



New Zealand ACL Registry

Annual Report 2021



Acknowledgements:

The New Zealand ACL Registry Trust would like to thank the Accident Compensation Corporation for its funding assistance. We also receive funding from our industry partners: DePuy, Device Technologies and Smith & Nephew. We are also grateful for the participation of New Zealand Orthopaedic Surgeons for participating in the Registry, both through financial contributions and enrolling their patients.

ACL Registry Trust Structure:

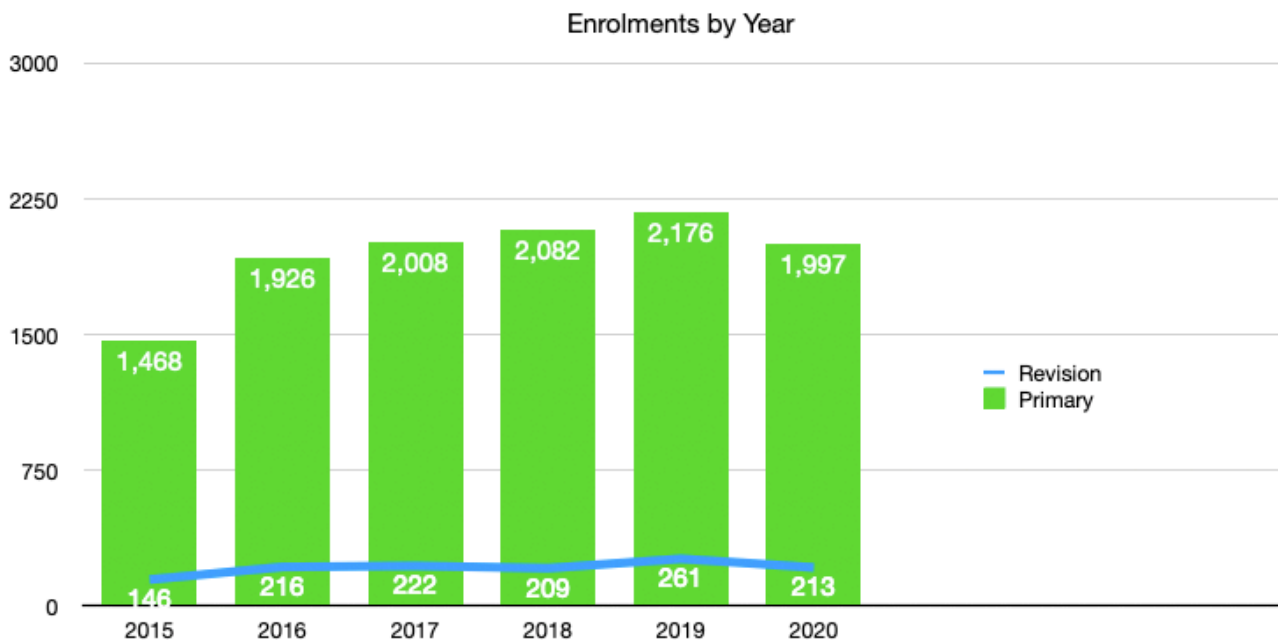
The ACL Registry Trust has been registered as a charitable Trust under New Zealand law. The Trustees are Hamish Love, Orthopaedic Surgeon, Christchurch, Mark Clatworthy, Orthopaedic Surgeon, Auckland and David Barker, Accountant, Christchurch.

The Registry has a permanent database Administrator, Charlotte Smith and employs a part-time data entry assistant.

Introduction:

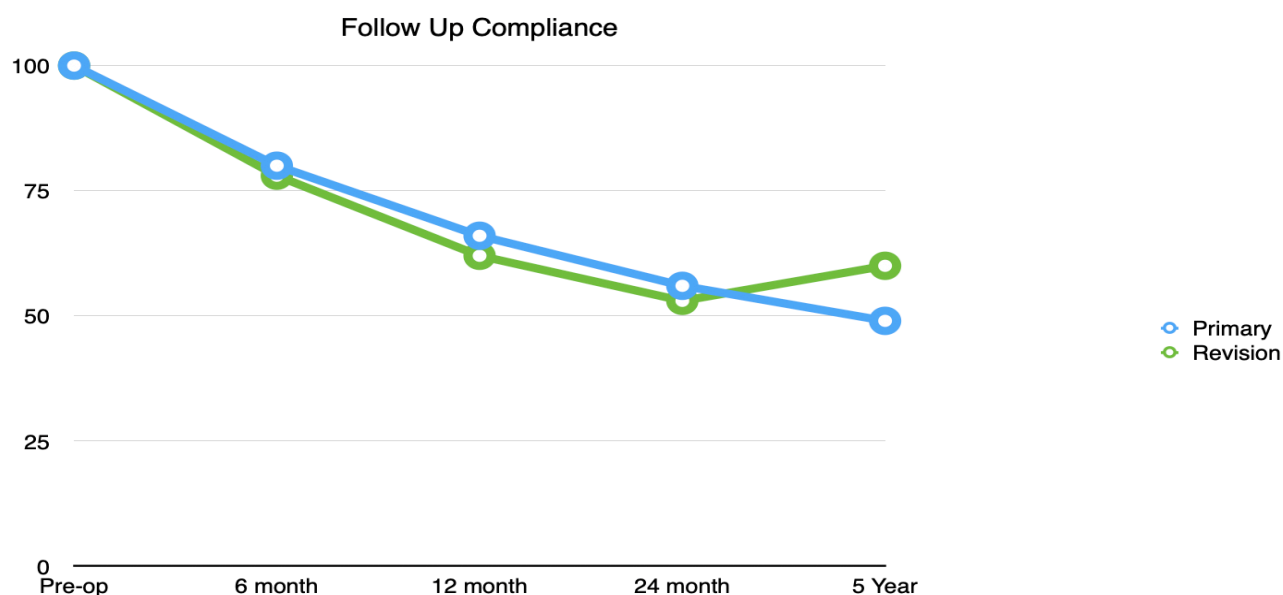
The New Zealand ACL Registry is now in its eighth year of operation. We are progressing towards our goal of capturing all ACL procedures done in New Zealand. The number of Surgeons and Hospitals involved in the Registry has been steadily growing over the last 11 months. In September 2015, there were 68 participating Surgeons, now this number is 150. In the 11 months to 9 August 2021, 2336 new patients were enrolled in the Registry. The numbers through the year continued to grow, and we estimate we enrolled around 89% of the 2418 ACL reconstructions performed in New Zealand last year. As at 9 August 2021, 14740 patients have been enrolled in the ACL Registry.

The ACL Registry has received Protected Quality Assurance Activity status from the Minister of Health. Participation in the ACL registry is a compulsory NZOA CME requirement, similar to Joint Registry participation.



Data set integrity:

The Registry continues to work hard on maintaining a complete data set. The majority of individuals requiring ACL reconstruction are young, mobile and often hard to keep a track of. As a consequence, the well-established Typically, registries only achieve a 50% follow up at the two-year mark, dropping off to less than 40% at the five-year mark. Currently we are achieving over 56% follow up at two years for our primary ACLs and 49% at five years, and better than that at all preceding time points. There are some issues with getting patients to complete all sections of all forms, resulting in some incomplete data sets. We are confident that patient reporting of significant complications is being completed accurately. In 2020 we completed a comprehensive audit of reoperation rates, cross-referencing with ACC data. There were a number of previously unrecorded reoperations captured through this process. This has increased the integrity of the data set in relation to capturing complications. This ACC cross-referencing will be an ongoing process to ensure we have the most complete data possible.



Future directions:

International collaboration:

The New Zealand ACL Registry Clinical Advisors remain in regular contact with other Registries around the world. They are working towards international collaboration on major research projects and developing structural arrangements to ensure compatibility between the data sets we collect.

Non-operative patient enrolment:

In conjunction with the College of Sports & Exercise Physicians, we have commenced enrolment in a non-operative arm. Patients with MRI-proven ACL rupture, who choose non-operative management of their ACL injury, will be eligible for enrolment.

Sports Physicians and Surgeons enrol patients into the registry. They are then followed up in a similar manner to operatively managed patients at 6 months, 1, 2 and 5 years. PROMs scores, failure of management requiring ACL reconstruction or other surgical intervention, eg meniscectomy, will be recorded.

Unfortunately, there has been very limited uptake by the Sports & Exercise Physicians and enrolment rates have been low. This is unlikely to improve without significant allocation of time and effort.

Research Projects:

The New Zealand ACL Registry is pleased to be involved with providing data that leads to quality research in ACL injuries and their treatment. As at the beginning of August 2021, there were 12779 patients who have completed 6 months post-op, 11638 past 1 year post-op, 9520 past 2 years and 3106 at 5 years. The data set is now reaching numbers where meaningful research can be completed.

We are once again funding a Summer Research Scholarship for students showing promise in medical research. The 2020/21 award has been presented to Richard Rahardja. Richard's summer research project will be supervised by Simon Young.

Publications , projects and presentations over the last 12 months include:

Accepted, in press, by the American Journal of Sports Medicine:

Higher Return to Pre-Injury Activity Levels following ACL Reconstruction with Bone-Patellar Tendon-Bone Versus Hamstring Tendon Autograft in High Activity Patients: Results from the New Zealand ACL Registry

In submission, under review by the American Journal of Sports Medicine:

Suspensory Tibial Fixation of Hamstring Tendon Autografts has a Lower Risk of Revision Following Anterior Cruciate Ligament Reconstruction: Results from the New Zealand ACL Registry

About to be submitted to the American Journal of Sports Medicine:

Risk Factors for Meniscal Repair Failure Following Concurrent Primary ACL Reconstruction: Results from the New Zealand ACL Registry

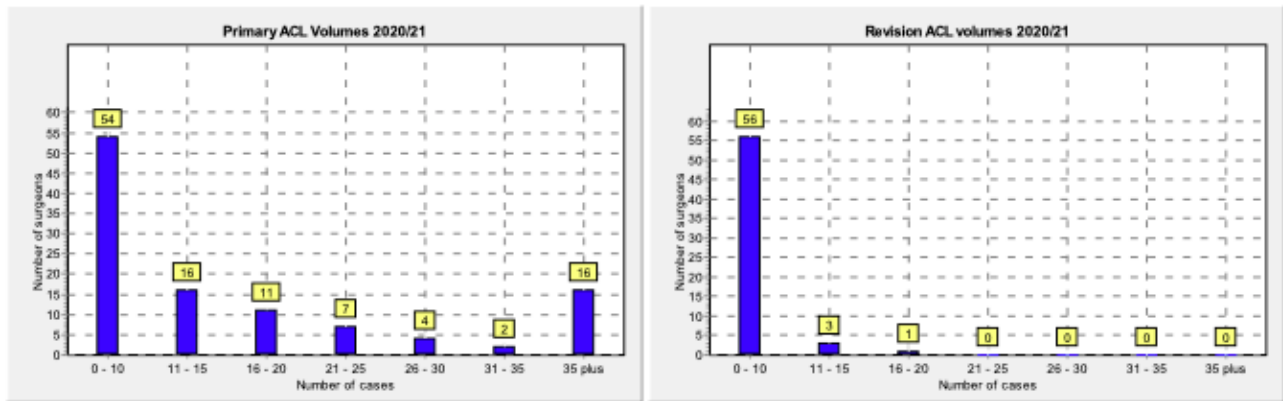
Results:

As of July 2021, 14393 patients had been enrolled in the ACL registry. 12969 primary and 1424 revision ACL reconstructions were recorded.

Operations by Hospital (all procedures cumulative)

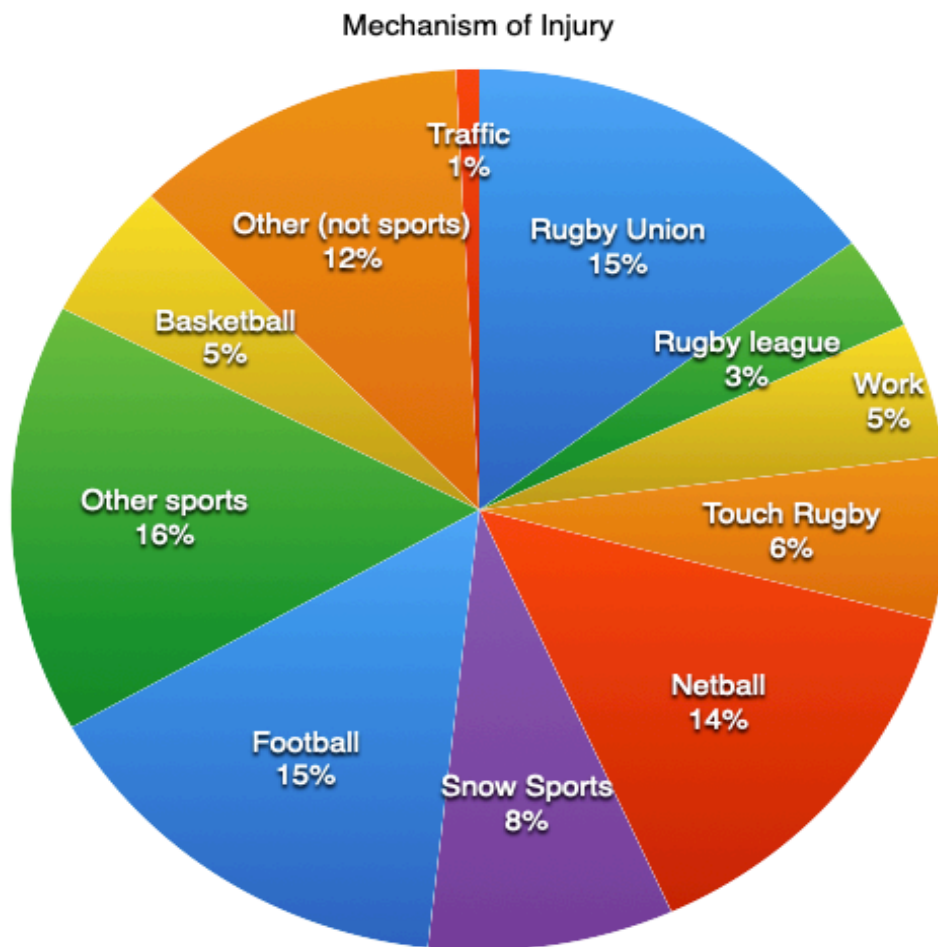
Hospital	Number	Percent
SX Christchurch	847	5.9
St Georges	779	5.5
Royston	311	2.2
Manuka Street	380	2.6
Wakefield	398	2.7
Mercy Dunedin	290	2
Selina Sutherland	55	0.4
Bowen Hospital	300	2.1
SX New Plymouth	318	2.2
SX Wellington	516	3.6
SX North Harbour	1023	7.2
Southland Invercargill	8	0
SX, Invercargill	337	2.3
SX, Hamilton	584	4.
Belverdale	126	0.8
Mercy/Ascot	2318	16.2
SX, Rotorua	146	1.0
SX, Brightside	70	0.5
Crest	105	0.7
Grace	424	2.9
Forte	1156	8.1
Auckland Surgical Centre	2204	15.4
Anglesea	195	1.3
Churchill	120	0.9
Chelsea	66	0.4
Bidwill	257	1.9
Braemar	360	2.6
Kensington	76	0.5
SX Napier	1	0.0
Starship	1	0.0
Masterton	19	0.1
Nelson Hospital	2	0.0
Northland Orthopaedics	178	1.2
SX Palmerston North	1	0.0
Whangarei	1	0.0
Wanganui	2	0.0
Northshore	2	0.0
Ormiston	146	1.0
Burwood	16	0.1
Unspecified	14	0.1
Boulcott	20	0.1
SX, N Shore Surg Centre	217	1.5
Timaru	1	0.0
Aorangi	1	0.0
St Marks Surgical Centre	1	0.0
Middlemore	1	0.0

Case volume by surgeon:



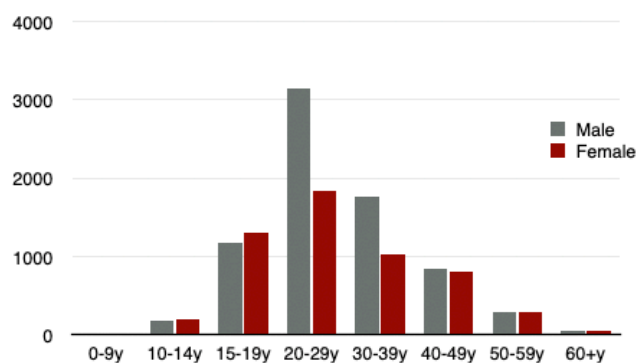
Mechanism of Injury:

Rugby, in its various forms, remains the most common mechanism of injury (24% of patients), with football (15%), netball (14%) and snow sports (8%) being the other common codes.

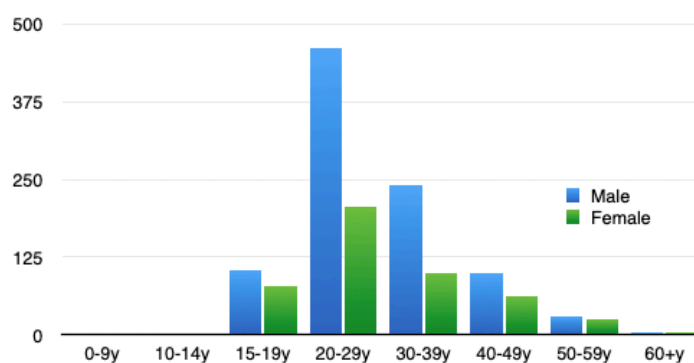


Demographics:

	Primary ACL Reconstruction	Revision ACL reconstruction
Male: female	7450:5519 (57.4% male)	945:479 (66.3% male)
Average age at surgery	29.3y (8.5-79)	29.8y (13.7-68.1y)
Delay to surgery	10months	17.3 months



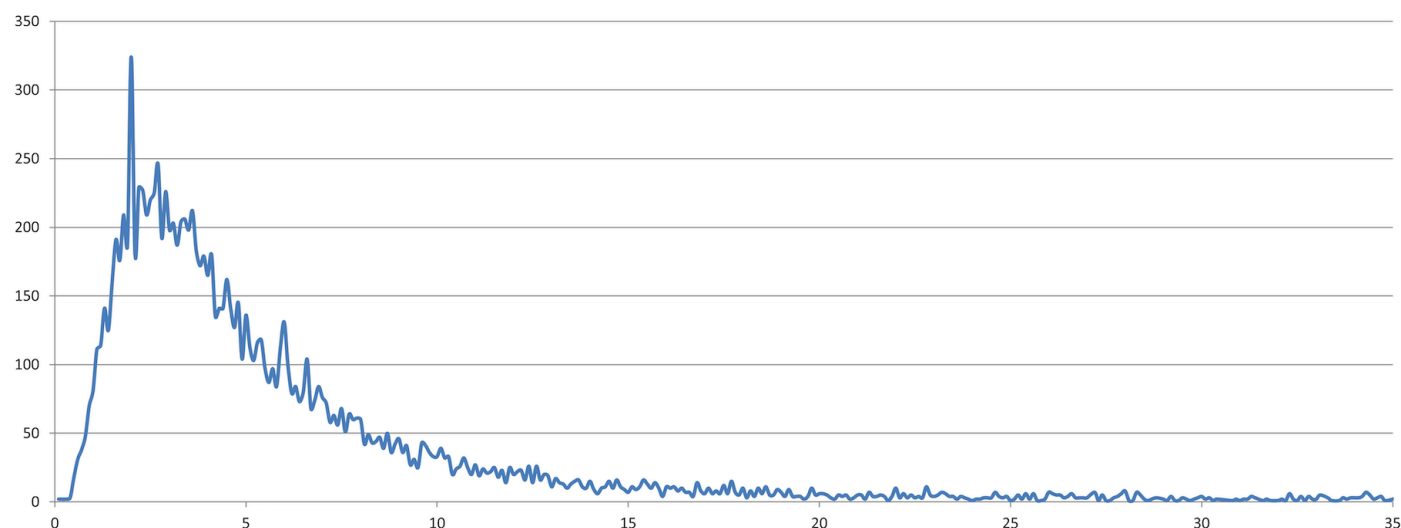
Age distribution: Primary



Age distribution: Revision

The majority of patients receive a primary ACL reconstruction within 6 months of injury. Median time is around 4.3 months. The long tail on the curve pushes the average time out to 10 months. Personalised reporting this year contains each surgeons time interval to surgeon compared with the national rates.

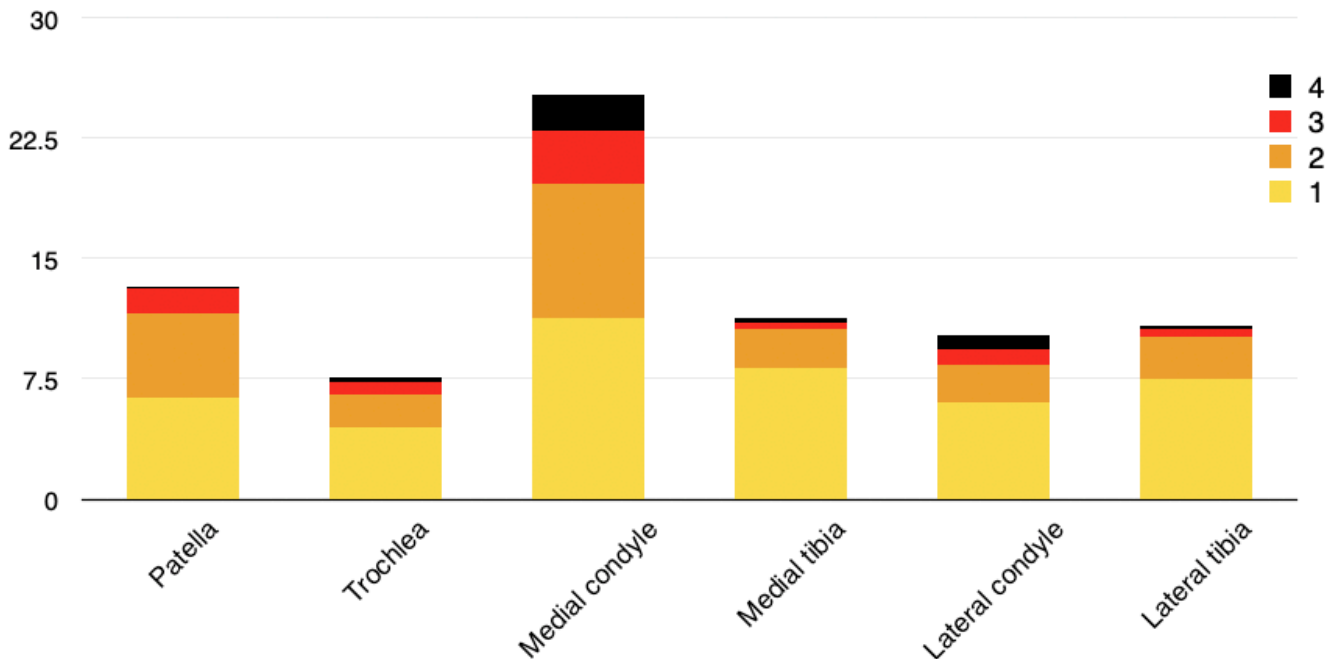
Delay to Surgery



Chondral injury:

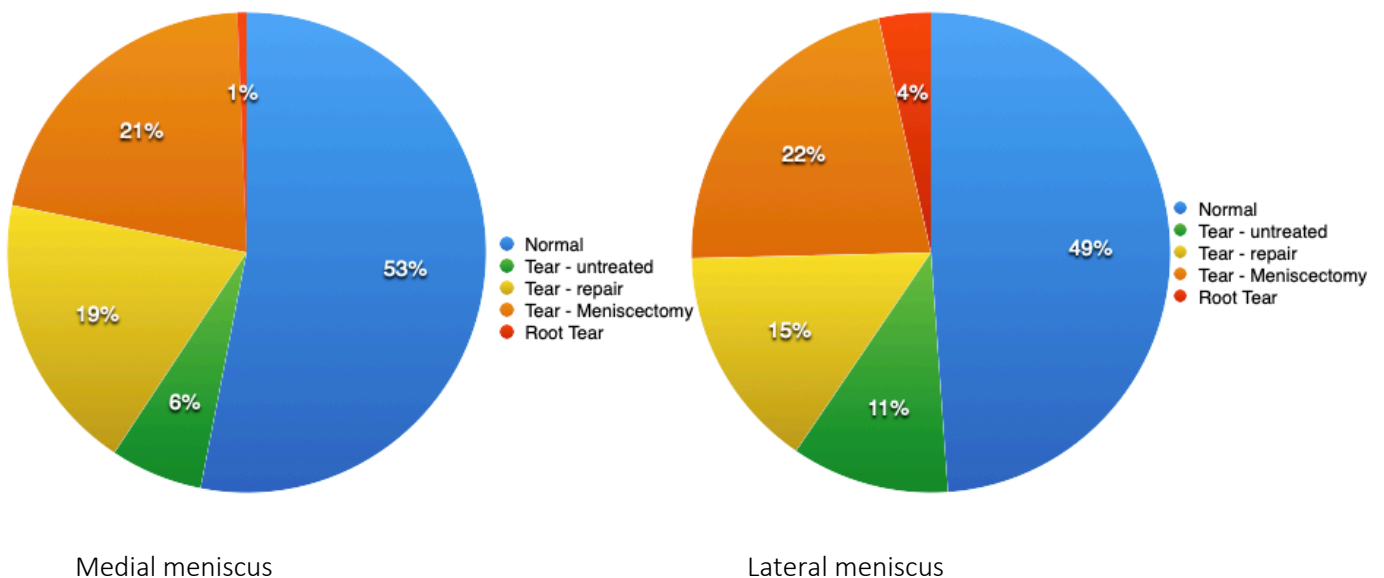
Chondral injuries were common at the time of surgery, the most frequently and severely affected area was the medial femoral condyle, being damaged in 25.2% of cases, it was also the area most frequently associated with higher grade chondral injuries (ICRS grade 3 and 4).

The majority of the injuries were not treated (77.6%). Chondroplasty was completed in 5.8% and microfracture in 2.9%. The chondral treatment field was not completed in 13.4% of operative data forms.



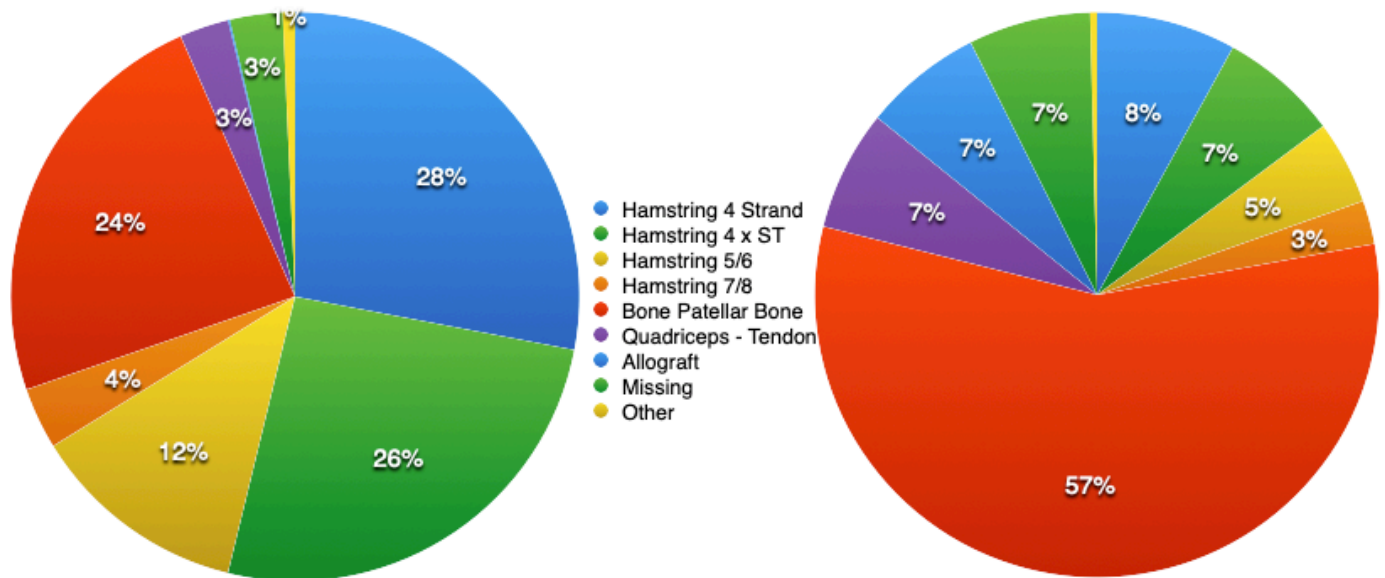
Meniscal injury:

About 1/3 of menisci have significant tears requiring treatment at the time of ACL reconstruction (38% medial, 36% lateral). The meniscus are found to be similarly reparable on the medial and lateral sides (18% and 12.5%). Implants are used six times more often as the more traditional sutures techniques on the lateral side and 10 times more often on the medial side of the knee.



Graft Choice:

For primary ACL reconstruction, the predominant graft choice is hamstring, accounting for 69.7% of all primary ACLs. 28% are 4 strand grafts with semitendinosus and gracilis. The majority of the others are quadrupled semitendinosus grafts (25.8%), although there is a trend for an increasing use of 6 to 8 strand grafts (15.9%). BTB is the next most popular graft, making up 23.7% of primary ACLs.

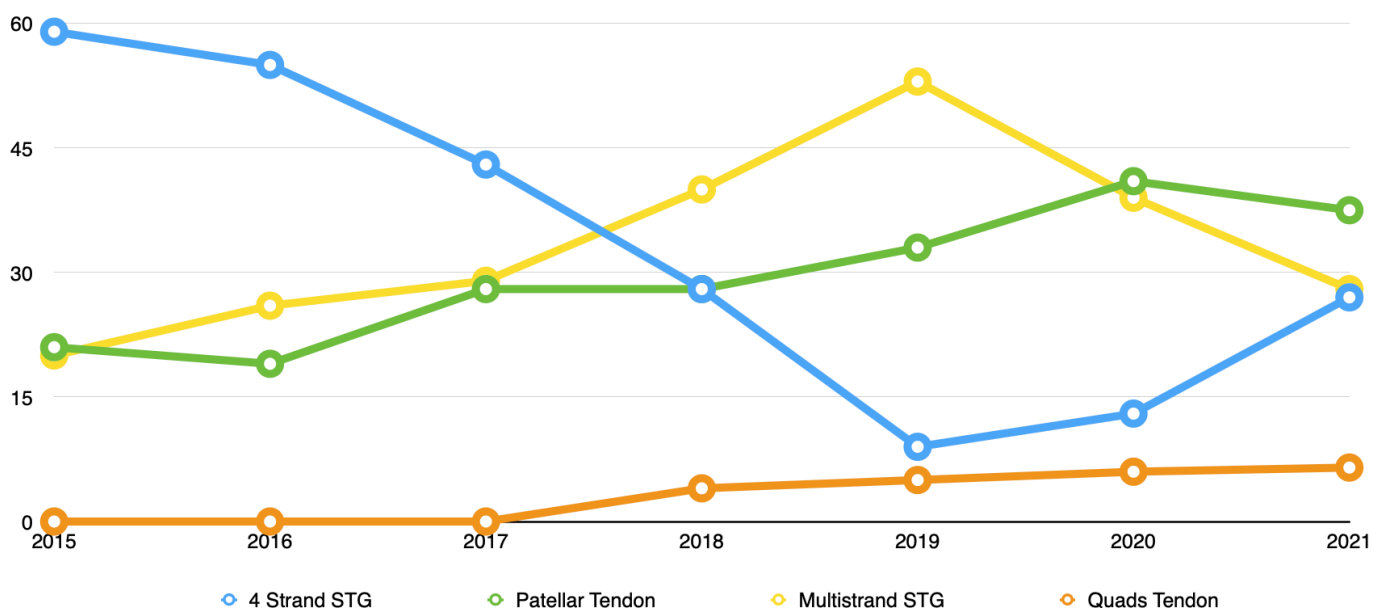


Graft choice: Primary

Graft choice: Revision

Trends in graft choice:

In 2019 there was a small decrease in the rate of hamstring grafts for primary ACL reconstruction and an upswing in the popularity of both patellar and quads tendon grafts. Anecdotally, this reflects surgeon concern about the emerging published evidence of inferior survival rates in hamstring grafts, particularly in comparison to patellar tendon grafts. This trend has continued into 2020. Patellar tendon now accounts for nearly 40% of all primary ACL reconstructions. Quads tendon grafting use continues to increase, but still only accounts for 6.5% of primary procedures.

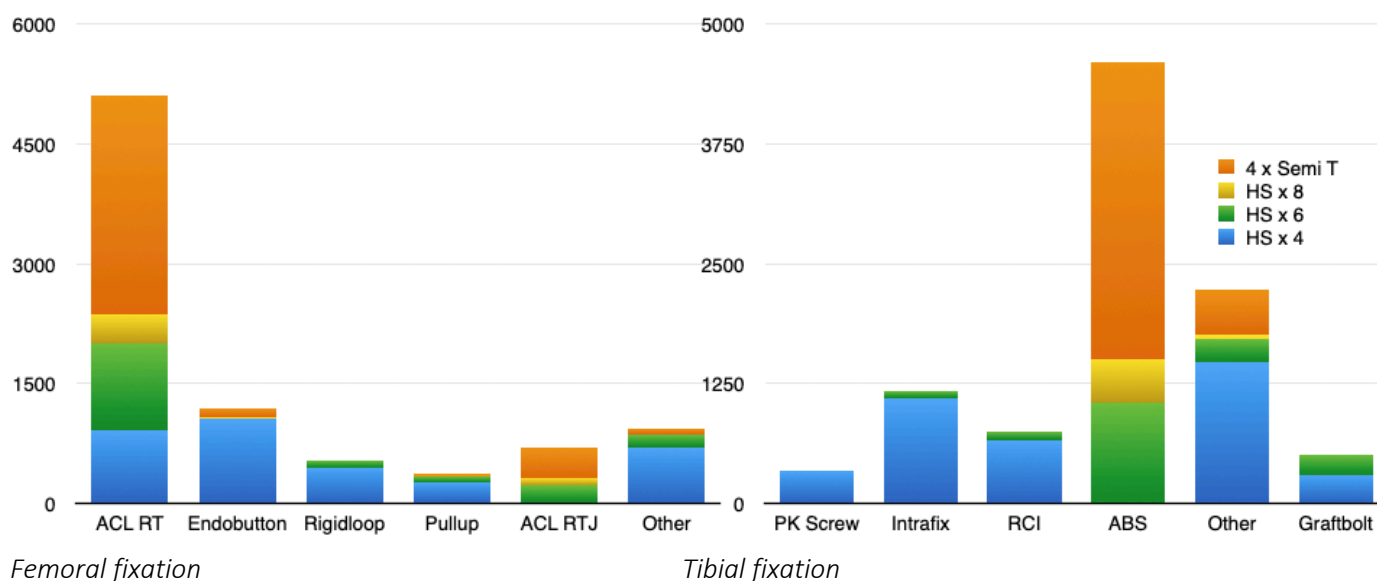


Tunnel drilling technique:

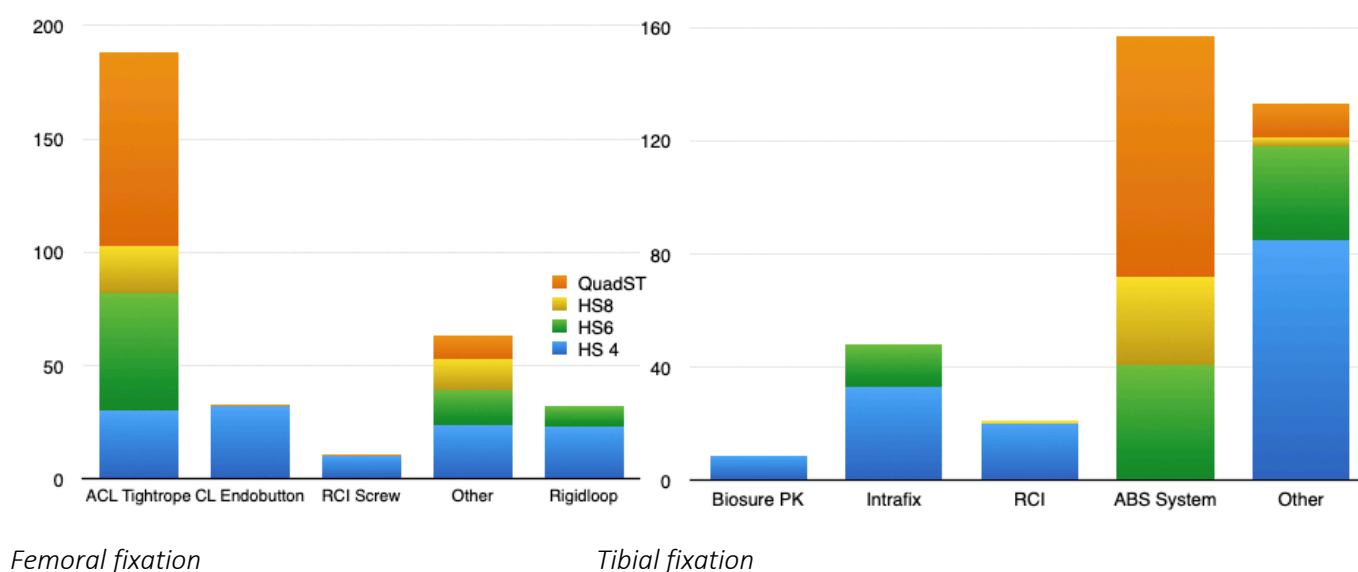
Tibial tunnel drilling data indicates that almost all are completed with antegrade drilling techniques. However, the operative data form was not completed in 16.5% of cases. 14 physéal sparing cases were recorded.

Femoral tunnel drilling was via an anteromedial portal in 71% of cases, transtibial in 11% and outside-in with a Flipcutter technique in 0.5% of cases. Data was missing in 16.5% of cases. An analysis of survival rates showed no difference in survival rates comparing trans-tibial and anteromedial drilling techniques¹.

Graft fixation technique: Hamstring Primary Patients

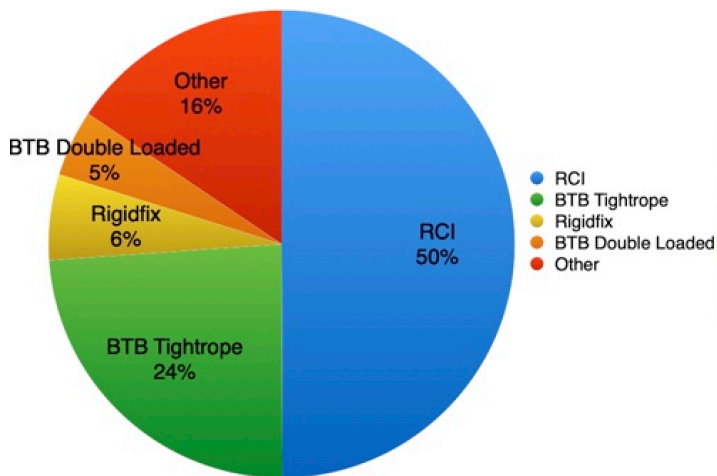


Graft fixation: Hamstring Revision Patients

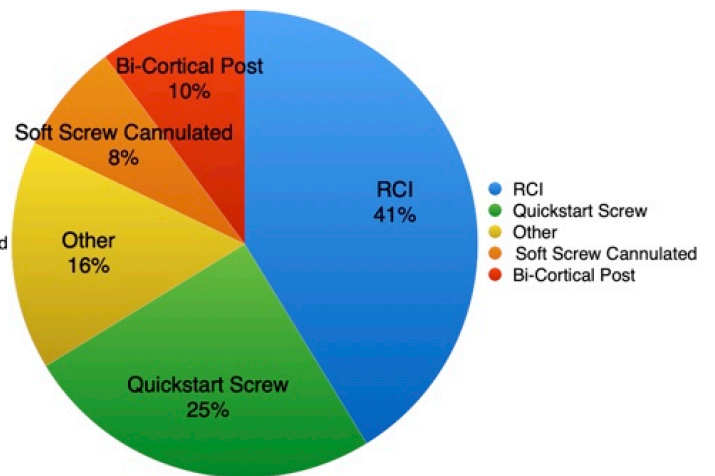


¹ No Difference in Revision Anterior Cruciate Ligament (ACL) Reconstruction between Anteromedial Portal and Transtibial Drilling of the Femoral Graft Tunnel: Results from the New Zealand ACL Registry. Richard Rahardja, Mark Zhu, Hamish Love, Mark G. Clatworthy, Andrew Paul Monk, Simon W. Young

Graft fixation: Patellar tendon Primary Patients

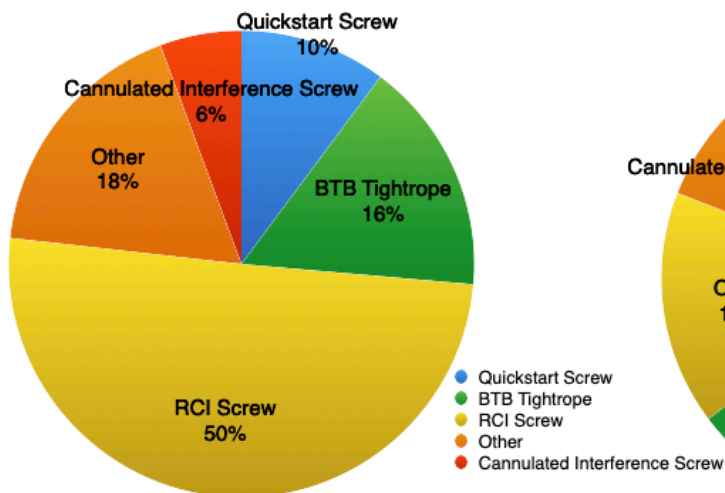


Femoral fixation

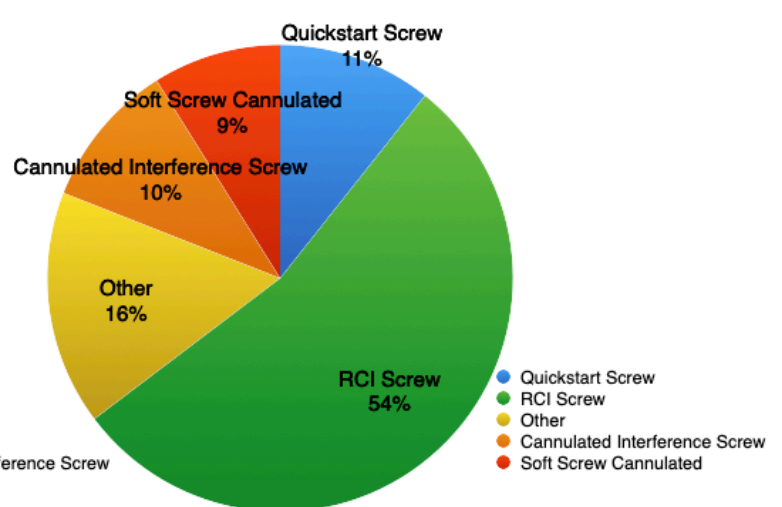


Tibial fixation

Graft fixation: Patellar tendon Revision Patients



Femoral Fixation



Tibial Fixation

Antibiotic use:

Cephazolin	74.8%
Cefuroxime	1.2%
Augmentin	2.5%
Vancomycin/ceph	12.2%
Other	0.2%
None recorded	8.9%

Thromboprophylaxis:

None	63.9%
Aspirin	14.6%
TEDs	7.9%
ICD	10.4%
Clexane	3%
Other	0.2%

Complications:

Intraoperative Complication	Number
Implant Failure	132
Patella Rupture	9
Hamstring Amputation	19
Tunnel/Graft Mismatch	4
Inadequate graft	26
Contaminated Graft	3
Other	104
Post-operative complication	
Infection (includes 13 with reoperation)	63
DVT/PE (includes 4 with reoperation)	43
Arthrofibrosis (Includes 230 with reoperation)	299
Implant-irritation/removal (includes 49 with reoperation)	71
Other hospital admission/reoperation (not meniscus, chondral or Arthrofibrosis)	47
Meniscal Resection/Repair (includes 362 with reoperation)	424
Chondral Repair (includes 87 with reoperation)	98
Donor site problem: Hamstring	270
Donor site problem: Patella	94
Complex regional pain syndrome	7
Patella tendon rupture	4
Other (no re-operation)	152
Septic Arthritis	4
Recurrent Instability	
Atraumatic	164
Traumatic	391
Not recorded (failures but no revision)	110
Graft Rupture Implant Failure	5
Not specified	7
Revision ACL Reconstruction	354

Complications are captured in 4 ways.

- Operative complications are recorded on the operative data form by the treating surgeon.
- Post-op complications identified by treating surgeons are recorded on the complications form and returned to the registry.

- Patients completing follow up questionnaires are asked if they have had any complications relating to their ACL surgery or further injuries to their knee.
- Finally, a cross-referencing with ACC data on further procedures related to the original surgery claim ensures a complete data set regarding subsequent surgery to the same knee.

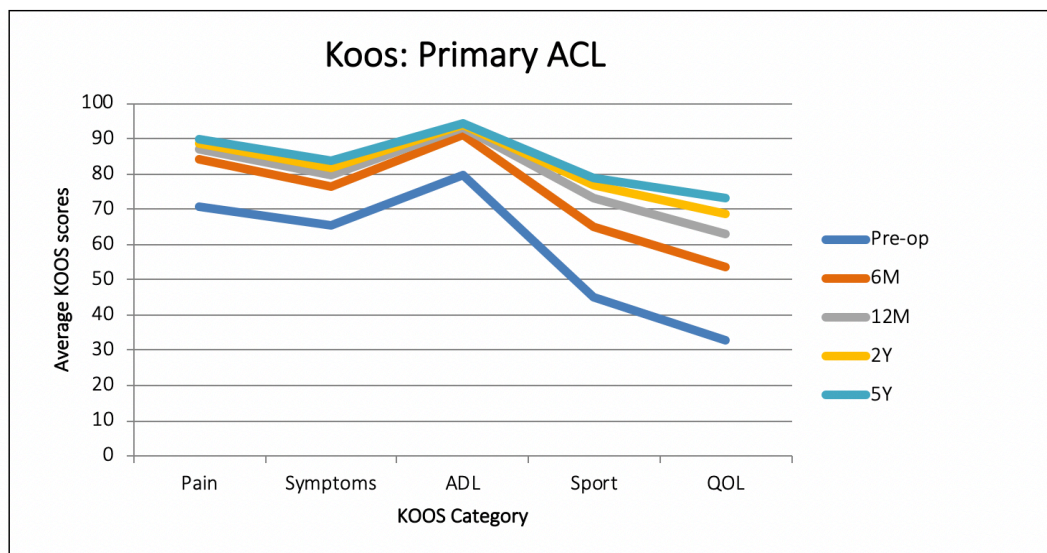
* Complications are recorded if they are significant to require hospital readmission or reoperation.

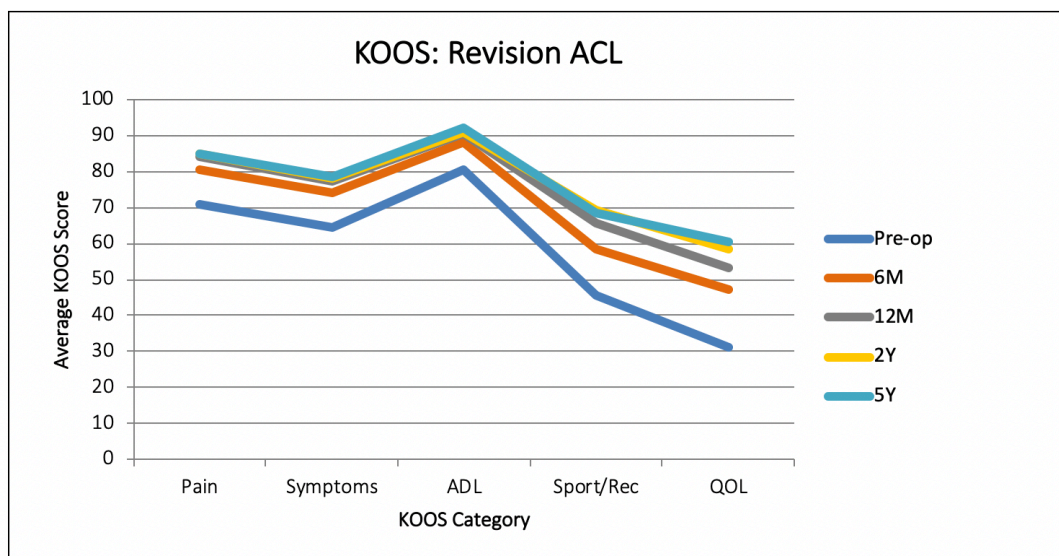
**The exception to this is donor site problems. These are listed if the patient reports significant symptoms related to the graft harvest site.

Outcome scores:

The KOOS score is a validated outcome questionnaire for ACL injuries and surgery. A 5 point scale from 0: none, to 4: Extreme, is completed for each of the subscales. These include:

- Pain: amount of pain in the last week
- Symptoms: Knee injury symptoms in the last week e.g. swelling, grinding, ability to straighten knee.
- ADL: Functional problems with activities of daily living, e.g. descending stairs
- Sport/Recreation: The degree of difficulty in physical tasks performed in the last week e.g. squatting pivoting etc.
- Quality of Life: Awareness of knee problems and confidence in the knee.

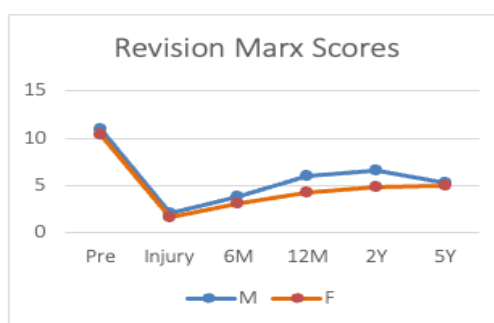
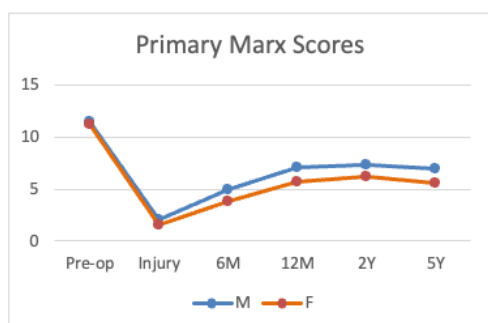




The scores in our cohort over time are very similar to those presented in other registry data. KOOS scores show improvement over all time points in primary ACL reconstruction. Revision KOOS scores show less improvement overall, in spite of a similar starting point.

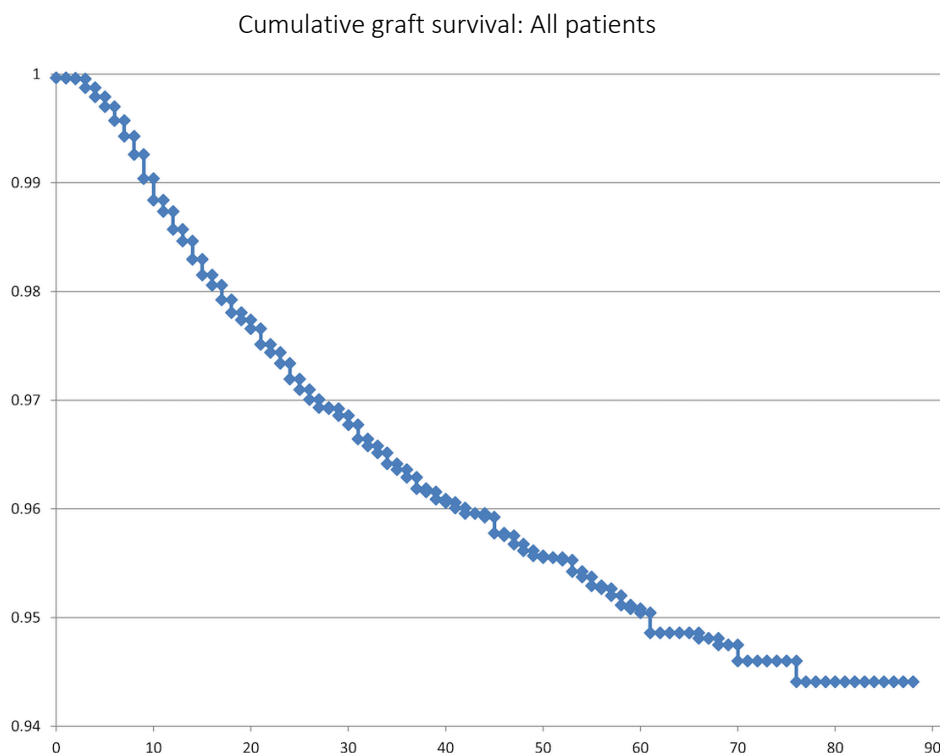
Marx Scores:

The Marx score is a measurement of how often the individual engages in ACL-dependent physical activities including running, cutting, decelerating and pivoting. The Marx scores show a poorer return to activity after revision surgery when compared with primary ACL reconstruction.



Survivorship:

Cumulative survival for ACL reconstruction in the NZ ACL Registry is 95.4% (95%CI 94.5-96.1)



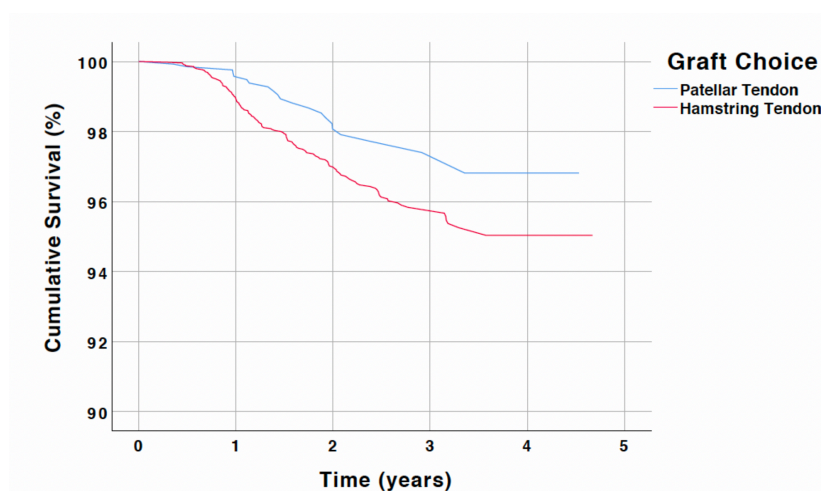
Independent patient-related risk factors for graft rupture and revision included²:

- Age. Patient <18y old have the greatest risk of re-injury. Those >36y old were at the lower risk of re-injury or revision surgery
- Male gender. Increased risk of graft rupture (RR 1.81) and of revision (RR 1.65) compared with females (p = 0.001)
- Early ACL reconstruction (within 6 months of injury) had a higher risk of revision compared with delayed reconstruction (>12 months post injury).

² Patient Risk Factors for Revision Anterior Cruciate Ligament (ACL) Reconstruction in the New Zealand ACL Registry
Richard Rahardja, Mark Zhu, Hamish Love, Mark G. Clatworthy, Andrew Paul Monk, Simon W. Young

Graft Choice:

There is a trend in registry data showing that patella tendon grafts have lower revision rates compared with hamstring grafts. 1.3% vs 2.7% (adjusted HR = 2.51; 95% CI 1.55 – 4.06; $p < 0.001$)³. However there was an increased rate of contralateral ACL rupture in the patellar tendon group 1.8% vs 0.9% (adjusted HR = 1.91; 95% CI 1.15 – 3.16; $p = 0.012$).



The difference in graft choice failure rates tends to be magnified by independent variables, for example age, as an analysis of failure rates among female patients comparing hamstring to patellar tendon shows.

Age group	BTB	HS
< 20y	2.7%	12.4%*
20 – 24y	4.3%	10.3%**
25+	0.9%	3.8%

* $p = 0.02$

** $p = 0.03$

These trends need more analysis before firm conclusions can be reached and recommendations about graft choice made. A recent paper presented at the Australasian Sports & Exercise Physicians Annual Scientific meeting has explored this issue in more detail. This data will be presented at the next Knee Society meeting.

³ *Impact of Graft Choice on Revision and Contralateral Anterior Cruciate Ligament Reconstruction: Results from the New Zealand ACL Registry* Richard Rahardja, Mark Zhu Hamish Love, Mark G. Clatworthy, Andrew Paul Monk, Simon W. Young.

Conclusions:

The Registry is producing a high quality and robust data set. This will enable us to generate meaningful information on patient outcomes and research into the variables of ACL injury and reconstruction. Our primary goal is to improve the quality of patient care in the management of ACL injuries. The Trustees of the ACL Registry wish to express their gratitude to all participating Surgeons and to the New Zealand Orthopaedic Association, in particular its Knee Society, for making the ACL Registry possible.