	4	4%
Persons	180	57	32%	7	4%

The chart below shows the variation in reasons for **revision** in knee arthroplasty patients between ACORN hospitals. Revisions are relatively uncommon, and thus many of the differences may be random variation, but some systematic variation between hospitals may be present. More data would be needed to investigate this. The order of hospitals and their labels is random. One hospital did not perform any revisions.



5.3 Acute Care Measures

During the admitted period of care, the specific acute care measures collected by ACORN are: any requirement for a high care bed and whether this was a planned or unplanned admission to that bed; any complication experienced during the admitted acute care stay; the need for a blood transfusion; and discharge destination from the acute care ward.

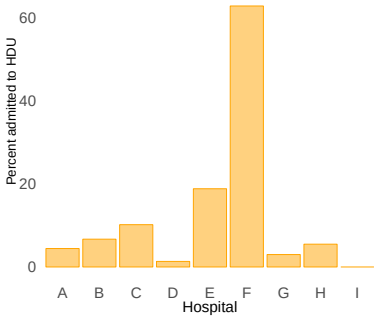
Complications are required to have been documented in the medical record. They include delirium, surgical site infection (SSI), deep venous thrombosis (DVT), pulmonary embolus (PE), respiratory infection, cardiovascular events, dislocation, fracture, nerve injury, bladder infection or retention, wound dehiscence, and death.

5.3.1 High Care Bed Utilisation

HIGH CARE BED UTILISATION — PRIMARY KNEES

	n	Missing		High Care Bed		Unplanned*	
Male	2254	2	0.09%	204	9%	158	77%
Female	3692	1	0.03%	241	7%	145	60%
Persons	5946	3	0.05%	445	7%	303	68%

The chart below shows the variation in high care bed utilisation following **primary** knee arthroplasty between ACORN hospitals. The labelling and order of hospitals is randomised.



HIGH CARE BED UTILISATION — REVISION KNEES

	n	Missing		High Care Bed		Unplanned*	
Male	73	0	0%	5	7%	3	60%
Female	107	0	0%	6	6%	5	83%
Persons	180	0	0%	11	6%	8	73%

* Percentage of admissions to high care beds which were unplanned.

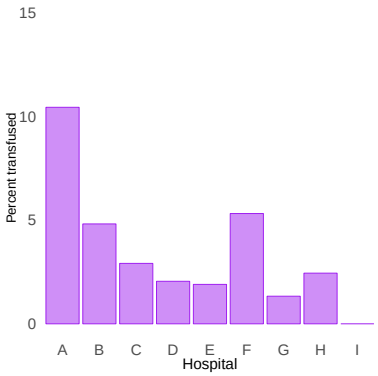
5.3.2 *Peri-operative Blood Transfusion*

Blood Transfusion — Primary knees

	n	Missing		Transfused		Mean units
Male	2254	12	0.5%	74	3%	2.2
Female	3692	23	0.6%	193	5%	1.9
Persons	5946	35	0.6%	267	4%	2

	n	Autologous †		Donor †		Missing source	
Male	2254	3	4%	57	77%	12	16%
Female	3692	5	3%	143	74%	36	19%
Persons	5946	8	3%	200	75%	48	18%

The chart below shows the variation in blood transfusion utilisation following **primary** knee arthroplasty between ACORN hospitals. The labelling and order of hospitals is randomised.

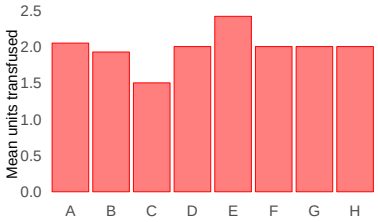


Blood Transfusion — Revision knees

	n	Missing		Transfused		Mean units
Male	73	1	1%	10	14%	2.3
Female	107	1	0.9%	13	12%	1.5
Persons	180	2	1%	23	13%	1.9

	n	Autologous †		Donor †		Missing source	
Male	73	0	0%	7	70%	1	10%
Female	107	1	8%	10	77%	1	8%
Persons	180	1	4%	17	74%	2	9%

The variation between hospitals in the mean number of units transfused (in those patients receiving a transfusion) for primary knee arthroplasty patients is shown below.



* percentages are of patients who received transfusions.

5.3.3 Complications during Index Admission

COMPLICATIONS (ANY) DURING ADMISSION — PRIMARY KNEES

	n	1 or more		None		Unk/NS	
Males	2254	348	(15%)	1884	(84%)	15	(0.7%)
Females	3692	434	(12%)	3219	(87%)	33	(0.9%)
Persons	5946	782	(13%)	5103	(86%)	48	(0.8%)

COMPLICATIONS (DETAILS) DURING ADMISSION — PRIMARY KNEES

Complications	Males		Females		Persons	
Drug reaction	1	0.044%	1	0.027%	2	0.034%
Delirium	33	1.5%	24	0.65%	57	0.96%
SSI requiring oral antibiotics	2	0.089%	0	0%	2	0.034%
SSI requiring IV antibiotics	0	0%	5	0.14%	5	0.084%
SSI requ surg c̄ prosth removal	0	0%	0	0%	0	0%
SSI requ surg s̄ prosth removal	0	0%	0	0%	0	0%
Deep vein thrombosis	9	0.4%	18	0.49%	27	0.45%
Pulmonary embolus	7	0.31%	21	0.57%	28	0.47%
Fat emboli	0	0%	1	0.027%	1	0.017%
Respiratory infection	10	0.44%	26	0.7%	36	0.61%
CVS	40	1.8%	62	1.7%	102	1.7%
Dislocation	0	0%	0	0%	0	0%
Fracture	4	0.18%	14	0.38%	18	0.3%
Nerve injury	2	0.089%	5	0.14%	7	0.12%
Urinary tract infection	22	0.98%	20	0.54%	42	0.71%
Urinary retention	72	3.2%	28	0.76%	100	1.7%
Wound dehiscence	20	0.89%	18	0.49%	38	0.64%
Reoperation during index adm	2	0.089%	4	0.11%	6	0.1%
Pressure area	1	0.044%	3	0.081%	4	0.067%
Fall	9	0.4%	12	0.33%	21	0.35%
Hypotension	15	0.67%	31	0.84%	46	0.77%
Cellulitis	7	0.31%	9	0.24%	16	0.27%
Death	0	0%	2	0.054%	2	0.034%
Other	99	4.4%	150	4.1%	249	4.2%

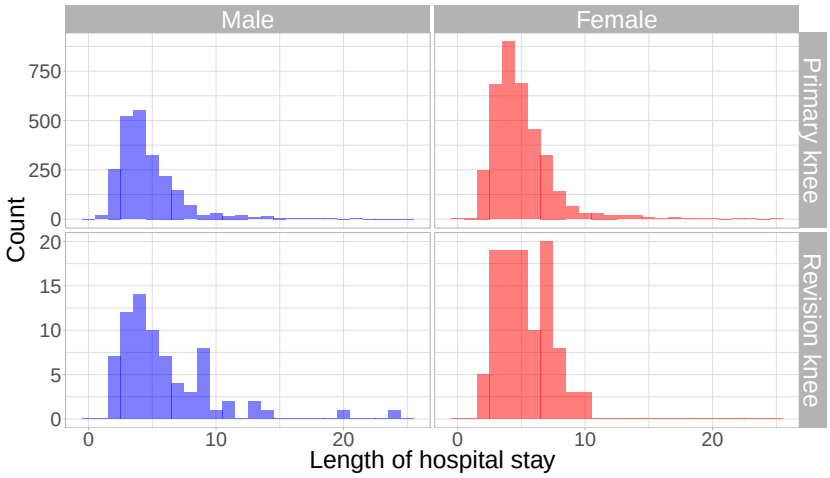
Complications (any) during Admission — Revision knees

	n	1 or more		None		Unk/NS	
Males	73	7	(10%)	65	(89%)	1	(1%)
Females	107	13	(12%)	93	(87%)	1	(0.9%)
Persons	180	20	(11%)	158	(88%)	2	(1%)

Complications (details) during Admission — Revision knees

Complications	Males		Females		Persons	
Drug reaction	0	0%	0	0%	0	0%
Delirium	0	0%	0	0%	0	0%
SSI requiring oral antibiotics	0	0%	0	0%	0	0%
SSI requiring IV antibiotics	0	0%	0	0%	0	0%
SSI requ surg c̄ prosth removal	0	0%	0	0%	0	0%
SSI requ surg s̄ prosth removal	0	0%	0	0%	0	0%
Deep vein thrombosis	0	0%	1	0.93%	1	0.56%
Pulmonary embolus	0	0%	0	0%	0	0%
Fat emboli	0	0%	0	0%	0	0%
Respiratory infection	0	0%	1	0.93%	1	0.56%
CVS	1	1.4%	0	0%	1	0.56%
Dislocation	0	0%	0	0%	0	0%
Fracture	0	0%	0	0%	0	0%
Nerve injury	0	0%	0	0%	0	0%
Urinary tract infection	0	0%	1	0.93%	1	0.56%
Urinary retention	1	1.4%	2	1.9%	3	1.7%
Wound dehiscence	1	1.4%	0	0%	1	0.56%
Reoperation during index adm	0	0%	0	0%	0	0%
Pressure area	0	0%	0	0%	0	0%
Fall	0	0%	0	0%	0	0%
Hypotension	1	1.4%	0	0%	1	0.56%
Cellulitis	0	0%	0	0%	0	0%
Death	0	0%	0	0%	0	0%
Other	3	4.1%	6	5.6%	9	5%

5.3.4 *Length of Stay in Hospital*



The plot at left excludes 19 cases in which the length of stay in hospital was greater than 25 days.

The variation between hospitals in the mean length of stay (in days) for primary knee arthroplasty patients is shown below.

Length of Stay in Hospital — Primary knees

	n		Missing		Mean	Median	75th %ile	95th %ile
Male	2254	38%	4	0.2%	4.9	4	6	10
Female	3692	62%	11	0.3%	5.2	5	6	9
Persons	5946	100%	15	0.3%	5.1	4	6	9

Length of Stay in Hospital — Revision knees

	n		Missing		Mean	Median	75th %ile	95th %ile
Male	73	41%	0	0%	6	5	8	13
Female	107	59%	0	0%	6.1	5	7	9
Persons	180	100%	0	0%	6.1	5	7	10

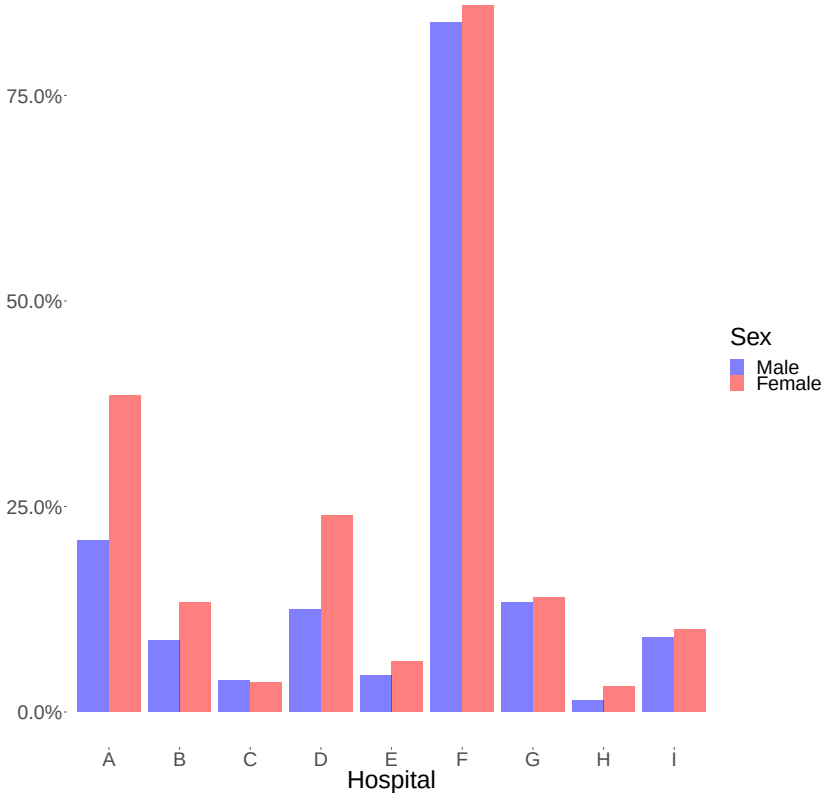
5.3.5 *Discharge Destination*

DISCHARGE DESTINATION — PRIMARY KNEES

	n	Unk/NS		Usual residence		Inpatient rehab		Other	
Male	2254	23	1%	1935	86%	288	13%	8	0.4%
Female	3692	35	0.9%	2917	79%	722	20%	18	0.5%
Persons	5946	58	1%	4852	82%	1010	17%	26	0.4%

DISCHARGE DESTINATION — REVISION KNEES

	n	Unk/NS		Usual residence		Inpatient rehab		Other	
Male	73	2	3%	60	82%	11	15%	0	0%
Female	107	0	0%	79	74%	28	26%	0	0%
Persons	180	2	1%	139	77%	39	22%	0	0%



There is considerable variation between hospitals in the proportion of knee arthroplasty patients who are discharged to inpatient rehabilitation. The graph at left demonstrates this variation for primary knee arthroplasty patients. Hospital identities have been randomised.

5.4 Patient-Reported Outcome Measures (PROMs)

Patient-reported outcome measures (PROMs) are measures of health status collected directly from the person. In ACORN, they provide a personal perspective of the impact of surgery by comparing health status at two different points in time, therefore allowing comparison of not only clinical measures but also the perceptions of the individual.

Since March 2013, ACORN has included measures of the individual's expectations of surgical outcome. Prior to admission, each person is asked "what are your expectations of your hip/knee pain six months after your surgery?" and "what are your expectations of your functional ability six months after your surgery?" At follow-up, questions to measure perceived satisfaction and success are asked. These replicate the questions used by the PROMs programme in England and Wales. They have been incorporated into ACORN's post-operative follow-up with permission from the National Joint Registry (NJR) England & Wales.

For satisfaction, the question asked is "how would you describe the results of your operation?" with five options provided: excellent; very good; good; fair; or poor.

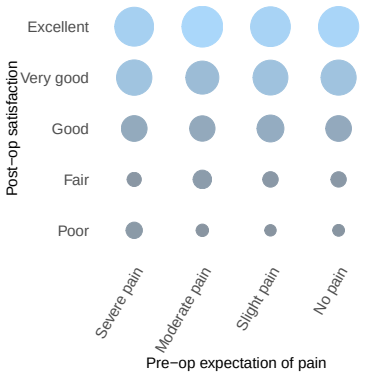
For success, the question asked is "overall, how are the problems now with your hip/knee on which you had surgery, compared to before your operation?" This question also allows the person to choose one of five options: much better; a little better; about the same; a little worse; and much worse.

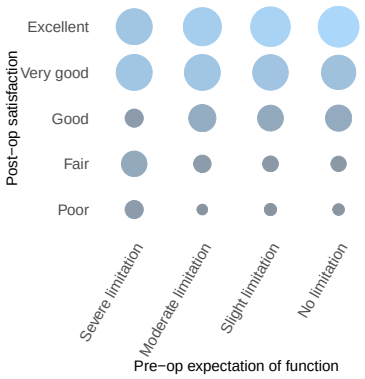
In addition, ACORN asks participants whether they have been re-admitted to hospital since discharge, had another operation on the joint that was replaced six months earlier, and whether they have experienced any other problem not requiring re-admission or re-operation. By asking this additional question about problems not requiring re-admission or re-operation, ACORN is able to capture those outcomes that continue to impact the individual or have resulted in additional services being utilised in the primary or community care setting, although they have not resulted in additional utilisation of admitted hospital services.

The Oxford Hip Score (OHS) and the Oxford Knee Score (OKS) are 12-item, person-reported instruments developed to assess pain and function in people undergoing hip or knee arthroplasty. The questionnaires explore a person's perception of their pain and functional impairment in tasks of daily living over the previous four weeks. The least difficulty undertaking tasks or the least severity of symptoms scores four points, and the most severe symptoms and dysfunction scores zero. The individual scores are summed to achieve a single score, with the highest attainable score of 48 indicating a person who experiences no functional impairment and no pain. The lowest score of 0 means the person has severe pain and functional impairment as a result of their joint problems. In reporting the

A person's pre-operative expectations of their post-operative pain and function are considered to be important predictors of the outcome of joint replacement surgery.

The charts below illustrate this relationship between pre-operative expectation of pain following surgery and 6-month satisfaction rating (top chart), and pre-operative expectation of joint function following surgery and 6-month satisfaction rating (lower chart) for **primary knee arthroplasty** patients. The area of each circle indicates the proportion of patients in each pre-operative expectation category who end up in each the 6-month post-operative satisfaction categories.





Oxford Hip and Knee Scores, outcomes are additionally grouped into four score categories, as reported by the New Zealand Joint Registry. Prior to surgery, the surveys are patient-completed. After surgery, an interviewer completes the surveys by the telephone.

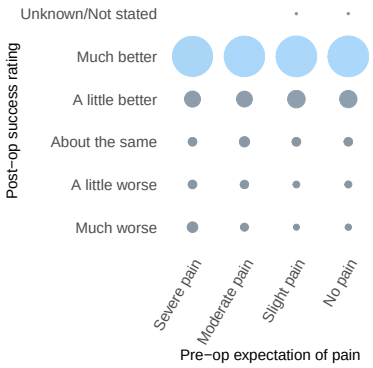
The EQ-VAS records a person's self-rated health on a 20 cm vertical scale with 0 at the bottom representing "worst health imaginable" and 100 at the top representing "best health imaginable". Prior to surgery, the surveys are completed by patients on paper. After surgery, the surveys are completed over the telephone by an interviewer.

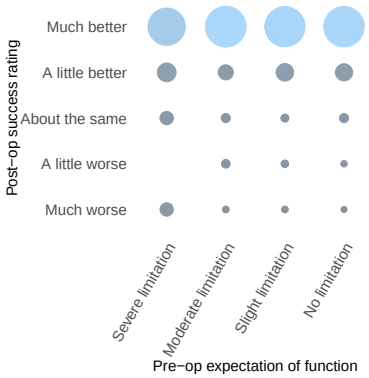
The EQ-5D-5L is a descriptive system of five dimensions of a person's general health. The dimensions are Mobility, Self-care, Usual Activities, Pain or Discomfort, and Anxiety or Depression. Each dimension has five levels: no problems, slight problems, moderate problems, severe problems, or extreme problems. A person is asked to indicate his/her health state by marking the box beside the most appropriate statement in each of the five dimensions on the day the survey is administered. Prior to surgery, the surveys are patient-completed. After surgery, the surveys are completed over the telephone by an interviewer.

Please note: Only those patients for whom 6 month follow-up is complete or who have been declared lost to follow-up appear in the tables and graphs below that show 6 month follow-up data.

The EQ-5D quality of life scores provide a measure of the overall effect of the procedure on a person's health and well-being. They also allow different types of procedures to be compared.

The charts below illustrate this relationship between pre-operative expectation of pain following surgery and 6-month rating of success (top chart), and pre-operative expectation of joint function following surgery and 6-month rating of success (lower chart) for **primary knee arthroplasty** patients. The area of each circle indicates the proportion of patients in each pre-operative expectation category who end up in each the 6-month post-operative success rating categories.





5.4.1 *Pre-op Expectation of Pain at 6 months post-op*

EXPECTATION OF PAIN — PRIMARY KNEES

	n	Unknown/ Not stated		No pain		Slight pain		Moderate pain		Severe pain	
Male	2254	375	17%	1158	51%	574	25%	121	5%	26	1%
Female	3692	690	19%	1721	47%	1031	28%	214	6%	36	1%
Persons	5946	1065	18%	2879	48%	1605	27%	335	6%	62	1%

EXPECTATION OF PAIN — REVISION KNEES

	n	Unknown/ Not stated		No pain		Slight pain		Moderate pain		Severe pain	
Male	73	15	21%	29	40%	20	27%	8	11%	1	1%
Female	107	22	21%	42	39%	36	34%	6	6%	1	0.9%
Persons	180	37	21%	71	39%	56	31%	14	8%	2	1%

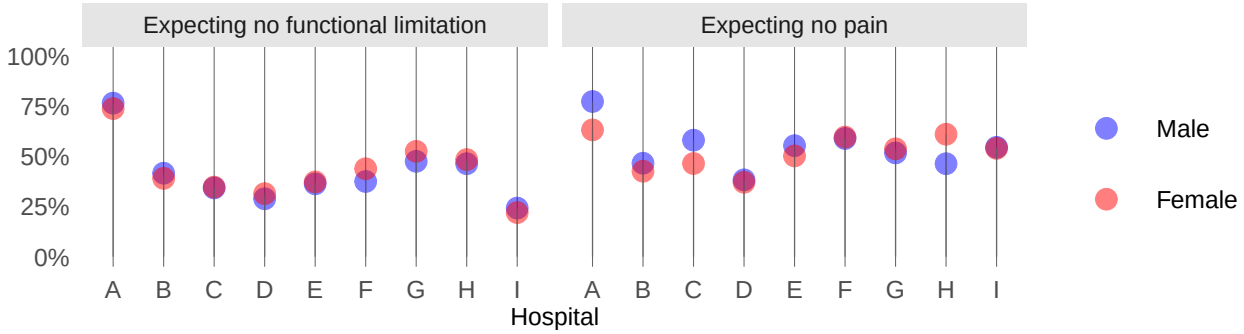
5.4.2 *Pre-op Expectation of Function at 6 months post-op*

EXPECTATION OF FUNCTION — PRIMARY KNEES

	n	Unknown/ Not stated		No limitation		Slight limitation		Moderate limitation		Severe limitation	
Male	2254	378	17%	968	43%	800	35%	99	4%	9	0.4%
Female	3692	691	19%	1584	43%	1201	33%	210	6%	6	0.2%
Persons	5946	1069	18%	2552	43%	2001	34%	309	5%	15	0.3%

EXPECTATION OF FUNCTION — REVISION KNEES

	n	Unknown/ Not stated		No limitation		Slight limitation		Moderate limitation		Severe limitation	
Male	73	15	21%	28	38%	24	33%	6	8%	0	0%
Female	107	21	20%	44	41%	40	37%	1	0.9%	1	0.9%
Persons	180	36	20%	72	40%	64	36%	7	4%	1	0.6%



Please note: The data shown in the remainder of this PROMs section of the report only include those patients for whom six month follow-up is complete or who were deemed lost to follow-up.

5.4.3 Satisfaction at 6 months post-op

SATISFACTION AT 6 MONTHS POST-OP — PRIMARY KNEES

	n	Unk/NS		Poor		Fair		Good		Very good		Excellent	
Male	2251	144	6%	84	4%	135	6%	344	15%	645	29%	899	40%
Female	3688	266	7%	111	3%	212	6%	629	17%	1115	30%	1355	37%
Persons	5939	410	7%	195	3%	347	6%	973	16%	1760	30%	2254	38%

SATISFACTION AT 6 MONTHS POST-OP — REVISION KNEES

	n	Unk/NS		Poor		Fair		Good		Very good		Excellent	
Male	73	8	11%	6	8%	8	11%	18	25%	15	21%	18	25%
Female	107	3	3%	8	7%	12	11%	25	23%	27	25%	32	30%
Persons	180	11	6%	14	8%	20	11%	43	24%	42	23%	50	28%

5.4.4 Patient-perceived Success at 6 months post-op

SUCCESS AT 6 MONTHS POST-OP — PRIMARY KNEES

	n	Unk/NS		much worse		a little worse		about the same		a little better		much better	
Male	2251	143	6%	45	2%	56	2%	74	3%	294	13%	1639	73%
Female	3688	264	7%	58	2%	66	2%	129	3%	497	13%	2674	73%
Persons	5939	407	7%	103	2%	122	2%	203	3%	791	13%	4313	73%

SUCCESS AT 6 MONTHS POST-OP — REVISION KNEES

	n	Unk/NS		much worse		a little worse		about the same		a little better		much better	
Male	73	9	12%	3	4%	7	10%	6	8%	13	18%	35	48%
Female	107	3	3%	4	4%	3	3%	8	7%	25	23%	64	60%
Persons	180	12	7%	7	4%	10	6%	14	8%	38	21%	99	55%

5.4.5 Complications in the 6 months post-op

Post-Discharge Complications (any) — Primary knees

	n	None		1		2		3 or more		Number unknown	
Male	2251	505	22%	491	22%	283	13%	211	9%	761	34%
Female	3688	884	24%	796	22%	428	12%	332	9%	1248	34%
Persons	5939	1389	23%	1287	22%	711	12%	543	9%	2009	34%

Post-Discharge Complications (any) — Revision knees

	n	None		1		2		3 or more		Number unknown	
Male	73	14	19%	18	25%	6	8%	10	14%	25	34%
Female	107	23	21%	29	27%	18	17%	12	11%	25	23%
Persons	180	37	21%	47	26%	24	13%	22	12%	50	28%

Post-Discharge Complications (details) in the 6 months post-op — Primary & revision knees

	Primary knees (*n*=5939)		Revision knees (*n*=180)	
SSI requiring oral antibiotics	232	3.9%	6	3.3%
SSI requiring IV antibiotics	9	0.15%	0	0%
DVT index leg	80	1.3%	1	0.56%
DVT other leg	3	0.051%	0	0%
DVT both legs	0	0%	1	0.56%
Pulmonary embolus	7	0.12%	1	0.56%
Dislocation	4	0.067%	0	0%
Joint stiffness	1047	18%	36	20%
Bladder infection or retention	6	0.1%	2	1.1%
Fracture	4	0.067%	1	0.56%
Unexpected pain	548	9.2%	30	17%
Cardiac	9	0.15%	0	0%
Stroke	1	0.017%	0	0%
Leg length discrepancy	83	1.4%	4	2.2%
Joint or lower limb swelling	878	15%	30	17%
Paraesthesia or numbness	887	15%	23	13%
Cellulitis	34	0.57%	0	0%
Neuropathy	65	1.1%	1	0.56%
Muscle weakness	124	2.1%	7	3.9%
Respiratory infection	7	0.12%	0	0%
Other	344	5.8%	15	8.3%

Combined Complications (details) in the 6 months post-op — Primary & revision knees

	Primary knees (*n*=5940)		Revision knees (*n*=180)	
SSI requiring oral antibiotics	233	3.9%	6	3.3%
SSI requiring IV antibiotics	14	0.24%	0	0%
SSI requ surg c̄ prosth removal	0	0%	0	0%
SSI requ surg s̄ prosth removal	0	0%	0	0%
Deep vein thrombosis	106	1.8%	2	1.1%
Pulmonary embolus	34	0.57%	1	0.56%
Fat emboli	1	0.017%	0	0%
Drug reaction	2	0.034%	0	0%
Delirium	57	0.96%	0	0%
Hypotension	46	0.77%	1	0.56%
CVS	112	1.9%	1	0.56%
Respiratory infection	43	0.72%	1	0.56%
Urinary tract infection or retention	143	2.4%	6	3.3%
Wound dehiscence	38	0.64%	1	0.56%
Pressure area	4	0.067%	0	0%
Fall	21	0.35%	0	0%
Cellulitis	48	0.81%	0	0%
Death	19	0.32%	0	0%
Dislocation	4	0.067%	0	0%
Fracture	22	0.37%	1	0.56%
Joint stiffness	1047	18%	36	20%
Unexpected pain	548	9.2%	30	17%
Leg length discrepancy	83	1.4%	4	2.2%
Joint or lower limb swelling	878	15%	30	17%
Nerve injury†	939	16%	23	13%
Muscle weakness	124	2.1%	7	3.9%
Re-operation	145	2.4%	8	4.4%
Other	575	9.7%	24	13%

This table combines complications which occurred during the hospital admission in which joint replacement surgery was performed, and complications which occurred following discharge from hospital but within six months after surgery.

SSI Surgical Site Infection

CVS Cardiovascular system

* including paraesthesia & numbness

5.4.6 Re-admission in the 6 months post-op

RE-ADMISSION — PRIMARY KNEES

	n	Missing		Re-admission due to arthroplasty		Re-admission for other reasons		Total re-admissions	
Male	2251	126	6%	148	7%	178	8%	311	14%
Female	3688	247	7%	193	5%	244	7%	418	11%
Persons	5939	373	6%	341	6%	422	7%	729	12%

RE-ADMISSION — REVISION KNEES

	n	Missing		Re-admission due to arthroplasty		Re-admission for other reasons		Total re-admissions	
Male	73	8	11%	6	8%	5	7%	9	12%
Female	107	1	0.9%	13	12%	11	10%	23	21%
Persons	180	9	5%	19	11%	16	9%	32	18%

REASON FOR RE-ADMISSION — PRIMARY & REVISION KNEES

	Primary (*n*=725)		Revision (*n*=32)	
Reasons related to arthroplasty				
DVT	23	3%	1	3%
Pulmonary embolus	8	1%	1	3%
MUA	105	15%	2	6%
Dislocation	0	0%	0	0%
Surgical site infection	113	16%	6	19%
Wound dehiscence	5	0.7%	0	0%
Index joint revision	1	0.1%	1	3%
Other	82	11%	8	25%
Reasons unrelated to arthroplasty				
Cardiac	32	4%	1	3%
Renal/urinary tract	38	5%	4	12%
Cancer	12	2%	2	6%
Other	336	47%	9	28%

5.4.7 Re-operation in the 6 months post-op

RE-OPERATION — PRIMARY KNEES

	n	Re-operation due to arthroplasty	
Male	2251	65	3%
Female	3688	74	2%
Persons	5939	139	2%

RE-OPERATION — REVISION KNEES

	n	Re-operation due to arthroplasty	
Male	73	4	5%
Female	107	4	4%
Persons	180	8	4%

REASON FOR RE-OPERATION — PRIMARY KNEES

	Males (*n*=65)		Females (*n*=74)		Persons (*n*=139)	
SSI requiring surgery with no prosthesis removal	15	23%	15	20%	30	22%
SSI requiring surgery with prosthesis removal	3	5%	6	8%	9	6%
Dislocation	0	0%	0	0%	0	0%
Joint stiffness	38	58%	45	61%	83	60%
Periprosthetic fracture	1	2%	1	1%	2	1%
Implant fracture	0	0%	1	1%	1	0.7%
Bleeding	0	0%	0	0%	0	0%
Other	8	12%	6	8%	14	10%
Unknown/NS	0	0%	0	0%	0	0%

REASON FOR RE-OPERATION — REVISION KNEES

	Males (*n*=4)		Females (*n*=4)		Persons (*n*=8)	
SSI requiring surgery with no prosthesis removal	1	25%	0	0%	1	12%
SSI requiring surgery with prosthesis removal	1	25%	2	50%	3	38%
Dislocation	0	0%	0	0%	0	0%
Joint stiffness	1	25%	0	0%	1	12%
Periprosthetic fracture	0	0%	0	0%	0	0%
Implant fracture	0	0%	1	25%	1	12%
Bleeding	0	0%	0	0%	0	0%
Other	1	25%	1	25%	2	25%
Unknown/NS	0	0%	0	0%	0	0%

SSI = Surgical Site Infection

5.4.8 Deaths in the 6 months post-op

POST-DISCHARGE DEATH — PRIMARY KNEES

	n	Unknown/ not stated		Died in hospital		Total deaths at 6 mths post-op	
Male	2251	92	4%	0	0%	13	0.6%
Female	3688	187	5%	2	0.05%	6	0.2%
Persons	5939	279	5%	2	0.03%	19	0.3%

POST-DISCHARGE DEATH — REVISION KNEES

	n	Unknown/ not stated		Died in hospital		Total deaths at 6 mths post-op	
Male	73	10	14%	0	0%	0	0%
Female	107	4	4%	0	0%	0	0%
Persons	180	14	8%	0	0%	0	0%

Please note: The data shown in the following EQ-5D and EQ-VAS graphs and tables only refer to those patients for whom six month follow-up is complete. In the tables which follow in this section, "post-op" means at the follow-up contact, which occurs approximately six months post-operatively.

5.4.9 *EuroQoL EQ-5D Measures*

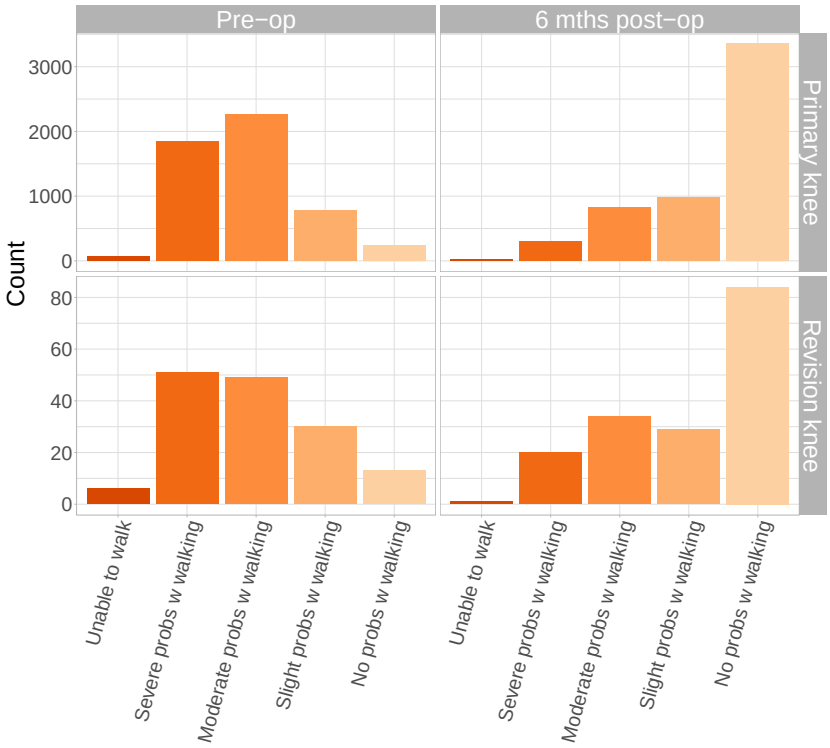


Figure 5.1: Knee Arthroplasties: Distribution of EQ-5D Mobility, pre-op versus post-op

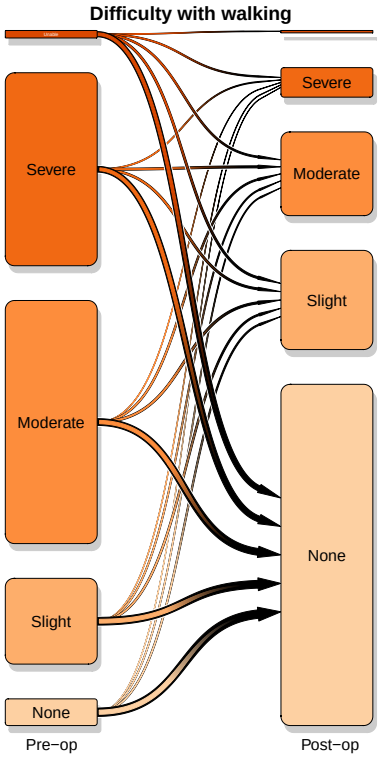
EQ-5D Mobility — Primary knees

	Pre-op		Post-op	
Unable to walk	75	1%	22	0.4%
Severe problems with walking	1854	32%	304	5%
Moderate problems with walking	2262	38%	824	14%
Slight problems with walking	784	13%	984	17%
No problems with walking	239	4%	3355	57%
Unknown/Not stated	669	11%	394	7%

EQ-5D Mobility — Revision knees

	Pre-op		Post-op	
Unable to walk	6	3%	1	0.6%
Severe problems with walking	51	28%	20	11%
Moderate problems with walking	49	27%	34	19%
Slight problems with walking	30	17%	29	16%
No problems with walking	13	7%	84	47%
Unknown/Not stated	30	17%	11	6%

The chart below shows the transition in mobility difficulty in **primary knee arthroplasty** patients, from pre-operatively on the left to six months post-operatively on the right.



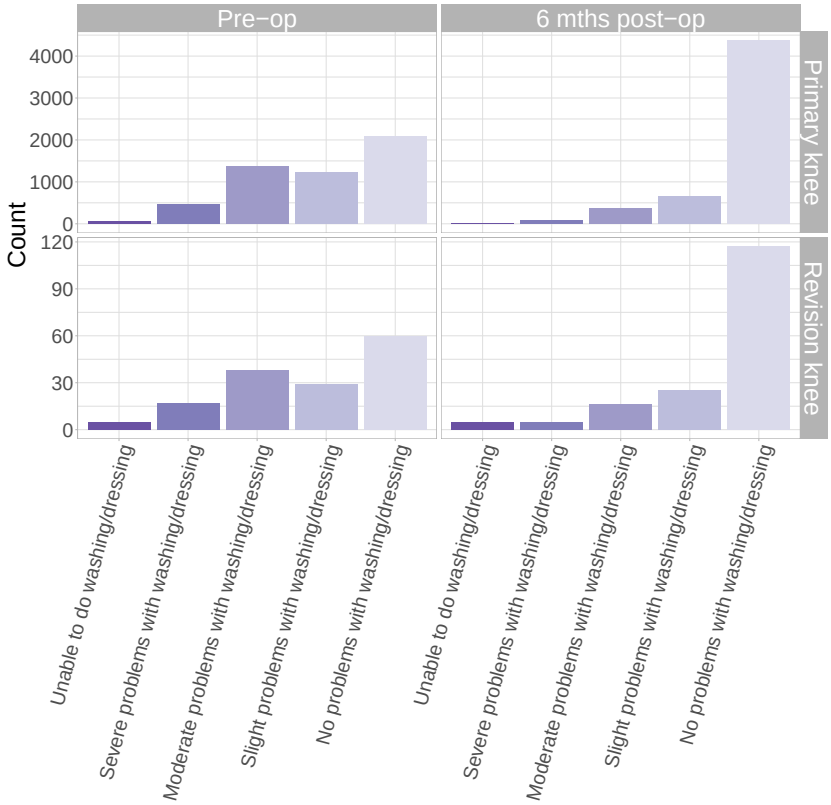


Figure 5.2: Knee Arthroplasties: Distribution of EQ-5D Personal Care, pre-op versus post-op

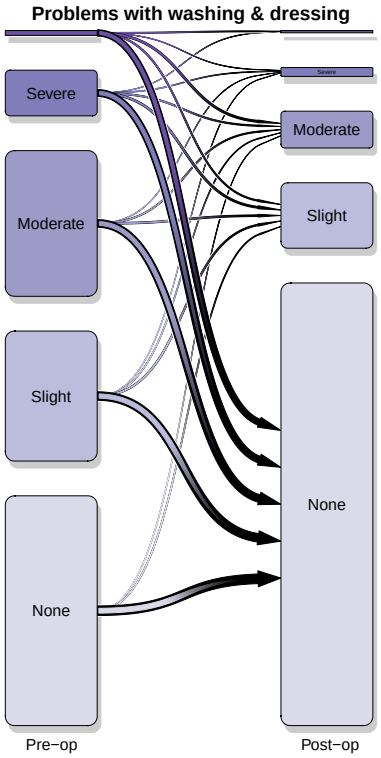
EQ-5D Personal Care — Primary knees

	Pre-op		Post-op	
Unable to do washing/dressing	51	0.9%	23	0.4%
Severe problems washing/dressing	468	8%	91	2%
Mod. problems washing/dressing	1374	23%	362	6%
Slight problems washing/dressing	1226	21%	644	11%
No problems washing/dressing	2096	36%	4366	74%
Unknown/Not stated	668	11%	397	7%

EQ-5D Personal Care — Revision knees

	Pre-op		Post-op	
Unable to do washing/dressing	5	3%	5	3%
Severe problems washing/dressing	17	9%	5	3%
Mod. problems washing/dressing	38	21%	16	9%
Slight problems washing/dressing	29	16%	25	14%
No problems washing/dressing	60	34%	117	65%
Unknown/Not stated	30	17%	11	6%

The chart below shows the transition in difficulty with washing and dressing in **primary knee arthroplasty** patients, from pre-operatively on the left to six months post-operatively on the right.



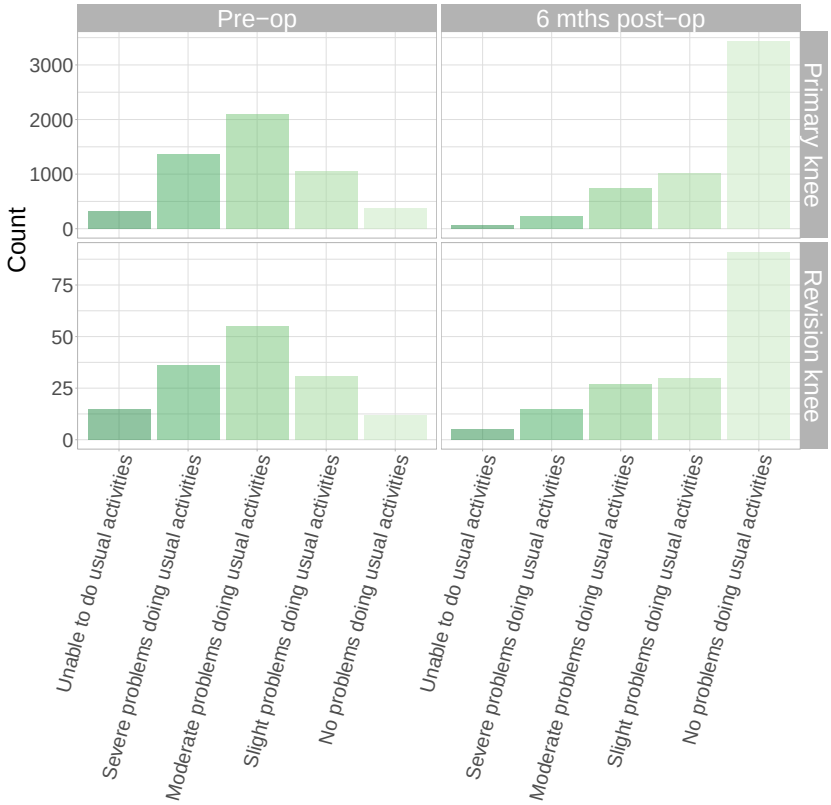


Figure 5.3: Knee Arthroplasties: Distribution of EQ-5D Usual Activities, pre-op versus post-op

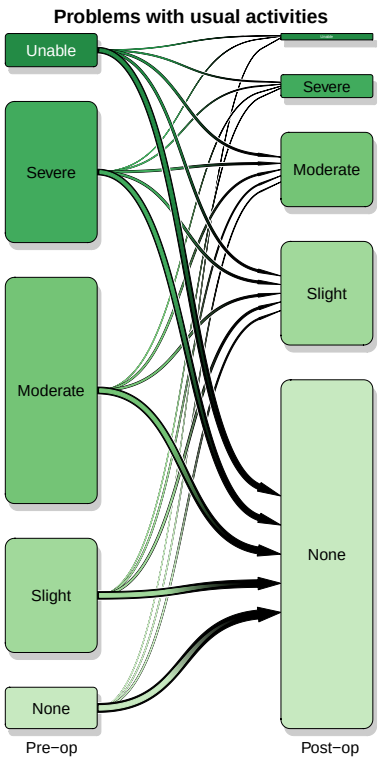
EQ-5D Usual Activites — Primary knees

	Pre-op		Post-op	
Unable to do usual activities	321	5%	69	1%
Severe problems c̄ usual activities	1357	23%	226	4%
Mod. problems c̄ usual activities	2099	36%	738	13%
Slight problems c̄ usual activities	1058	18%	1015	17%
No problems c̄ usual activities	379	6%	3439	58%
Unknown/Not stated	669	11%	396	7%

EQ-5D Usual Activites — Revision knees

	Pre-op		Post-op	
Unable to do usual activities	15	8%	5	3%
Severe problems c̄ usual activities	36	20%	15	8%
Mod. problems c̄ usual activities	55	31%	27	15%
Slight problems c̄ usual activities	31	17%	30	17%
No problems c̄ usual activities	12	7%	91	51%
Unknown/Not stated	30	17%	11	6%

The chart below shows the transition in difficulty with usual activities in **primary knee arthroplasty** patients, from pre-operatively on the left to six months post-operatively on the right.



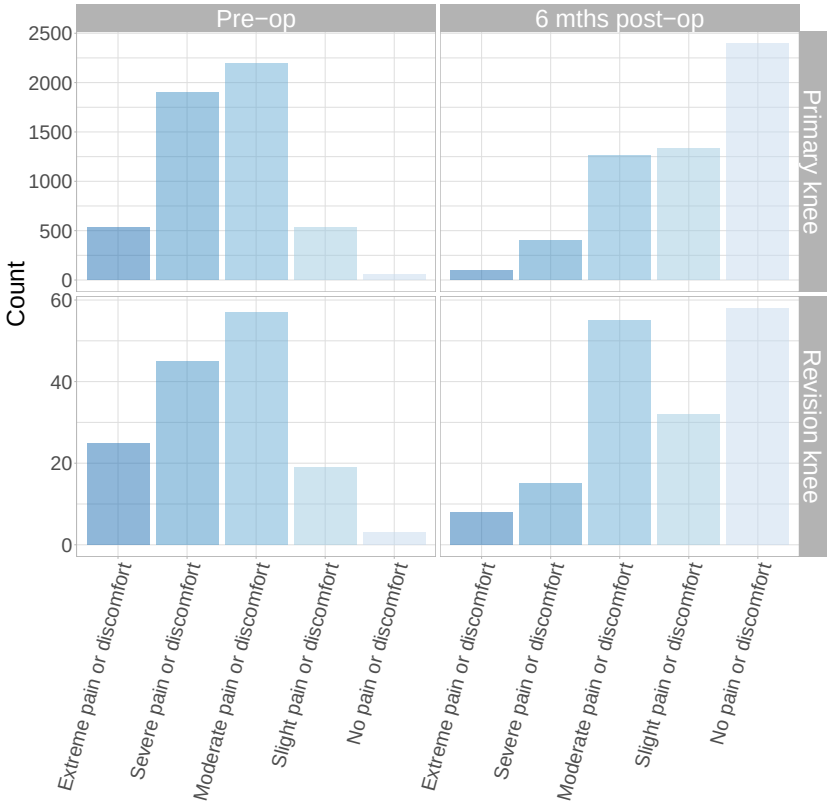


Figure 5.4: Knee Arthroplasties: Distribution of EQ-5D Discomfort, pre-op versus post-op

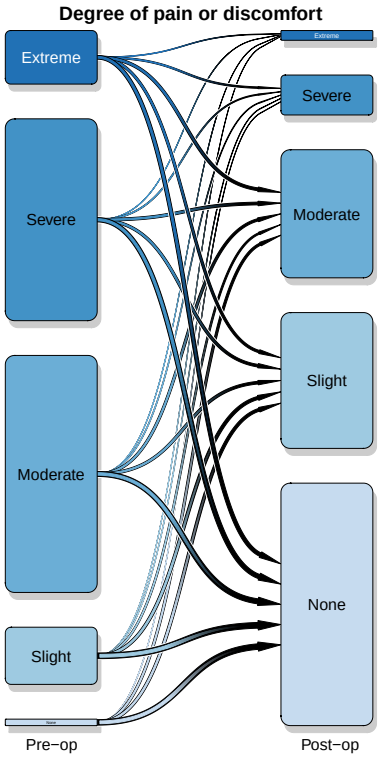
EQ-5D Discomfort — Primary knees

	Pre-op		Post-op	
Extreme pain or discomfort	530	9%	98	2%
Severe pain or discomfort	1904	32%	404	7%
Moderate pain or discomfort	2196	37%	1258	21%
Slight pain or discomfort	528	9%	1333	23%
No pain or discomfort	59	1%	2397	41%
Unknown/not stated	666	11%	393	7%

EQ-5D Discomfort — Revision knees

	Pre-op		Post-op	
Extreme pain or discomfort	25	14%	8	4%
Severe pain or discomfort	45	25%	15	8%
Moderate pain or discomfort	57	32%	55	31%
Slight pain or discomfort	19	11%	32	18%
No pain or discomfort	3	2%	58	32%
Unknown/not stated	30	17%	11	6%

The chart below shows the transition in the degree of pain or discomfort in **primary knee arthroplasty** patients, from pre-operatively on the left to six months post-operatively on the right.



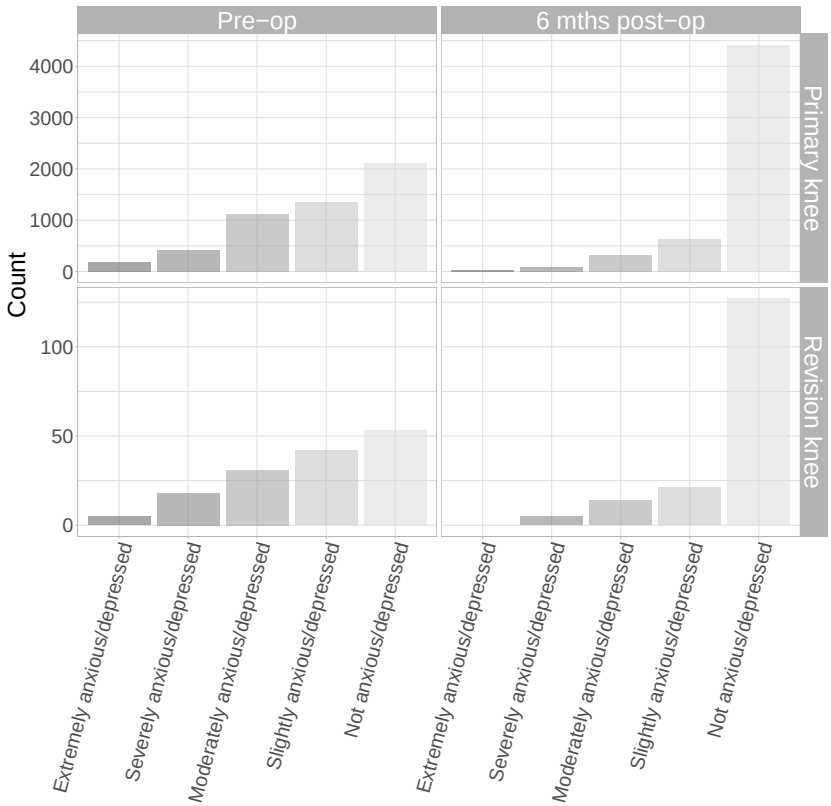


Figure 5.5: Knee Arthroplasties: Distribution of EQ-5D Anxiety/Depression, pre-op versus post-op

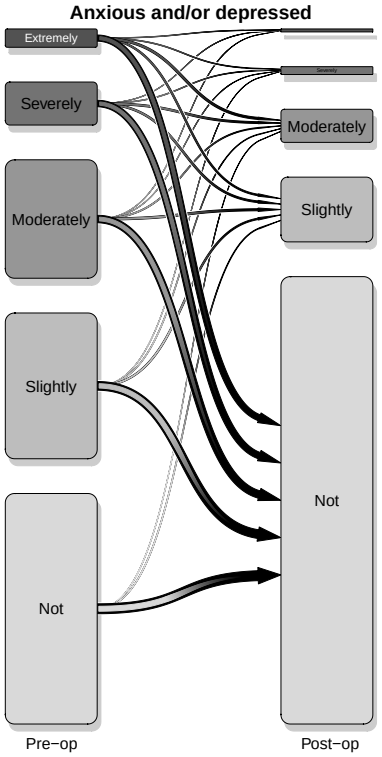
EQ-5D Anxiety/Depression — Primary knees

	Pre-op		Post-op	
Extremely anxious/depressed	188	3%	29	0.5%
Severely anxious/depressed	428	7%	83	1%
Moderately anxious/depressed	1122	19%	322	5%
Slightly anxious/depressed	1354	23%	631	11%
Not anxious/depressed	2116	36%	4417	75%
Unknown/not stated	672	11%	398	7%

EQ-5D Anxiety/Depression — Revision knees

	Pre-op		Post-op	
Extremely anxious/depressed	5	3%	0	0%
Severely anxious/depressed	18	10%	5	3%
Moderately anxious/depressed	31	17%	14	8%
Slightly anxious/depressed	42	23%	21	12%
Not anxious/depressed	53	30%	127	71%
Unknown/not stated	30	17%	12	7%

The chart below shows the transition in the degree of anxiety/depression in **primary knee arthroplasty** patients, from pre-operatively on the left to six months post-operatively on the right.



5.4.10 *EuroQoL Visual Analogue Scale (EQ-VAS)*

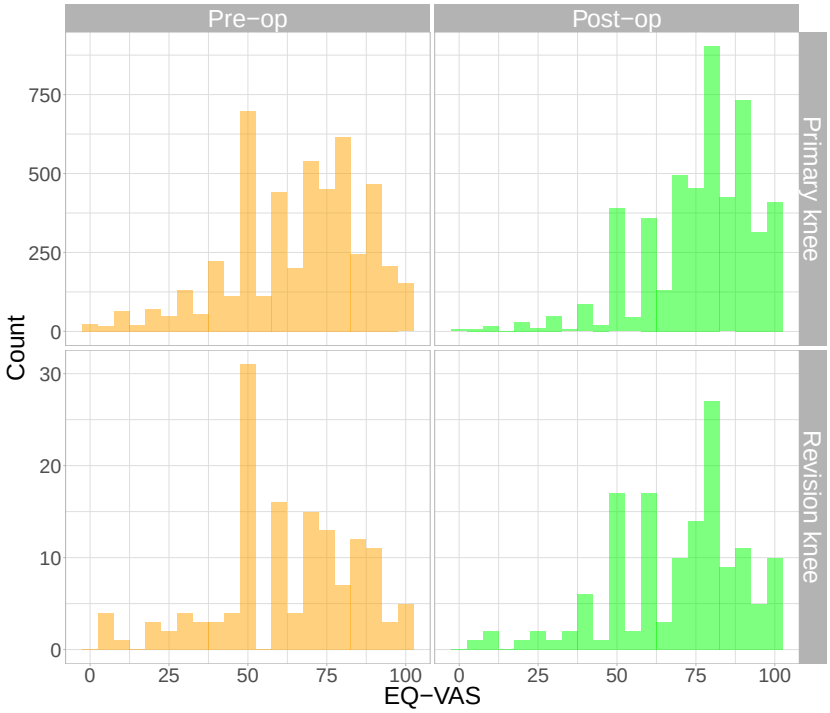


Figure 5.6: Knee Arthroplasties: Distribution of EQ-VAS, pre-op versus post-op

Table 5.1: knee Arthroplasties: Distribution of EQ-VAS, pre-op versus post-op

Procedure	Sex	Timing	*n**	Mean	5th %ile	Median	95th %ile
Primary knee	Males	Pre-op	3015	63.8	25.0	68	95.0
		Post-op	3015	75.5	50.0	80	100.0
Primary knee	Females	Pre-op	1880	69.2	30.0	75	95.0
		Post-op	1880	77.4	50.0	80	100.0
Primary knee	Persons	Pre-op	4895	65.9	27.7	70	95.0
		Post-op	4895	76.2	50.0	80	100.0
Revision knee	Males	Pre-op	89	61.6	27.0	60	93.0
		Post-op	89	68.6	27.0	75	100.0
Revision knee	Females	Pre-op	52	64.0	15.1	70	94.5
		Post-op	52	70.9	50.0	75	92.2
Revision knee	Persons	Pre-op	141	62.5	20.0	60	95.0
		Post-op	141	69.4	35.0	75	100.0

* Number of cases with both pre-op and 6 months post-op EQ-VAS data available.

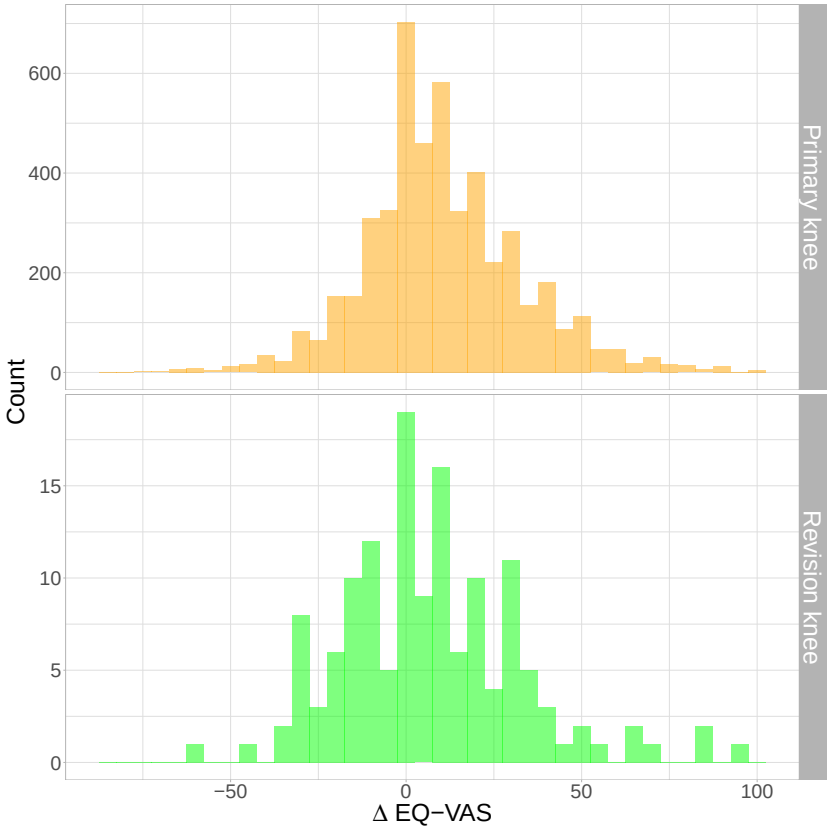


Figure 5.7: Knee Arthroplasties: Change in EQ-VAS, pre-op to post-op

5.4.11 *Oxford Knee Scores*

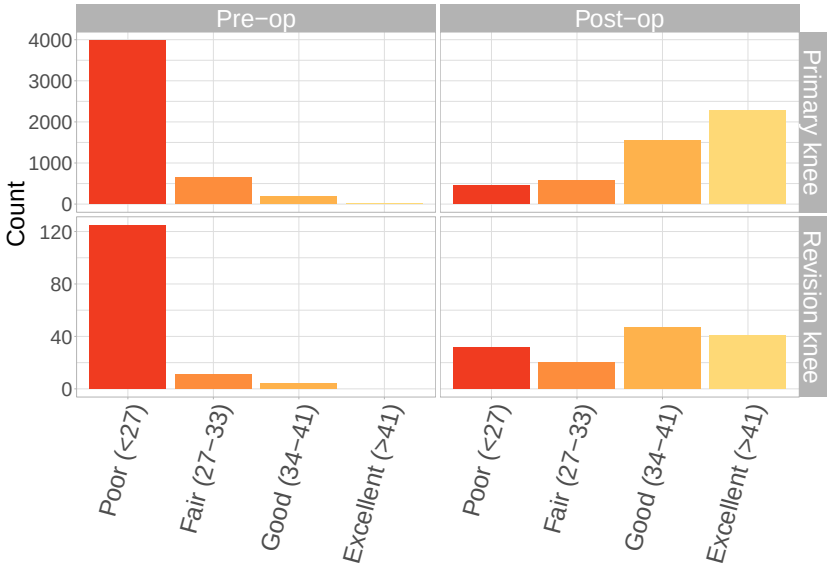


Figure 5.8: Distribution of grouped total Oxford Knee Scores, pre-op to post-op

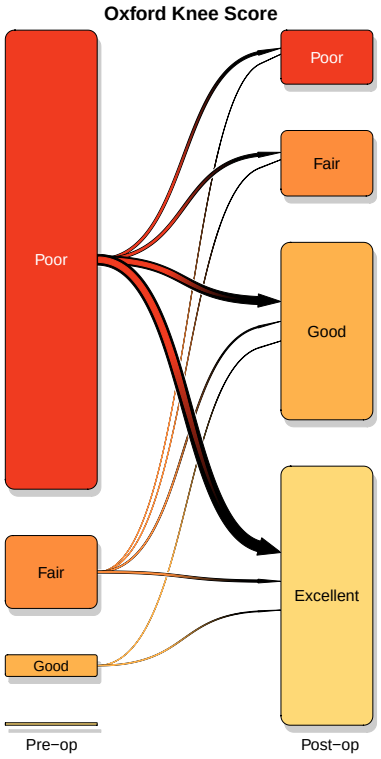
Partitioned total Oxford knee Scores, pre-op and post-op — Primary knees

Total Oxford score	Pre-op		Post-op	
Poor (<27)	3988	82%	452	9%
Fair (27-33)	642	13%	567	12%
Good (34-41)	190	4%	1543	32%
Excellent (>41)	22	0.5%	2280	47%

Partitioned total Oxford knee Scores, pre-op and post-op — Revision knees

Total Oxford score	Pre-op		Post-op	
Poor (<27)	125	89%	32	23%
Fair (27-33)	11	8%	20	14%
Good (34-41)	4	3%	47	34%
Excellent (>41)	0	0%	41	29%

The chart below shows the transition in Oxford Knee Scores in **primary knee arthroplasty** patients, from pre-operatively on the left to six months post-operatively on the right.



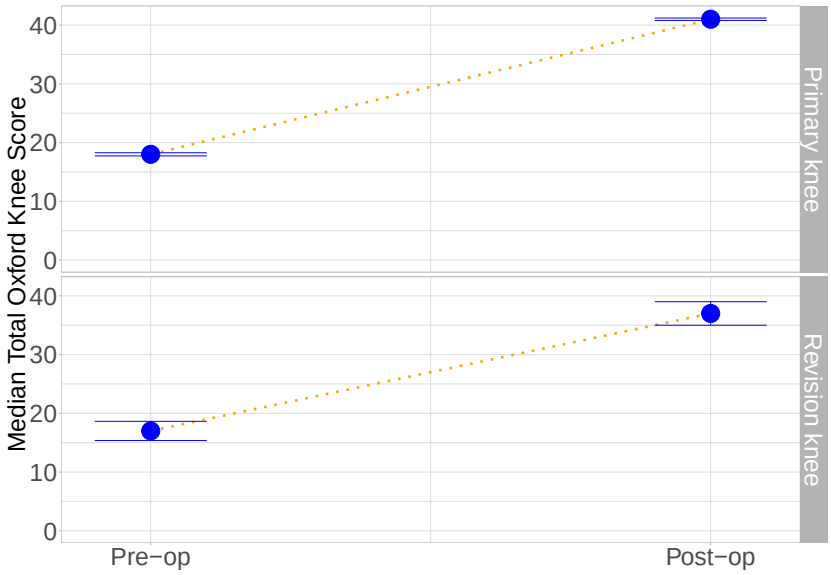


Figure 5.9: Domino plot of median Pre-op and Post-op Oxford Knee Scores

Explanatory note: In this "domino" plot, the central dot indicates the median Oxford Knee Score (OKS) for each group of patients (means and medians for each group are also shown in the tables on the pages which immediately follow this graph). The upper and lower horizontal lines are positioned at $\frac{1.58*IQR}{\sqrt{n}}$ (where IQR is the inter-quartile range), which represents an approximate 95% confidence interval around the median OKS. If these confidence intervals do not overlap, then the difference between the medians is almost certainly statistically significant.

Table 5.2: knee Arthroplasties: Distribution of total Oxford knee Scores, pre-op versus post-op

Procedure	Sex	Timing*	*n***	Mean	5th %ile	Median	95th %ile	IQRÂ¶
Primary knee	Males	Pre-op	2980	17.3	6.0	17.0	31.0	12.0
		Post-op	2980	38.0	21.0	41.0	47.0	10.0
	Females	Pre-op	1862	20.8	8.0	21.0	35.0	11.0
		Post-op	1862	39.2	22.0	42.0	48.0	8.0
	Persons	Pre-op	4842	18.7	6.0	18.0	33.0	11.8
		Post-op	4842	38.4	21.0	41.0	47.0	9.0
Revision knee	Males	Pre-op	86	15.8	4.2	14.0	30.5	12.0
		Post-op	86	34.0	12.2	37.5	45.0	15.0
	Females	Pre-op	54	18.2	6.0	20.0	28.0	12.0
		Post-op	54	34.1	16.2	36.0	44.3	14.5
	Persons	Pre-op	140	16.8	4.0	17.0	30.0	12.2
		Post-op	140	34.0	12.9	37.0	45.0	15.0

* "Post-op" means 6 months post-operative.

** Number of cases with both pre-op and 6 months post-op Oxford knee Score data available.

¶ Inter-quartile range.

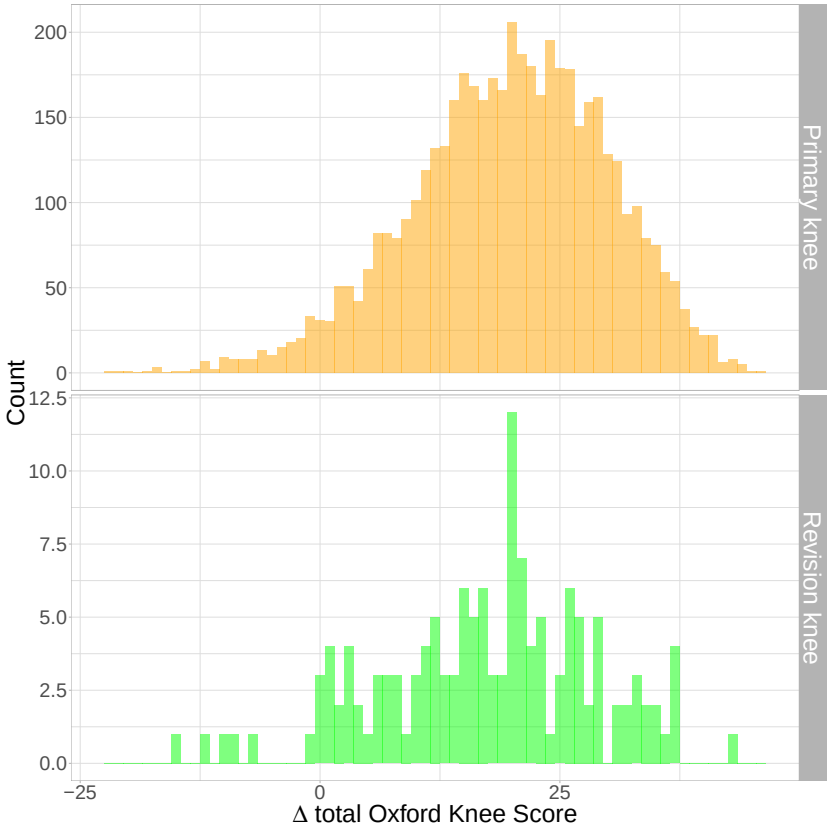


Figure 5.10: Change in total Oxford knee scores, pre-op to post-op

Table 5.3: Knee Arthroplasties: Change in total Oxford Knee Score, pre-op to post-op

	Procedure	Sex	*n**	Mean change	5th %ile	Median	95th %ile
2	Primary knee	Males	2980	20.6	3.0	21.0	36.0
1		Females	1862	18.3	0.0	19.0	35.0
5		Persons	4842	19.8	2.0	20.0	35.0
4	Revision knee	Males	86	18.2	1.0	20.0	34.8
3		Females	54	15.9	-3.1	17.0	33.1
6		Persons	140	17.3	0.0	18.5	35.0

* Number of cases with both pre-op and 6 months post-op Oxford knee Score data available.