The National Ligament Registry

The Second Annual Report (2016)

NATIONAL LIGAMENT REGISTRY

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1 Steering Group Introduction

The UK National Ligament Registry (NLR) is designed to collect and store outcomes data relating to anterior cruciate ligament reconstruction surgery. It was launched at the BASK annual scientific meeting in 2013. Any data collection system must be established to answer clear questions. A simple aim, but hard when trying to predict the future issues. Simple questions need robust systems to provide valid answers. For this very reason, we have concentrated on a single procedure, primary anterior cruciate ligament (ACL) reconstruction, and we are confident that the results will benefit future surgeons and patients alike. When established it will ease the journey to develop similar pathways for the revision of ACL procedures and other ligament reconstructions.

This will only succeed if all partners (patients, surgeons and industry) are involved, feel valued and benefit. The Registry is established as a surgeon led entity without the initial involvement of governmental agencies. This approach therefore requires external financial support and we have received sponsorship from 8 companies involved in ACL reconstruction as well as a 'priming' grant from BASK. In return the companies will be provided with information on the performance of their particular products, but will not be able to access other company data. We need surgeon support to ensure we achieve a critical number of surgeons and procedures.

With the Registry, surgeons should strive to achieve the primary aim of a (complete) database of the 'functional' outcome of ACL reconstruction in the UK — it will then enable some secondary gains which could include uses in surgeon revalidation and the establishment of a platform to allow the controlled introduction of new products.

Registry data provides a substantial amount of information directed towards answering questions and raising overall standards of care, for the benefit of patients, clinicians, the NHS and industry.

We are delighted to publish the second annual report of the National Ligament Registry. The NLR continues to grow both in terms of patient numbers and in terms of its reach and popularity. We have received great support from the British Association for Surgery for the Knee, the International Registries Consortium and of course from industry who help fund this initiative. At this point we have 6,105 pathways entered and 41,158 outcome forms completed. These continue to increase at a rapid rate. In 2015, 53 surgeons have joined in the registry increasing the total number to 333 registered surgeons. We are keen to continue to provide a resource for all new surgeons and all patients who suffer ACL injuries. We hope ultimately to capture every ACL injury sustained in the UK to look at both those treated operatively and non-operatively and to develop a robust data set.

We continue to work with Amplitude and to evolve their offering. We have received support in that regard from the TORUS Group at the BOA and from Julia Trusler and Mike Kimmons in particular. The Steering Group has expanded. John Fairclough, Steve Bollen and Andy Price have moved on to other projects and initiatives, Sean O'Leary, Tim Spalding and Fares Haddad continue from the original group but have been joined by James Robinson and Mike McNicholas who will particularly focus on website and industry relations, and by William Hage who is in the treasurer position. We continue to look for surgeon champions and enthusiasts and are very grateful to our regional coordinators.

We hope the material in this report is of interest and that you will continue to help us to collect more data so that we can provide feedback to our surgeons, our patients and our healthcare providers, in order to improve outcomes.

2 Aim of Registry

When understanding outcomes following ligament reconstruction, it is important to analyse all relevant factors that may have an effect. This could be anything from graft choice and surgical fixation, to patient factors and rehabilitation factors. The registry aims to:

- Collect relevant demographic data
- Identify any current or emerging trends in practice
- Identify failing techniques / devices at the earliest opportunity
- Provide functional outcome data and complication rates
- Improve the standard and quality of care in the UK as a result of all of the above

Currently, there is a lack of information regarding the number of procedures, functional outcome and complication rate following ACL reconstruction (ACLR) operations in the UK. The Registry aims to address this gap, creating standard best practice approaches and one central hub of clear and concise data. We hope this will:

- Help patients (and surgeons) understand the outcome
- Identify standards of practice
- Identify techniques / implants that do not excel
- Provide information to commissioners to guide the genesis of high value pathways

3 Background

The UK National Ligament Registry has been designed by surgeons for the benefit of patients. It is an exciting collaborative project, aimed at understanding and optimising the outcome following anterior cruciate ligament reconstruction. At the time of writing, we have 333 registered surgeons who will be defined as the enthusiasts. This is already a huge endorsement for the early phase of this project. This number should steadily increase as surgeons and orthopaedic departments see the advantage of having a readymade tool for use in governance and revalidation.

The Registry is a user-friendly web based platform that collects various outcome data from ACL reconstruction operations. The Registry platform is easily accessible via computer and tablet, simplifying the process for clinicians and patients. The 'registry route' is simple, requiring small contributions from both surgeon and patient at different stages. It also automatically prompts patients to fill in their information at scheduled times of treatment and rehabilitation, taking the hassle and stress out of clinical data collection for clinicians. At the time of writing we have 6,105 registered patients.

Bluespier was selected as the company to collect and host the data utilising their newly developed Amplitude system. With their help, we have established a new model for this Registry which involves automated online (paperless) data entry. It enables surgeons, patients and support staff to access/register online in a straightforward manner with easy access guidelines.

The population undergoing ACL reconstructions are typically younger, more mobile and busy. This makes them difficult to trace and track which is why two of the key elements of information are the NHS number and an email address. This is the electronic age and email and text communication is the norm and must be acknowledged. It will take some effort and vigilance to enter patients but with automated follow up the process is simple and appealing.

In understanding outcome following ligament reconstruction it is important to analyse all relevant factors that may be considered to affect outcome including graft choice, surgical/fixation techniques, patient factors and rehabilitation factors. The outcome measures chosen are the knee injury and osteoarthritis outcome score (KOOS), subjective International Knee Documentation Committee (IKDC), Euroqol (EQ5D) and the Tegner activity score. These scores allow comparison and communication with existing Registries as well as allowing potential 'generic health benefit' comparisons to other non-Orthopaedic procedures.

The data from the NLR is managed by the surgeons who input their patients. Backed by industry partner support, it will be overseen by the NLR steering group, producing an independent annual report. There will also be a research subcommittee appointed through the NLR steering group, with responsibility for deciding direction of research and managing data requests from external parties. The program will be run and technically supported by Amplitude, experts in collecting clinical outcomes data.

4 Results from Current data (2012-2015)

A total of 6105 patients with ACL injury were registered in the national ligament registry between the first of December 2012 and the 31st of January 2016. Of these, 4811 patients (78.8%) underwent ACLR surgery and 1294 patients (21.2%) received non-operative treatment. A total of 2585 patients were added to the registry between 31st of January 2015 and 31st of January 2016. This group of patients is the main focus of this report. Of these, 1851 patients (71.6%) underwent ACLR procedure and 734 patients (28.4%) received non-operative treatment.

4.1 Age at Surgery

The average age for patients undergoing ACLR was 29. This reflects the increase in ACLR surgery in the older age group. Around 19% of patients who underwent ACLR surgery were over the age of 40. This could be attributed to the increased sports participation in this age group with patients performing high level-athletic activities longer in life that predisposes them to ACL injury. Figure (1) demonstrates the number of patients who had ACLR surgery in different age groups. Figure (2) demonstrate the number of patients who had non-operative or surgical treatment in relation to their age groups.

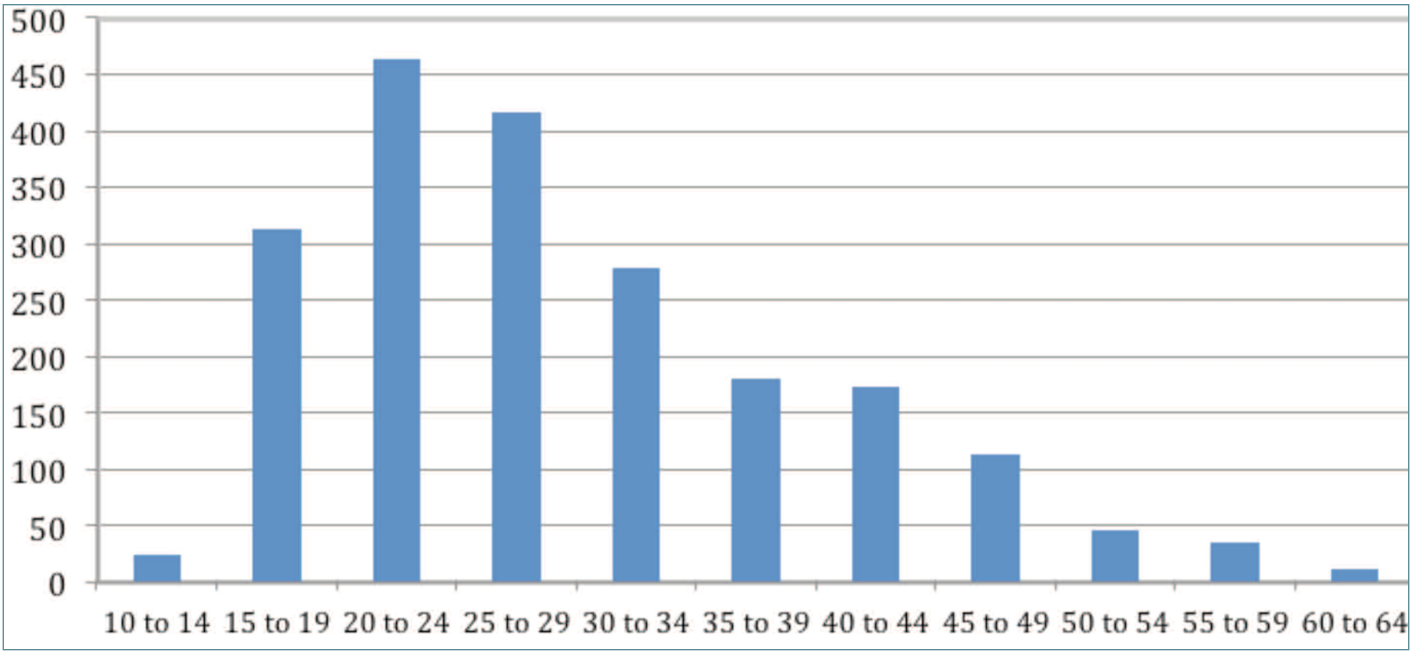

Figure 1: Number of patients who underwent primary ACLR according to their age at time of surgery in 2015

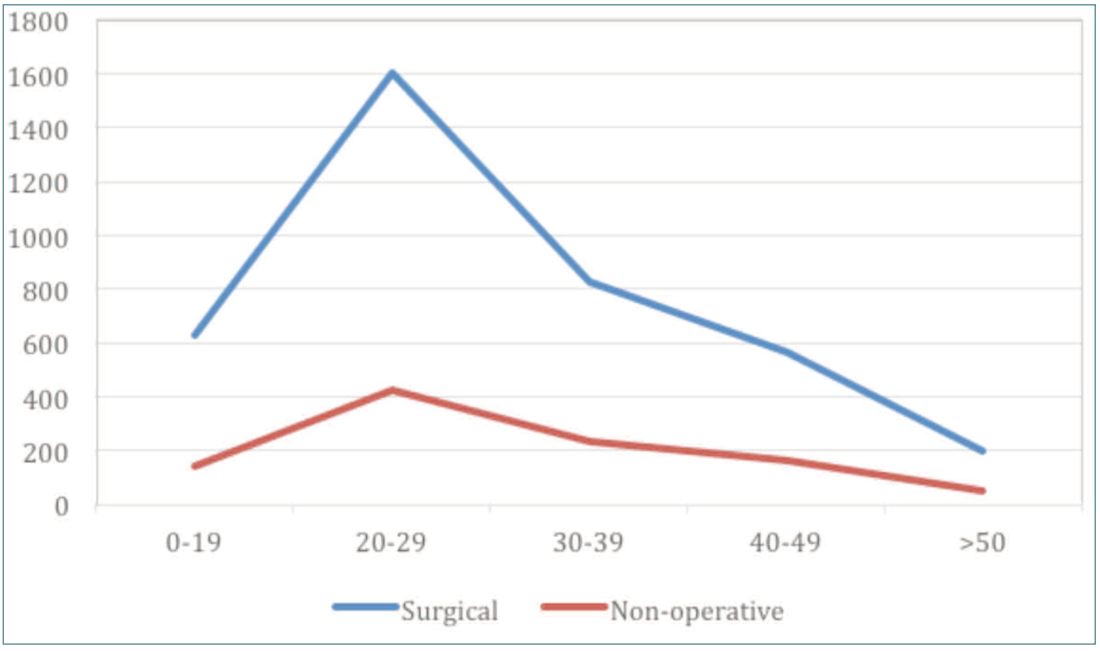

Figure 2: Number of patients with ACL injuries who had surgical or non-operative treatment according to their age

4.2 Gender distribution

The percentage of men and women who underwent ACLR surgery in 2015 were 73% and 23% respectively with a male to female ratio of about 3:1(Figure 3). Figure (4) shows the distribution of male and female patients who underwent ACL surgery between 2012 and 2015.The average age for women who had ACL surgery was 37 while it was 31 in men. The distribution of male and female in different age groups is shown in figure (5). More women underwent ACL surgery above the age of 50.

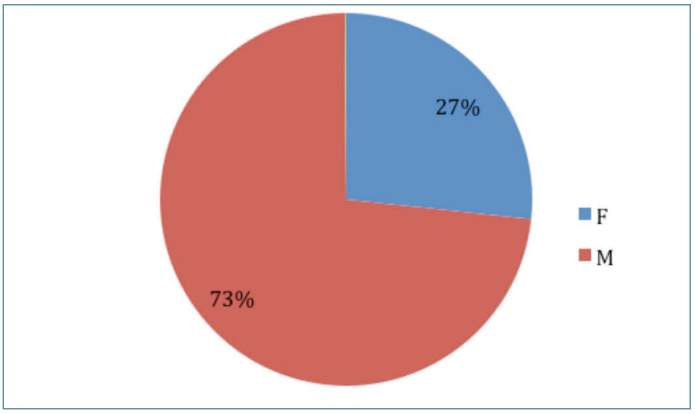

Figure 3: Percentage of male and female patients who underwent ACLR surgery

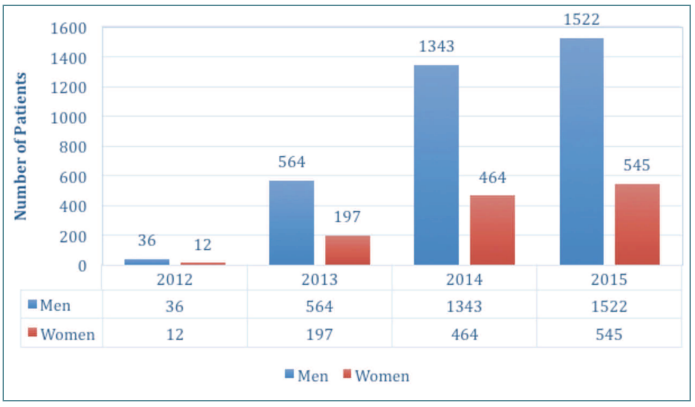

Figure 4: The distribution of male and female patients who underwent ACLR surgery between the end of 2012 and February 2016

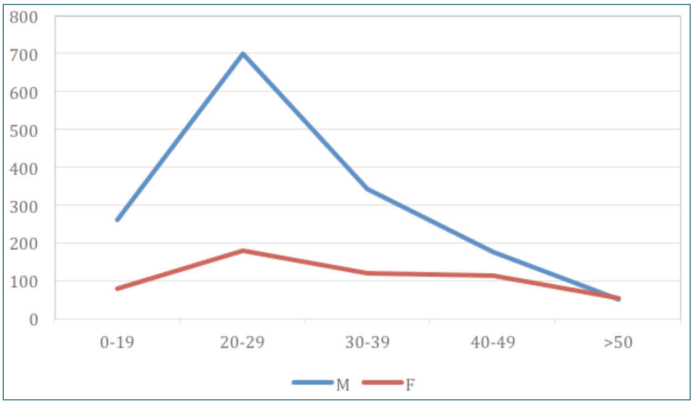

Figure 5: Distribution of male and female patients who underwent ACLR surgery in different age groups in 2015

4.3 Operated Side

The right knee was operated upon in 54% of patients who underwent ACLR surgery while it was the left knee in 46% of patients (Figure 6). The results were comparable to the non-operative group (Figure 7).

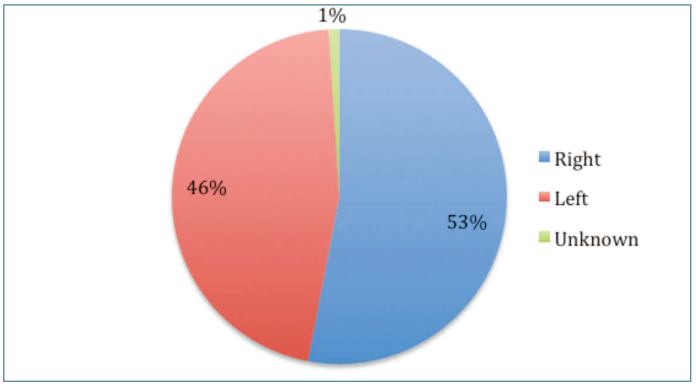

Figure 6: Operated Side

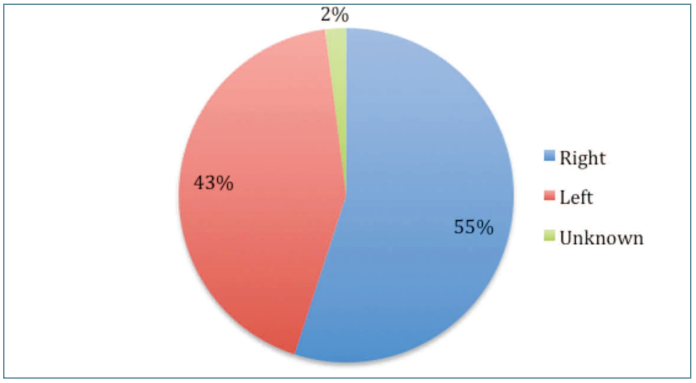

Figure 7: ACL injury side in patients who had non-operative treatment

4.4 BMI distribution

Figure (8) describes the body mass index (BMI) ranges for patients who underwent ACLR procedures in 2015. The BMI was recorded in 1001 patients. Of these, around 45% of the patients had BMI values between 18.5 and 25 while 2.7% were over 35.

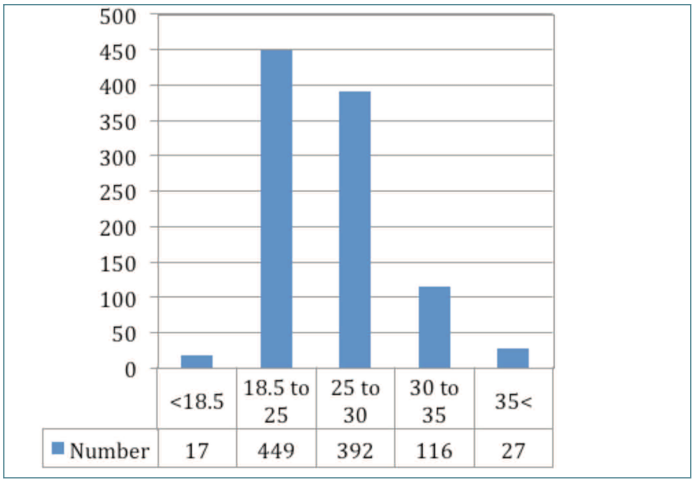

Figure 8: BMI ranges for patients who underwent ACLR procedures. Data from a total of 1001 patients were available for analysis

4.5 Activity in Association with the ACL injury

Sport injuries are the leading cause for ACL tears. This is particularly common in pivoting and cutting sports. Out of 2585 patients who ACL injuries in 2015, 1130 have answered the question on the activity leading to their ACL injury. 86% of those that answered sustained their ACL injury while engaged in sports activities while 14% sustained their ACL injury due to non-sport activities. Football (soccer) was the most common activity associated with an ACL injury. Among men, the second most common activities associated with ACL injury were rugby followed by snow skiing. However, snow skiing was the most common activity associated with an ACL injury in women followed by netball and football (soccer). Table (1) shows the sport activities in relation to the ACL injuries in men and women. Table (2) shows the various non-sport activities that lead to ACL injury. Over one third of these patients reported having a fall as the cause for their ACL injuries.

Table 1: Distribution of sport activities as the cause for ACL injuries in men and women

	Total	M	F	%
Football (Soccer)	476	445	31	48
Rugby	171	154	17	17
Snow Skiing	125	38	87	13
Other	44	22	22	5
Netball	43	0	43	4
Hockey (Field Hockey)	12	4	8	1
Martial Arts	12	8	4	1
Basketball	12	10	2	1
Trampolining	8	1	7	0.8
American Football	8	8	0	0.8
Skate Boarding	6	6	0	0.6
Cycling (Mountain Bike)	6	5	1	0.6
Badminton	5	4	1	0.5
Tennis	5	2	3	0.5
Cricket	5	5	0	0.5
Judo	5	4	1	0.5
Boxing	5	4	1	0.5
Horse riding	3	0	3	0.3
Squash	3	3	0	0.3
Cycling (Road bike)	3	3	0	0.3
Wrestling	2	2	0	0.2
Athletics – Field	2	1	1	0.2
Volley Ball	2	2	0	0.2
Snow Boarding	2	1	1	0.2
Gaelic Games	1	1	0	0.1
Running	1	1	0	0.1
Gymnastics	1	0	1	0.1
Golf	1	0	1	0.1
Water Skiing	1	1	0	0.1
Roller Blading	1	1	0	0.1
Weight Lifting	1	1	0	0.1
Handball	1	0	1	0.1

Table 2: Distribution of non-sport activities as the cause for ACL injuries in men and women

	Total	M	F	%
I had a Fall	60	27	33	38
Other	33	17	16	21
Work related injury	25	22	3	16
Dance	16	6	10	10
Motor Bike (Traffic accident)	7	6	1	4
Motor Vehicle (Traffic accident)	6	4	2	4
Motor Bike (Off road)	5	4	1	3
Assault	4	2	2	2

4.6 Associated knee injuries with ACL tears

Of the 2,585 patients who had ACLR surgery in 2015, 47.8% had associated knee injuries that required surgical treatment. Medial meniscus surgery including partial menisectomy and meniscal repair were the commonest associated surgery (20%). The second common associated procedure was lateral meniscus surgery (13%). Combined medial and lateral meniscus surgeries were undertaken in 6.6% of the patients. Table (3) shows a breakdown of patients who had knee surgery associated with ACLR procedures.

Table 3: Incidents of ACLR and associated surgery. Number of patients is presented in the first column. Tick sign represents the associated injury or combination of injuries

Number	ACL	MM	LM	Lateral tenodesis	Articular cartilage	CL	PCL	ALL	PLC	Other
967	✓									
376	✓	✓								
248	✓		✓							
123	✓	✓	✓							
33	✓				✓					
17	✓									✓
16	✓			✓						
13	✓					✓				
11	✓		✓		✓					
8	✓	✓		✓						
5	✓	✓	✓		✓					
4	✓	✓				✓				
4	✓		✓			✓				
4	✓		✓	✓						
3	✓			✓				✓		
3	✓					✓			✓	
2	✓	✓								✓
2	✓						✓			
2	✓						✓			✓
1	✓	✓						✓		
1	✓	✓				✓	✓			
1	✓	✓	✓					✓		
1	✓	✓	✓	✓		✓				
1	✓	✓	✓	✓						✓
1	✓	✓	✓			✓				
1	✓		✓	✓						✓
1	✓			✓	✓					
1	✓					✓	✓			
1	✓						✓		✓	

4.7 Funding Sources

The National Health Service (NHS) has funded 72% of the ACLR surgery recorded in the NLR in 2015. The remaining 28% was funded independently (Figure 9). This shows an increase in the number of registered patient from the independent sector by 8% compared to 2013-2014.

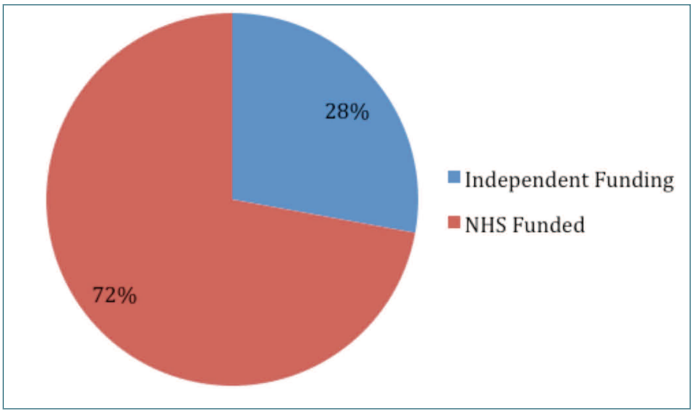

Figure 9: Funding sources for ACLR procedures

4.8 Time to surgery

In 2015, the average time between ACL injury and surgical reconstruction was 350 days. This is 9 days less than the average time recorded in last year's report (2013-2014). Although this might appear as a long period between injury and surgery, it is similar to what has been reported by the Scandinavian registries. The reason for such a long period is unknown. Possible explanations include delayed diagnosis; long surgical waiting lists and lengthy rehabilitation programs for patients who were initially managed non-operatively.

4.9 Surgeons' Profile

In 2015, 179 surgeons have registered their patients on the NLR. Figure (10) demonstrates the number of surgeon in relation to the total ACLRs procedure they have performed in 2015. Forty three surgeons performed 10 or less ACLR surgery while two surgeons performed 98 ACLR procedures. Figure (11) shows the grades of operating surgeons who performed the ACLR surgery. Around 93% of ACLR surgery has been performed by consultant grade surgeons.

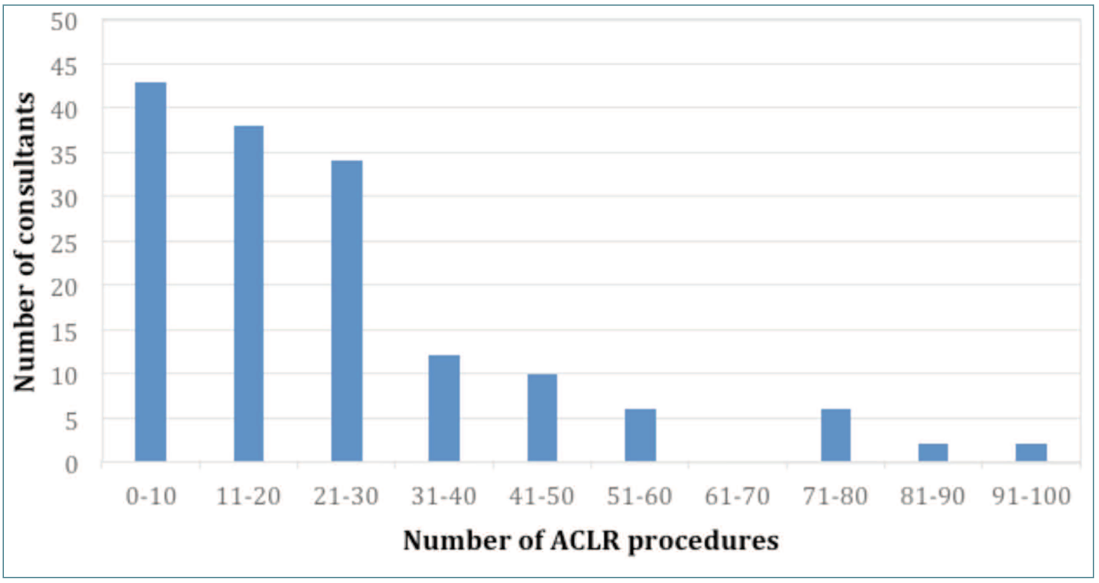

Figure 10: Number of surgeons in relation to the total ACLRs procedures they performed in 2015

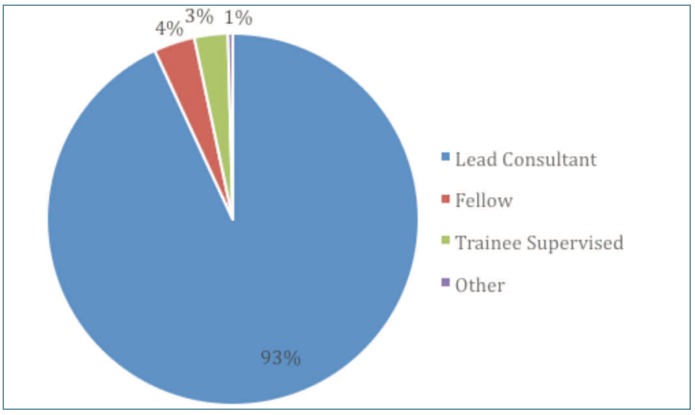

Figure 11: Grade of operating surgeons

4.10 Thromboprophylaxis

Perioperative thromboprophylaxis strategies were recorded in 887 patients who underwent an ACLR procedure between December 2012 and January 2016. Of these, 40% had no thromboprophylaxis given and 31% had mechanical methods of thromboprophylaxis (Figure 12). There were no details on what type of mechanical or chemical prophylaxis that were used. The indications for specific thromboprophylaxis strategy were not recorded either.

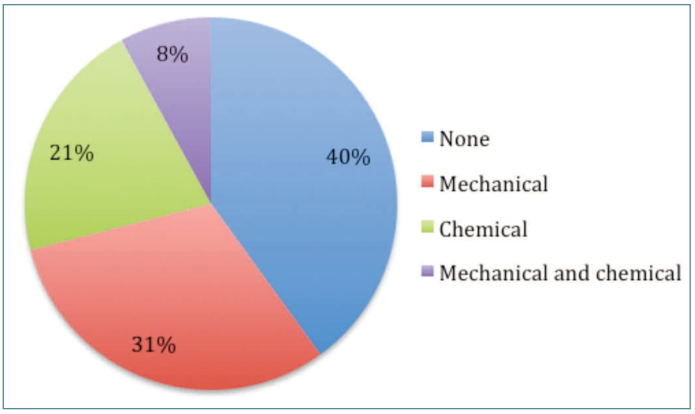

Figure 12: Percentage of different thromboprophylaxis strategies used in patients who underwent ACLR procedure

4.11 Graft type

In 2015, the type of ACL graft used was recorded in 1735 patients. Autograft was the most common graft choice in ACLR procedures (98%). Allograft was used in primary ACLR surgery in 1% of the patients. Synthetic graft was used in 10 patients only. Six patients underwent direct suture repair for the ACL tear instead of reconstruction procedure (Figure 13).

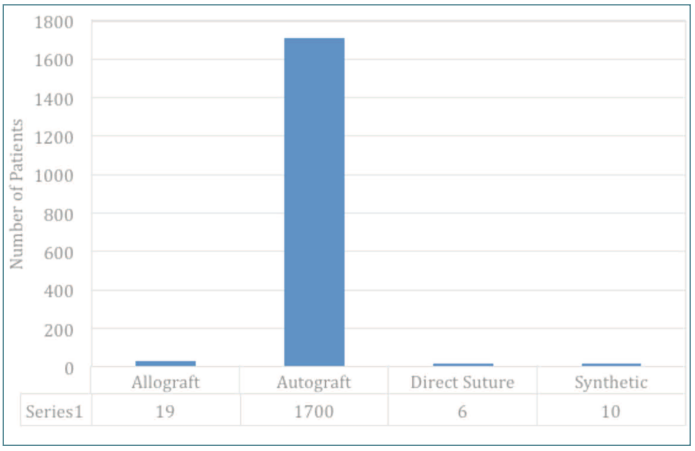

Figure 13: Type of ACL Graft. Data from 1735 patients were available for analysis

Hamstring tendon autograft was the graft of choice in the majority of patients who underwent ACLR procedures. A doubled semitendinosus and gracilis graft was the most commonly used autograft (77%) followed by semitendinosis alone (11%) and patellar tendon(11%). This shows a 4% increase in the use of patellar tendon autograft compared to last year's report (2013-2014). Quadriceps tendon autograft was used in four patients only (Figure 14).

The hamstring tendon autograft can be used in a single- or multi-strands configuration. Four-strands configuration was the most common (79%) followed by six-strands configuration (9.6%). Single-strand configuration was used in four patients only (Figure 15).

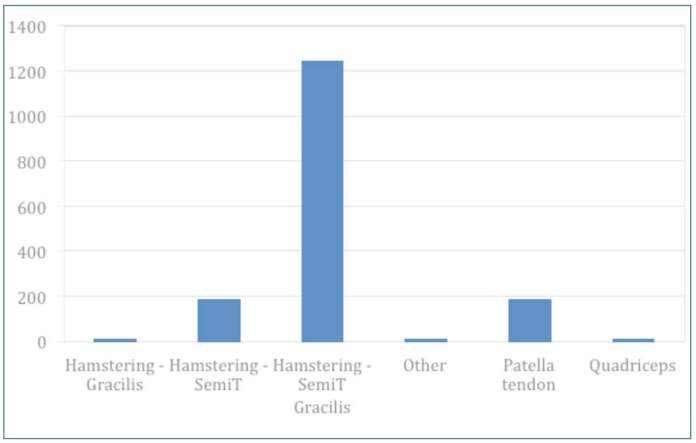

Figure 14: Types of ACL autograft

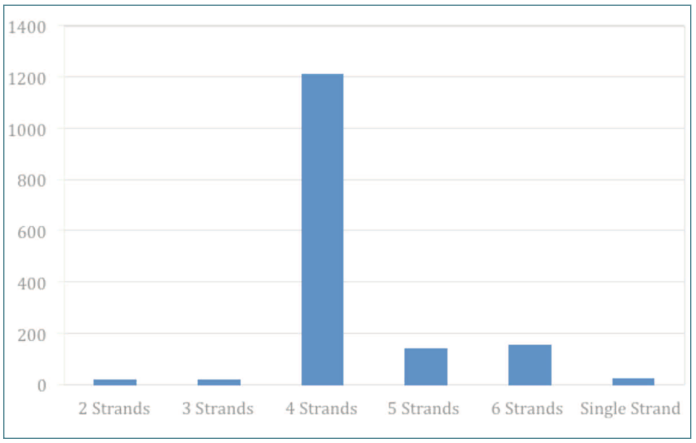

Figure 15: Hamstring tendon autograft doubling configurations

4.12 Graft diameter

The most common hamstring autograft diameter was 8 mm (37%). Four patients had a graft diameter of 6 mm(Figure 16). Figure 17 shows the graft diameters among men and women in different age groups.

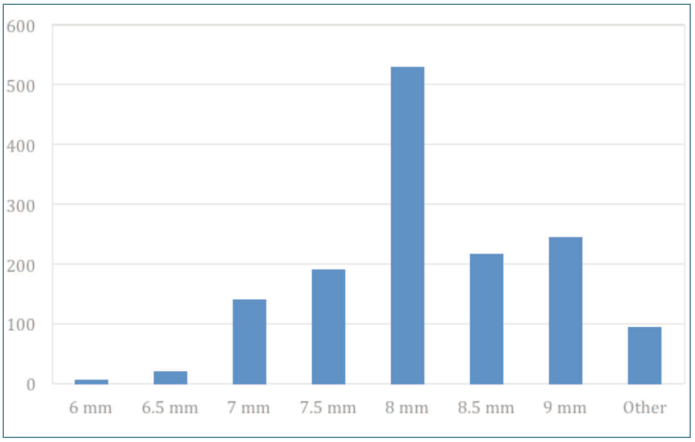

Figure 16: Graft diameter. Data from a total of 1838 patients were available for analysis.

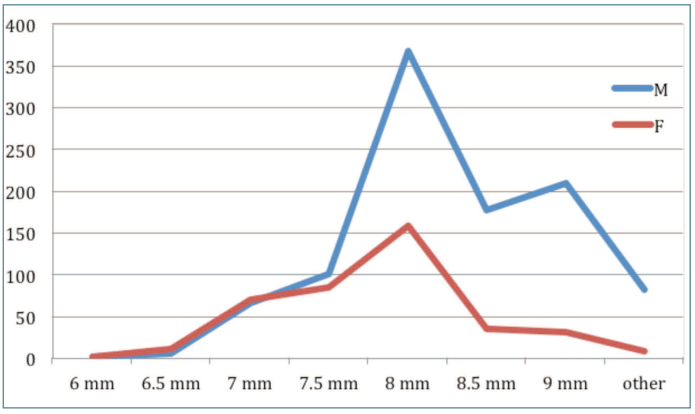

Figure 17: Graft diameter among men and women in different age groups

4.13 Femoral and tibial tunnels drilling

Antromedial portal (AM) was the most common portal for femoral tunnel drilling (Figure 18). The second common portal was the transtibial portal. The outside-in technique was the predominant technique for tibial tunnel drilling (Figure 19). These results show no change in the trends for femoral and tibial tunnels drilling compared to the results from 2013-2014.

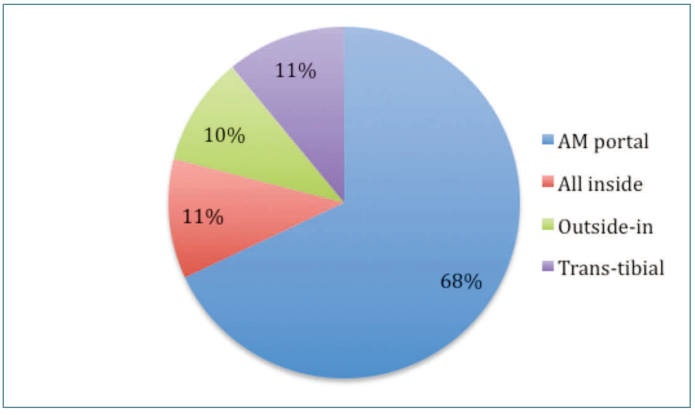

Figure 18: Femoral Tunnel Drilling Techniques

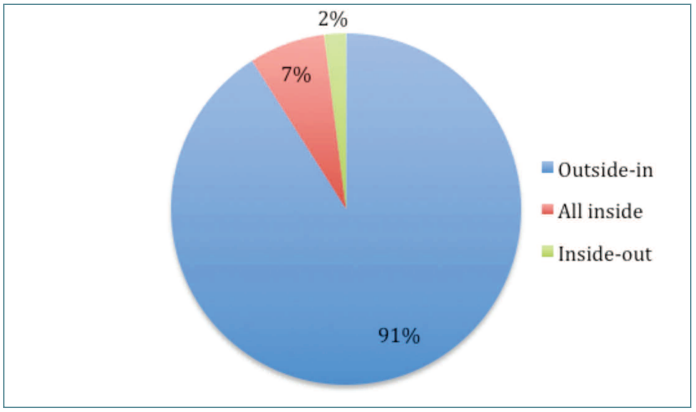

Figure 19: Tibial Tunnel Drilling Techniques

4.14 Femoral and tibial tunnels fixation

Figure (20) shows the percentage of different fixation devices for the ACL graft in the femoral tunnel. Endobutton suspensory mechanism was the most common fixation method (79%) followed by interference screws (13%). For tibial tunnel fixation, interference screws were used in 87% of ACLR procedures (Figure 21). Details of different devices used for femoral and tibial tunnel fixation are provided in Appendix A.

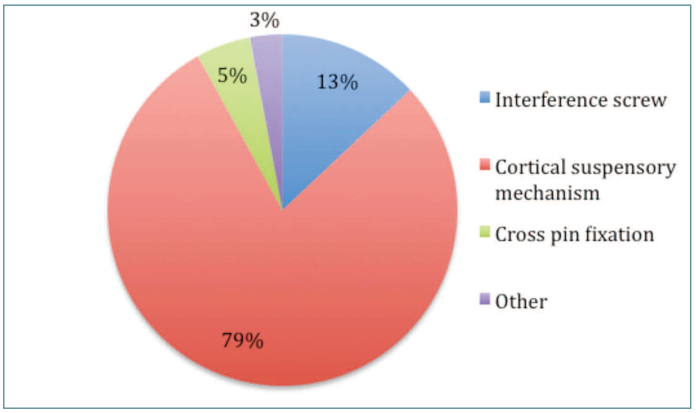

Figure 20: Femoral fixation devices

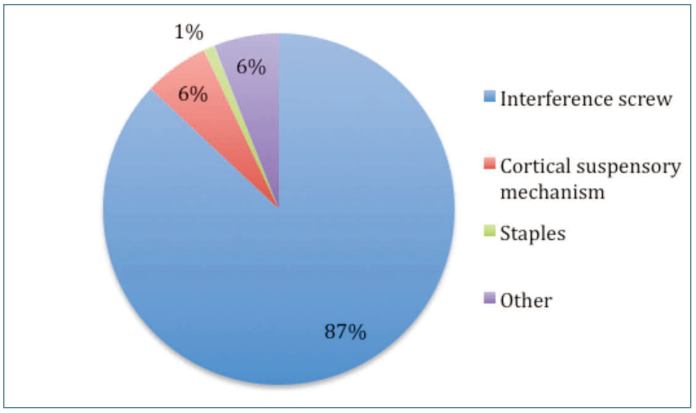

Figure 21: Tibial tunnel fixation devices

4.15 Patient reported outcome measures (PROMS)

PROMs have become an integral part for assessment of any surgical intervention. A combination of generic and disease specific outcome measure is commonly used to assess the treatment outcome. The NLR collect PROMS from patients preoperatively and at 6 months, 1 year, 2 years and 5 years postoperative ACLR surgery. The collected PROMs are EQ-5D, IKDC subjective, Tegner and KOOS scores. The results below are for all the patients registered on the NLR between December 2012 and January 2016.

4.16 EQ-5D

The EQ-5D is a simple generic measure of health for clinical and economic appraisal. It allows description of general health status along five domains. The results are presented as an index, a quality of life weighting between 0 (death) and 1 (complete health). The EQ VAS records the respondent's self-rated health on a 0 to 100 visual analogue scale with endpoints labelled 'the best health you can imagine' and 'the worst health you can imagine'. Figure 22 and figure 23 show improvement in postoperative EQ5D-index and EQ5D-VAS scores at 6 months and 1 year compared to preoperative scores.

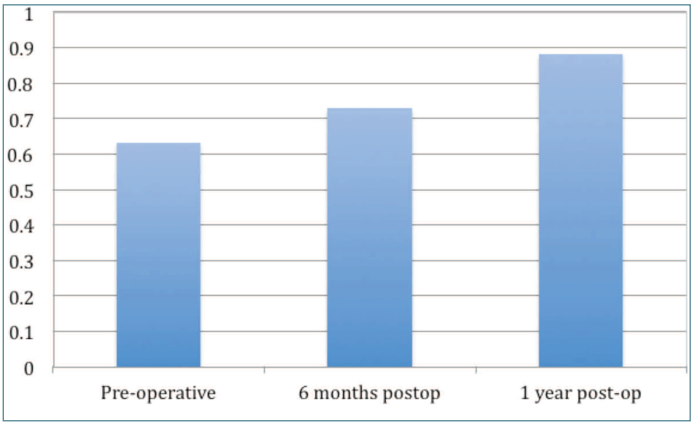

Figure 22: The average preoperative, 6 months and 1 year postoperative EQ5D-index scores for ACLR procedures

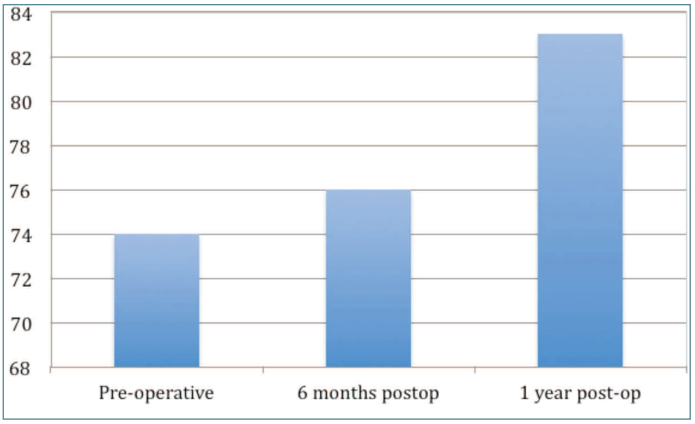

Figure 23: The average preoperative, 6 months and 1 year postoperative EQ5D-VAS scores ACLR procedures.

4.17 The International Knee Documentation Committee (IKDC)

The IKDC subjective knee questionnaire consists of 18 questions and evaluates symptoms, function, and sports activity. The raw scores are summed and transformed to a scale from 0 to 100. Figure 24 shows improvement in postoperative IKDC subjective scores at 6 months compared to preoperative score. A significant improvement in the average IKDC subjective score is noticed at 1 year postoperatively.

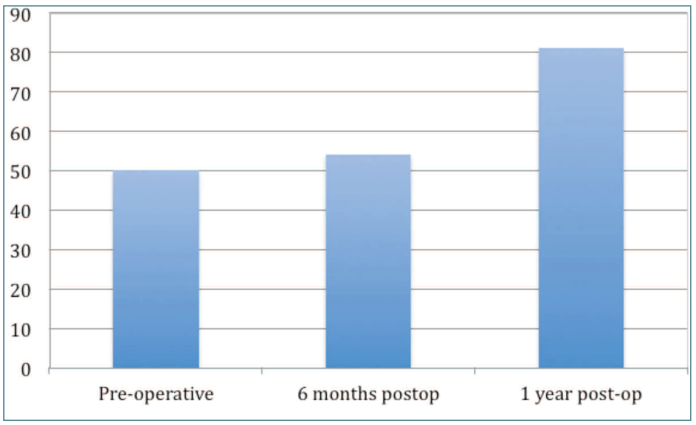

Figure 24: The average preoperative, 6 months and 1 year postoperative IKDC subjective scores for ACLR procedures.

4.18 Tegner score

The Tegner activity scale was designed as a score of activity level for patients with ligamentous injuries. The instrument scores a person's activity level between 0 and 10 where 0 is 'on sick leave/disability' and 10 is 'participation in competitive sports'.

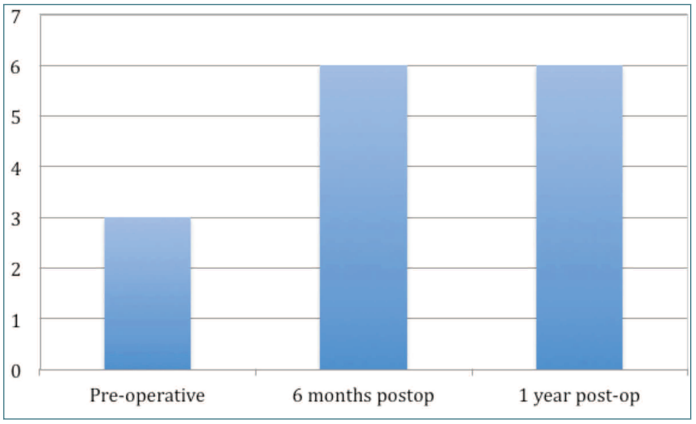

Figure 25: The average preoperative, 6 months and 1 year postoperative Tegner scores for ACLR procedures.

4.19 Knee Injury and Osteoarthritis Outcome Score (KOOS)

The KOOS is a knee-specific patient-reported instrument. It is used to evaluate five domains: pain, symptoms, activity of daily living, sport and recreation, as well as the knee-related quality of life in patients with knee injuries who are at risk of OA developing (ACL, meniscus, or chondral) injury. It consists of 42-item self- administered self-explanatory questionnaire is intended to monitor the short- and long-term consequences (i.e., OA) of these injuries. Figure 26 demonstrates the improvement in the average KOOS scores at 6 months and 1 year postoperatively across the 5 subscales. The quality of life subscale showed the highest increase in scores postoperative and was the most sensitive to change in the patient general health.

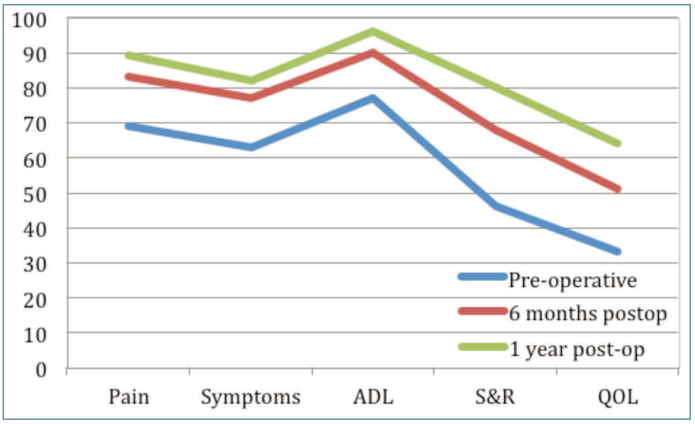

Figure 26: The average preoperative, 6 months and 1 year postoperative KOOS scores for ACLR procedures.

4.20 Compliance with the personal data and compliance with PROMS

The NLR is web-based register that relies on data entered by patients as well as surgeons. Figure 27 demonstrates the compliance rate for filling in the basic information entered for each patient. Email address is a fundamental step in registering patients on the NLR as it the main contact tool with the patient. Approximately 78% of patients have their email address entered on the NLR database.

Figure 28 shows compliance with filling in the different preoperative and postoperative PROMS questionnaires. The response rate preoperatively is over 50%. However, this drops down to around 19% at 1 year postoperatively.

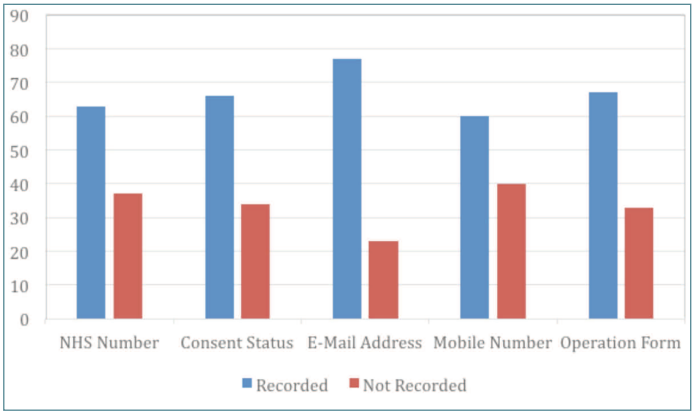

Figure 27: Compliance with basic patients information

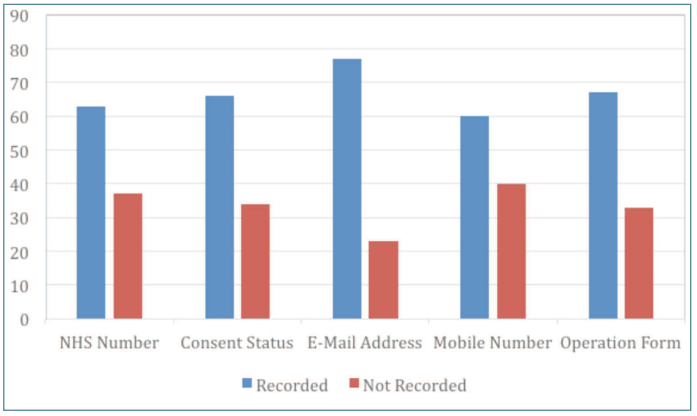

Figure 28: Response rate for different preoperative and postoperative PROMs

4.21 Complications

A total of 29 complications have been recorded on the NLR online data base (table 4). The commonest complication was wound infection (14 cases). All cases of wound infection required further surgical debridement, wound wash out and IV antibiotics apart from two cases of superficial wound infections that were treated with oral antibiotics. Graft failure was the second common complication (7 cases). One case had a snapped guide wire in the knee joint intraoperatively that required further surgery for arthroscopic removal of the snapped wire.

Table 4: Recorded complications following ACLR surgery

Complications	Number of cases	Time after ACLR
Superfecial infection	2	< 6 weeks
(Total=4)	2	> 6 weeks
Deep infection	7	< 6 weeks
(Total=10)	3	> 6 weeks
Graft failure	2	3-6 months
(Total=7)	4	6-12 months
	1	>12 months
Broken guide wire	1	< 6 weeks
Wound dehiscence and serous leak	1	< 6 weeks
Peripheral neuropraxia	1	< 6 weeks
Ongoing knee pain	3	>6 weeks
Cyclops	1	> 6 weeks
Post-menisectomy syndrome	1	> 6 weeks

5 Summary

Over the last 3 years, The NLR has provided invaluable information on the epidemiology, operative techniques and functional outcomes for patients with ACL injuries. Plenty of observations could be drawn from the data provided in this report. We had a total of 6105 ACLR patients between December 2012 and February 2016. Men in the age of 20s were the predominant group of patients who underwent ACLR surgery. Sports injuries and specifically football was the most common cause for ACL injury. Medial meniscus surgery was the most common associated procedure with ACLR surgery. Allograft was used in only 1% of patients who had ACLR procedures. Four-strands hamstring tendon was the most frequently used autograft. AM portal drilling was the most common technique for femoral tunnel drilling while it was the outside-in technique for the tibial tunnel drilling. The Endbutton suspensory mechanism was the most common method for graft fixation in the femoral tunnel while the interference screws predominated in the tibial tunnel fixation. Patients who underwent ACLR surgery showed steady progress of their functional outcome score at six month and 1 year postoperatively compared to their preoperative scores.

6 Future plans

6.1 Increase data capture

Increase number of registered consultants - The intention of this registry is to develop a safe and user-friendly system to record the extent and outcomes of knee ligament surgery in the UK. We remain a surgeon led Registry and endeavour to maintain this position in the future. This remains a 'development' area and we are aware that there are several reasons for surgeons not utilising the NLR. Smart phone and tablet apps can be developed to improve data collection by the clinical team. This enhances not only the ease of data input but creates a more systematic approach and could allow information to be inputted at the time of surgery or clinical review, reducing error and increasing registry compliance. We are currently making moves towards mandating the use of the registry in both NHS and private sectors. We are at an advanced stage of discussions with HQIP about accrediting the NLR as a 'National clinical audit' which will have significant benefits with regard to consent and data issues.

Improve data capture - The population undergoing ACL reconstructions are typically younger, more mobile and busy. This makes them difficult to trace and track which is why two of the key elements of information are the NHS number and an email address. This is the electronic age and email and text communication is the norm and must be acknowledged. It will take some effort and vigilance to enter patients but with automated follow up the process is

simple and appealing. Apps could also be developed for patient data collection – allowing subjects to collect their own data at home (e.g. video capture and sensor data). While these are likely to be more subjective they would provide invaluable insight to the patient experience opening up a whole new avenue of research work on this scale.

Demographic data - Further analysis of the patients' profile including ethnicity and social area deprivation will be conducted. The UK has the advantage of multi-ethnicity among its population, which will help better understanding for the epidemiology of ACL injuries. There is very little known about ACL injuries in the peripartum period. It would be interesting to collect data on the incidence and functional outcome for subject who had ACL injuries during peripartum period.

Increase information gathered/Include revision ACL surgery - To date, we have concentrated on a single procedure, primary ACLR, and we are confident that the results will benefit future surgeons and patients alike. When established it will ease the journey to develop similar pathways for the revision of ACL procedures and other ligament reconstructions.

Intra-operative data - The current operative form on NLR website doesn't have a differentiation between single and double bundle ACLR. The form also identifies collateral ligament surgery without identification whether medial or lateral. These two important surgical details need to be added to the operative form.

Post-operative data - We are working to involve our physical therapists in this work to a greater degree and are planning, in connection with the replacement of IT platforms, to improve our website when it comes to follow-ups after surgery and rehabilitation. Granting access to physiotherapists to input data online during rehabilitation will enrich our resister with objective assessments for ACLR patients during rehabilitation period. Objective measures such as lachman test and KT-1000 could be recorded online by the physiotherapists on follow up assessment.

6.2 Improved data analysis

Data analysis is the end point against which the NLR will be judged. Currently data analysed using simple correlations and basic statistical analysis. The world of data analysis is changing rapidly – especially with new fully validated machine learning tools – the NLR must look to these methods to truly uncover the impact of the data being collected. In conjunction with the computer science department at UCL, it is recommended to develop machine learning tools (e.g. Supervised learning, Unsupervised learning, Dimensionality Reduction, Evolutionary Optimisation) to uncover patterns in the data and build predictive surgical models – which may even be used in the future to guide people on the ideal operation based on patient demographics and injury details. This opens up a whole new field of research possibilities and uses for the NLR. It will also shed the light on new evidence that may have been missed by traditional analytical methods.

6.3 Improve Consultant Gains

Clinicians now have a framework to collect outcome data regarding their own ACLR practice, benchmarking it against practice across the NHS. The data can also be a valuable contribution towards each surgeon's annual appraisal and revalidation.

Appendices

Appendix A: Femoral and tibial tunnels fixation devices

Table 5 Femoral tunnel fixation devices

Devices	2012-2014	2015	Total
Arthrex Bio-Interferance	2	-	2
Arthrex Cannulated Full Thread Interference Screw	1	2	3
Arthrex RetroButton	75	101	176
Arthrex TightRope	159	216	375
Arthrex Transfix	11	9	20
DePuy Mitek Intrafix ACL Fixation	1	-	1
DePuy Mitek Rigidfix	64	73	137
LARS Interference Screw	1	5	6
Linvatec BioScrew	14	24	38
Linvatec ExoButton	12	21	33
Other	49	55	104
Smith and Nephew BIORCI RT	4	-	4
Smith and Nephew BIORCI-HA screw	6	1	7
Smith and Nephew Calaxo	1	-	1
Smith and Nephew Endobutton	917	973	1890
Smith and Nephew RCI	145	82	227
Smith and Nephew RCI RT	93	65	158
Smith and Nephew Soft Silk	44	40	84
Stortz MegaFix	43	-	43
Smith and Nephew BioSure HA screw	3	2	5
Biomet ToggleLoc with Ziploop	16	32	48
Biomet EZLoc	15	11	26
Linvatec Matryx Femoral screw	4	9	15
Smith and Nephew BIORCI	2	1	3
Arthrex BTB Tight-Rope	4	14	18
Arthrex Medical Portal TransFix	2	3	5

Table 5: Tibial Tunnel fixation devices

Devices	2012-2014	2015	Total
Arthrex GraftBolt	11 11	74	85
Arthrex FlipCutter	3	26	29
Arthrex Medical Portal TransFix	1	-	1
Arthrex Soft Screw	9	53	63
Arthrex TightRope	93	95	188
ArthrexTransfix	9	-	9
DePuy Mitek Bio-Intrafix ACL Fixation	136	140	276
DePuy Mitek Milagro Biocryl Rapide	9	-	9
DePuy Mitek Intrafix	1	7	8
LARS Interference Screw	1	-	1
Linvatec Bioscrew	8	28	36
Linvatec Bioscrew XtraLok	98	-	98
Linvatec XtraLok Screw	71	105	176
Other	85	116	201
Other Screw	83	95	178
Screw/Washer	1	4	5
Smith and Nephew BIORCI HA screw	75	46	121
Smith and Nephew BioSure HA screw	216	197	413
Smith and Nephew RCI	625	527	1152
Smith and Nephew RCI RT	19	41	60
Smith and Nephew Soft Silk	39	42	81
Staples	5	5	10
Stortz MegaFix	69	13	82
Stortz MegaFix T	-	18	18
Sutures and Post	6	3	9
Biomet WasherLoc	15	8	24
Arthrex BTB Tight-Rope	1	1	2
DePuy Mitek Milagro	27	68	95
Biomet TunneLoc	7	20	27
Arthrex Titanium Soft screw	1	3	4

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