

XBase

THE SWEDISH NATIONAL
KNEE LIGAMENT REGISTRY

The Swedish knee ligament registry. Annual Report 2018.

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3763 primary operations and 359 revisions. Clinics performing surgery 2018:

ARTROCENTER AKADEMISKA SJUKHUSET ALERIS ORTOPEDI ÄNGELHOLM ALINGSÅS
 LASARETT ART CLINIC ART CLINIC GÖTEBORG BLEKINGESJUKHUSET CAPIO ARTRO
 CLINIC CAPIO LUNDBY NÄRSJUKHUS CAPIO LÄKARGRUPPEN I ÖREBRO AB CARLANDERSKA
 ORTOPEDI CENTRALLASARETTET VÄXJÖ CITYAKUTEN PRIVATVÅRD DANDERYDS SJUKHUS
 DROTTNING SILVIAS BARN- OCH UNGDOMSSJUKHUS ELISABETHSJUKHUSET FALU LASARETT
 FRÖLUNDA SPECIALISTSJUKHUS FRÖLUNDAORTOPEDEN GÄVLE SJUKHUS HELSINGBORGS
 SJUKHUS HUDIKSVALLS SJUKHUS HÄSSLEHOLMS SJUKHUS HÖGLANDSSJUKHUSET KALMAR
 SJUKHUS KARLSTAD CENTRALSJUKHUS KAROLINSKA UNIVERSITETSSJUKHUSET/ORTOPED-
 KLINIKEN KUNGSBACKA SJUKHUS KUNGÄLVS SJUKHUS KÄRNSJUKHUSET I SKÖVDE
 LASARETTET I ENKÖPING LINKÖPINGS UNIVERSITETSKLINIK LJUNGBY LASARETT
 LÄKARHUSET HERMELINEN LÄNSSJUKHUSET RYHOV MOVEMENT MEDICAL AB MÄLARSJUK-
 HUSET ESKILSTUNA NORRLANDS UNIVERSITETSSJUKHUS, UMEÅ NORRTÄLJE SJUKHUS
 NU-SJUKVÅRDEN NYKÖPINGS LASARETT ORTHOCENTER I SKÅNE ORTHOCENTER STOCKHOLM
 ORTHOCENTER/IFK-KLINIKEN ORTOPEDISKA HUSET CAREMA ORTOPEDSPECIALISTERNA
 OSKARSHAMNS SJUKHUS PRAKTIKERTJÄNST ORTOPEDI STOCKHOLM SABBATSBERG
 NÄRSJUKHUSET SAHLGRENSKA UNIVERSITETSSJUKHUSET SKELLEFTEÅ SJUKHUS
 SKÅNES UNIVERSITETSSJUKHUS SOLLEFTEÅ SJUKHUS SOPHIAHEMMET SPECIALISTCENTER
 SCANDINAVIA SPORTS MEDICINE UMEÅ SPORTSMED SUNDERBY SJUKHUS SÖDERMALMS
 ORTOPEDI SÖDERSJUKHUSET SÖDRA ÄLVSBORGS SJUKHUS VISBY LASARETT VRINNEVI-
 SJUKHUSET VÄSTERVIKS SJUKHUS VÄSTERÅS CENTRALLASARETTET VÄSTERÅS ORTOPED-
 PRAKTIK ÖREBRO USÖ ÖRNSKÖLDSEVIKS SJUKHUS ÖSTERSUNDS SJUKHUS

Preface

The incidence of anterior cruciate ligament (ACL) injuries has been reported from a number of studies with a range of between 32-70/100,000 inhabitants/year. Recent Swedish studies based on national data from population-based studies indicate an incidence of around 80/100,000 inhabitants/year. ACL injury is a serious knee injury which, without satisfactory treatment, often helps to prevent young people from continuing to engage in heavy physical work or physical exercise and sport at recreational or elite level. Regardless of the primary treatment, studies have revealed that about 50% of patients present radiological signs of knee arthrosis within 10-15 years after the initial injury.

Treatment can take the form of only rehabilitation or a combination of surgery (ACL reconstruction) followed by rehabilitation. It is estimated that about half of all cruciate ligament injuries are not the subject of surgery for different reasons. An injury frequency of approximately 80 per 100,000 inhabitants a year in Sweden would mean that some 7,000 individuals suffer anterior cruciate ligament injuries every year and that some 3,500 undergo surgery. Recent studies reveal that around 20% of the patients undergoing surgery require repeat surgery within the space of a few years as a result of complications, first and foremost meniscal and/or cartilage damage, restricted mobility or the failure of the reconstructed cruciate ligament. The results after secondary surgery are probably poorer than after primary surgery. Good results have been reported in the short term after the primary operation, but there are only a few studies that are randomized or have a long follow-up. The number of operations per surgeon is unevenly distributed and about 40% of all surgeons perform fewer than 10 operations a year. A trend towards an increase in the number of operations per surgeon has, however, been seen since the knee ligament registry began in 2005.

To begin with, the knee ligament registry was a surgical registry, but attempts are now being made to register all the patients with this injury, regardless of surgical or non-surgical treatment. The absolute majority of the patients registered so far have undergone surgery and this annual report therefore includes a preliminary analysis of patient-reported data following non-surgical treatment. We are working to involve physical therapists in this work to a greater degree and we are also planning to improve our website when it comes to follow-ups after surgery and rehabilitation.

Goals and goal fulfillment

The overall goal of the registry is to promote the improved care of individuals with ACL injuries.

Treatment

The goal when treating an individual who has suffered an ACL injury should be a satisfied patient with optimal knee function, a high level of satisfaction and normalized, health-related quality of life. The result should also be long lasting.

In every case, an ACL injury should be treated with structured, purpose-designed rehabilitation. In at least 50% of cases, surgical stabilization of the injured knee is also needed to meet the patient's knee-function requirements, but which individuals require which treatment has not been scientifically documented. In all probability, a return to a high activity level, first and foremost in contact sports (such as soccer, handball and floorball), will necessitate an increase in the need for surgical treatment.

The main indication for an ACL reconstruction is, however, lasting symptoms in the form of functional instability. This is frequently described as the "knee giving way" or the patient being unable to rely on his/her knee.

Registry coverage

The target is 100% coverage of the number of registered operation reports. An annual check is made with the Swedish Board of Health and Welfare's patient registry at ID number level. At the present time, more than 90% of all operations are registered.

ACL reconstruction

There are currently about 80 clinics in Sweden that provide orthopedic care. Of these, 70 (unchanged over time) have informed the knee ligament registry that they performed ACL surgery in 2018.

Validity of input data

Patient-reported data cannot be validated retrospectively, but they are assumed to be valid, as the patients themselves register them. Comprehensive error checks are made when the data are entered and control software is run the whole time.

The surgical data are fed in by surgeons and the target for the Swedish knee ligament registry is that at least 95% of all the data that are entered are a direct match with patient notes and surgery reports. This has been confirmed by a previous study.

Dissemination of registry data and results

The target is that registry data should be readily available to all caregivers and that the annual report from the registry should reach all the clinics in Sweden running orthopedic programs. We are also hoping that the annual report will be disseminated at international level by translating it and through participation at different international meetings.

The registry is open to all the participating clinics when it comes to their own data. The annual report is distributed to all the orthopedic clinics and their clinical directors in Sweden. In 2010, the annual report was translated into English for the first time and it attracted a great deal of international interest. The steering committee is also planning to commission an English translation of the 2018 report..

Future vision for the Swedish quality registry

Every individual who suffers an ACL injury in Sweden is to be included in the Swedish knee ligament registry and followed up.

An ACL injury has serious consequences for the individual who sustains it. In the short term, the injury causes a reduction in activity levels and, in the longer term, one in every two sufferers develops arthrosis in the injured knee. Treatment can take the form of rehabilitation alone or with the addition of the surgical reconstruction of the damaged ligament. In the short term, many individuals experience a return to satisfactory knee function with the help of the two treatment methods, but we do not know which individuals should avoid surgical treatment and which require it. Nor is there currently any scientific proof that either treatment reduces the risk of future arthrosis.

One important line of development for the knee ligament registry is to include all patients with ACL injuries, regardless of how they are treated in the short and long term. In this way, data from the registry will be able to spotlight the risk of both short-term and long-term consequences of the injury in relation to the treatment that was given (no treatment, structured rehabilitation alone and surgical reconstruction combined with rehabilitation).

The success and usefulness of a registry are dependent on its coverage in terms of both baseline data and follow-up data. We currently have good coverage of the ACL reconstructions that are performed in Sweden (approx. 90% compared with the patient registry), but this figure needs to be confirmed in a separate validation process which we shall be presenting during the next year. There is, however, real scope for improvement when it comes to patient-reported follow-up data, as more than half of all patients are lost after five years.

The database is run by Karolinska University Hospital in its capacity as registry owner. Future collaboration with other orthopedic registries is a future vision which the steering committee favors.

Areas for improvement and action

Inclusion of all injured individuals regardless of treatment

The registry is still a surgery registry, even if the aim for several years has also been to include non-operated individuals with ACL injuries.

Recently published incidence data reveal that some 40-50% of all individuals with ACL injuries are treated without surgery. Within the framework of this project, we plan to contact specialist rehab units to evaluate the potential for registering patients via physical therapists offering treatment. Our aim is to involve these physical therapists as informants in the same way surgeons have provided information until now. This should increase the amount of information on specific knee function and a possible return to sports, but, first and foremost, it should increase the flow of patients who have recently sustained injuries and have been treated without surgery.

Preoperative patient-reported data

In the case of patients who undergo surgery, the frequency of patients' self-reported data prior to surgery is slightly more than 60%. There is a large difference between clinics. The steering committee has access to a coordinator who has been tasked with contacting all the clinics to investigate how we can improve the reporting of data. This work is ongoing and the steering committee is optimistic that the frequency of preoperative data reporting will improve in the future. Preoperatively, all clinics should approach 100%, as this is the "last" opportunity to collect all preoperative data. The knee ligament registry's steering committee is hoping to encourage all county councils and insurance companies not only to participate in the knee ligament registry but also to guarantee up to 100% preoperative registration (minimum requirement 90%). The Stockholm County Council introduced this in the requirements for orthopedic health-care selection in 2014, but it was subsequently removed in 2016. The steering committee is working actively to make participation in different registries mandatory when new care selections are made.

Quality of input data

At the present time, the registry data are fed in by patients (patient-reported data) and surgeons (surgical data) and we are reliant on the precision of the person responsible for registration when this takes place. A previous validation has revealed that the quality of the input data is generally good (the majority with more than 97% agreement compared with patient notes), but it has also identified variables of poorer quality. The steering committee has recently examined all the variables to facilitate registration and to remove variables with poor reliability. New variables have been added.

Data loss

The response rate for patient-reported data on all follow-up visits is low and no trend towards improvement can be seen. The follow-up data after two and five years, however, still have a low response rate (approx. 50% and 40% respectively). It is pleasing to report that the 10-year follow-up for 2005–2018 produced a response rate of around 40%. Patient-reported data are still followed up through targeted inquiries to patients' home addresses using the conventional postal service, one, two, five and ten years after surgery. The steering committee is working internationally to shorten the PROM questionnaires, first and foremost the KOOS, and to replace it with new questionnaires. Measures, such as the opportunity to use social media or mobile applications to maintain contact with patients, have been discussed.

This is, however, associated with some ethical and technical problems which need to be resolved before implementation can take place. A sharp improvement in response rates is still a top priority.

Improvement seminar

In collaboration with selected clinics, an improvement seminar was run in 2017. A large training activity was planned for 2019, but it was cancelled due to questions related to future economy.

Each surgeon is able to process the de-identified data in the registry using statistical functions that are posted on the website and he/she can also perform calculations on different variables.

Coverage and response rate

The Swedish National Board of Health and Welfare registered 4,062 ACL operations (both primary operations and revisions with surgery code NGE41) in 2017. The knee ligament registry contains 4,200 registered operations in the same year.

Matching at personal ID number level reveals that the knee ligament registry and the patient registry have a total of 4,664 unique ACL operations.

TABLE 1A
Response rate KOOS distributed by year of surgery

Year	KOOS									
	Pre-op		One year postop		Two years postop		Five years postop		10 years postop	
	N	%	N	%	N	%	N	%	N	%
2018	2349	57	246							
2017	2498	59	1864	45	247					
2016	2623	67	1720	45	1504	40				
2015	2713	72	1515	40	1489	41				
2014	2603	70	1708	47	1280	36	158			
2013	2763	74	1991	54	1610	44	1255	37		
2012	2621	70	1855	50	1830	51	1260	37		
2011	2495	70	1892	54	1750	51	1092	34		
2010	2448	68	1687	48	1806	52	1320	40		
2009	2363	72	1474	46	1583	50	1534	51	123	
2008	2045	65	1747	56	1459	48	1481	51	1054	37
2007	1639	56	1588	55	1335	47	1475	54	1007	39
2006	1505	57	1330	51	1245	49	1198	49	790	34
2005	1189	57	1063	51	1011	50	905	47	837	46
Total	31854	66	21680	49	18149	47	11678	44	3811	39

TABLE 1B
Response rate EQ-5D and/or EQ-VAS distributed by year of surgery

Year	EQ									
	Pre-op		One year postop		Two years postop		Five years postop		10 years postop	
	N	%	N	%	N	%	N	%	N	%
2018	2240	54	244							
2017	2346	56	1857	45	241					
2016	2382	61	1686	44	1480	40				
2015	2547	67	1437	38	1475	40				
2014	2452	66	1649	45	1256	35	153			
2013	2646	71	1928	52	1584	44	1237	36		
2012	2455	65	1787	48	1797	50	1238	36		
2011	2264	64	1830	52	1721	50	1077	33		
2010	2256	63	1614	46	1780	52	1298	40		
2009	2244	69	1401	43	1548	49	1508	50	120	
2008	1957	62	1664	53	1414	46	1458	50	1037	37
2007	1645	56	1580	55	1295	46	1460	54	991	38
2006	1303	50	1338	51	1242	49	1171	48	776	33
2005	950	45	1018	49	1042	52	846	44	825	45
Total	29687	61	21033	48	17875	46	11446	43	3749	39

Pre-op One year post-op Two years post-op Five years post-op 10 years post-op.

If the results are to be credible and applicable in a research context, the response rate for patient-reported data should be high. The response rate for the EQ-5D is slightly lower than that for the KOOS.

Funding the knee ligament registry

For 2018, around SEK 1 million was allocated. Taking balanced funds into account, no allocation has been granted for 2019. Compared with previous years, allocations have declined slightly and new reductions can be expected in the future. The registrar, Magnus Forssblad, is employed on a part-time basis at the Orthopedic Clinic at Karolinska Hospital. Anna Pappas works as a part-time administrator of the knee ligament registry.

Remuneration system and ACL operations

In the majority of cases, remuneration for ACL operations in Sweden is based on the DRG (diagnosis-related group) system. An ACL operation without complications is classified as DRG group H100 as day surgery and H13E as in-patient care. This group contains virtually all knee operations, apart from knee arthroplasty and less complex knee surgery in the form of day surgery (H120). The national weighting list also includes a factor of 2 when comparing day surgery with in-patient care. In the case of DRG H100, this dependence on point pricing results in remuneration for day surgery of between SEK 10,000 and 20,000 compared with between SEK 30,000 and 45,000 for in-patient care. The approximate cost price of an ACL operation is estimated at between SEK 25,000 and 30,000. The DRG remuneration is based on cost prices from different hospitals and, with the increase in specialization that has taken place in recent years, there are bound to be large differences between the case mix of operations at

different hospitals. In its current form, the system is not steering the remuneration towards increased day surgery, for example.

Nor do many private caregivers divulge their cost prices, as a result of the way negotiations are conducted. If they did, the purchaser would have complete insight into the economic situation of the person making the tender and this would then jeopardize the procurement process. In the longer term, a “less flexible” DRG system could also lead caregivers to choose not to perform more difficult operations as a result of inadequate remuneration.

In the Stockholm health-care selection set-up, all types of ACL operation (primary, revisions, multi-injuries) are entitled to the same amount of remuneration, regardless of complexity and cost price. To perform ACL operations within this health-care selection set-up, the surgeons performing these operations must perform at least 25 ACL operations a year, but no follow-up appears to be made.

The differences between county councils when it comes to remuneration pose a large problem and are creating inequality in terms of health care. Each clinic is tied to the same remuneration obtained from its individual county council. In spite of discussions with the SKL, Sweden’s Municipalities and County Councils, among others, no initiatives have been taken to change the remuneration for the free health care selection set-up and foreign patients. A nationwide pricelist would be the obvious alternative.

Organization

The Swedish knee ligament registry is administered by Karolinska University Hospital and the principal is the board.

Magnus Forssblad has been appointed by Karolinska University Hospital and the steering committee as the registrar.

The contact person and administrator is Anna Pappas at the Sports Trauma Research and Education Center, Karolinska Institutet, and the Capio Artro Clinic.

In 2018, the steering committee was made up of the following representatives from different regions in Sweden.

- Martin Englund, Professor, Lund University and Skåne University Hospital
- Karl Eriksson, Associate Professor, Söder Hospital, Stockholm
- Magnus Forssblad, Associate Professor, Karolinska University Hospital and the Sports Trauma Research and Education Center, Karolinska Institutet, Stockholm
- Anne Fältström, MD, Linköping University and the Ryhov County Hospital, Jönköping
- Erik Hamrin Senorski, MD, Sahlgrenska University Hospital, Gothenburg
- Professor Jon Karlsson, Sahlgrenska University Hospital, Gothenburg (until April 2019)
- Professor Jüri Kartus, NU-sjukvården, Trollhättan/Uddevalla
- Christina Mikkelsen, MD, Capio Artro Clinic and Sports Trauma Research and Education Center, Karolinska Institutet, Stockholm
- Paul Neuman, MD, Skåne University Hospital
- Kristian Samuelsson, Professor, Sahlgrenska University Hospital, Gothenburg
- Anders Stålman, MD, Capio Artro Clinic and Sports Trauma Research and Education Center, Karolinska Institutet, Stockholm

Tomas Antonelius, Stockholm, has been consulted as patient representative.

Henrik Hedevis, a statistician at Linköping University, has been co-opted as a member of the steering committee.

IT organization

The IT operations relating to the Swedish knee ligament registry are administered by Karolinska University Hospital, with both a relationship database as the base and a web-based solution for all users. Data operations are administered by Datatrion AB.

Research partnerships

The Swedish knee ligament registry enables data based on a very large number of individuals to be studied. This is an advantage that increases the safety of research results compared with an individual clinical study which, for various reasons, has problems encompassing such extensive patient material. In the Nordic region, Denmark and Norway also have effective national knee ligament registries which, like the Swedish registry, have been established for more than 15 years. To further increase the study population and thereby the accuracy of studies, the steering committee is encouraging national and international collaboration to enable data from different registries to be combined. It is pleasing to report that this has increased in recent years.

Research groups in Stockholm, Gothenburg and Linköping are running several projects in collaboration and they are planning to publish a number of reports over the next few years. Collaboration with Norway and Denmark continues and we can look forward to more studies including all the Nordic ACL patients. Registries have also been set up in other countries and their steering committees get together every year in conjunction with orthopedic meetings. This collaboration has resulted in a number of international initiatives such as ESSKA, ISAKOS and the ACL study group. More reports based on several international registries will also be initiated in the near future. A registry for children – PAMI – is an additional European initiative.

All the overarching registry projects involving data from the Swedish knee ligament registry are applied for and approved according to formal research agreements in accordance with the framework of the knee ligament registry.

Registry data

The registry reports ACL reconstructions in Sweden from January 2005. This information is individually based and the patient's personal ID number automatically shows his/her age and gender. The diagnosis is based on data that are entered manually. During the period 2005-2018, 45,090 primary ACL reconstructions and 3,322 revisions from a total of 91 clinics were registered.

Number of operations per clinic in 2005-2018

TABLE 2

Primary reconstructions and revisions distributed by region and clinic in 2005-2016, 2017 and 2018.

Region	Clinic	2018				2017				2005-2016			
		Primary	Revision	KOOS pre-op		Primary	Revision	KOOS pre-op		Primary	Revision	KOOS pre-op	
				Response				Response				Response	
		N	N	N	%	N	N	N	%	N	N	N	%
Greater Stockholm	KAROLINSKA UNIVERSITETS-SJUKHUSET	0	0	0	0	19	0	1	5	190	1	132	69
	ARTROCENTER	57	9	6	9	46	9	7	13	29	4	1	3
	S:T GÖRANS SJUKHUS CAPIO	0	0	0	0	0	0	0	0	102	5	2	2
	CITYAKUTEN PRIVATVÅRD	15	1	0	0	7	0	0	0	52	1	0	0
	DANDERYDS SJUKHUS	24	3	4	15	50	2	16	31	329	16	146	42
	LÖWETS SPECIALISTMOTTAGNING	0	0	0	0	0	0	0	0	247	0	215	87
	KAROLINSKA UNIVERSITETS-SJUKHUSET/ORTOPEDKLINIKEN	8	0	0	0	23	2	3	12	646	41	370	54
	NACKA NÄRSJUKHUS	0	0	0	0	0	0	0	0	105	5	51	46
	ODENPLANS LÄKARHUS	0	0	0	0	0	0	0	0	201	14	19	9
	ORTOPEDISKA HUSET CAREMA	9	0	3	33	15	1	14	88	725	43	342	45
	PRAKTIKERTJÄNST ORTOPEDI	193	17	148	70	41	9	12	24	0	0	0	0
	SABBATSBERG NÄRSJUKHUSET	93	7	64	64	16	1	16	94	146	14	86	54
	SÖDERMALMS ORTOPEDI	9	0	2	22	48	2	12	24	52	2	28	52
	SÖDERTÄLJE SJUKHUS	0	0	0	0	9	0	2	22	82	0	7	9
	SÖDERSJUKHUSET	76	14	35	39	136	9	53	37	1336	104	748	52
	SOPHIAHEMMET	6	2	6	75	12	1	3	23	53	4	16	28
	ORTHOCENTER STOCKHOLM	25	2	24	89	64	4	62	91	376	23	212	53
	CAPIO ARTRO CLINIC	685	73	542	72	789	79	646	74	7053	663	7276	94
Total	1200	128	834	63	1275	119	847	61	11724	940	9651	76	
Svealand + Gotland	AKADEMISKA SJUKHUSET	63	6	3	4	64	4	1	1	143	6	9	6
	BOLLNÄS SJUKHUS	0	0	0	0	3	0	3	100	9	2	7	64
	LASARETTET I ENKÖPING	12	0	0	0	31	1	5	16	72	6	7	9
	ELISABETHSJUKHUSET	92	16	71	66	95	14	76	70	757	70	509	62
	FALU LASARETT	50	2	13	25	45	4	11	22	524	29	232	42
	GÄVLE SJUKHUS	16	0	8	50	32	0	20	63	389	10	250	63
	HUDIKSVALLS SJUKHUS	13	1	12	86	15	2	15	88	295	17	257	82
	KARLSTAD CENTRALSJUKHUS	51	11	10	16	59	3	12	19	817	73	146	16
	KARLSKOGA LASARETT	0	0	0	0	0	0	0	0	11	0	9	82
	CAPIO LÄKARGRUPPEN I ÖREBRO AB	18	1	17	89	15	1	16	100	557	64	609	98
	MÄLARSJUKHUSET ESKILSTUNA	6	0	0	0	6	1	0	0	383	18	294	73
	NORRTÄLJE SJUKHUS	14	2	4	25	13	0	6	46	138	4	67	47
	NYKÖPINGS LASARETT	7	0	3	43	6	0	2	33	131	2	9	7
	ÖREBRO USÖ	79	3	57	70	89	5	38	40	342	20	126	35
	SAMARITERHEMMETS SJUKHUS	0	0	0	0	0	0	0	0	221	17	86	36
	SPECIALISTCENTER SCANDINAVIA	35	1	14	39	38	1	6	15	9	0	2	22
	VÄSTERÅS CENTRALLASARETTET	57	3	22	37	69	4	35	48	244	11	91	36
	VISBY LASARETT	8	1	4	44	12	1	8	62	94	3	73	75
VÄSTERÅS ORTOPEDPRAKTIK	27	2	14	48	32	2	15	44	128	7	71	53	
Total	548	49	252	42	624	43	269	40	5264	359	2854	51	

TABLE 2 continues on the next page.

Continuation of TABLE 2.

Region	Clinic	2018				2017				2005-2016			
		Primary	Revision	KOOS pre-op		Primary	Revision	KOOS pre-op		Primary	Revision	KOOS pre-op	
				N	%			N	%			N	%
		N	N	N	%	N	N	N	%	N	N	N	%
Skåne	ALERIS ORTOPEDI ÄNGELHOLM	8	1	2	22	14	2	6	38	625	43	523	78
	HÄSSLEHOLMS SJUKHUS	52	4	48	86	69	4	66	90	808	31	750	89
	HELSINGBORGSSJUKHUS	89	6	77	81	124	9	107	80	523	22	482	88
	LUNDS UNIVERSITET	0	0	0	0	0	0	0	0	412	21	244	56
	MALMÖ ALLMÄNNA SJUKHUS	0	0	0	0	0	0	0	0	788	66	731	86
	ORTHOCENTER I SKÅNE	39	1	29	73	31	0	21	68	108	15	90	73
	SKÅNES UNIVERSITETSSJUKHUS	230	22	159	63	233	23	155	61	1475	118	1181	74
	Total	418	34	315	70	471	38	355	70	4739	316	4001	79
Halland	HALMSTADS SJUKHUS	0	0	0	0	0	0	0	0	68	6	32	43
	KUNGSBACKA SJUKHUS	114	10	25	20	87	8	35	37	765	56	520	63
	MOVEMENT MEDICAL AB	72	14	57	66	65	13	47	60	1090	81	768	66
	ORTOPEDSPECIALISTERNA	56	3	41	69	50	1	29	57	17	0	13	76
	Total	242	27	123	46	202	22	111	50	1940	143	1333	64
Småland + Blekinge	ART CLINIC	10	1	7	64	14	1	13	87	48	2	41	82
	HÖGLANDSSJUKHUSET	34	1	17	49	0	0	0	0	479	16	216	44
	KALMAR SJUKHUS	37	1	23	61	31	4	15	43	643	41	326	48
	BLEKINGESJUKHUSET	16	0	7	44	21	0	8	38	111	1	40	36
	LJUNGBY LASARETT	31	0	0	0	10	1	1	9	202	8	75	36
	OSKARSHAMNS SJUKHUS	18	0	7	39	19	0	11	58	337	5	236	69
	LÄNSSJUKHUSET RYHOV	43	6	14	29	39	1	9	23	322	20	147	43
	CENTRALLASARETTET VÄXJÖ	36	2	28	74	44	4	46	96	560	32	449	76
	VÄRNAMO SJUKHUS/ORTOPED-KLINIKEN	0	0	0	0	0	0	0	0	75	1	57	75
	VÄSTERVIKS SJUKHUS	11	1	5	42	16	0	12	75	147	3	32	21
Total	236	12	108	44	194	11	115	56	2924	129	1619	53	
Västra Götaland	ALINGSÅS LASARETT	9	0	2	22	14	2	12	75	316	29	286	83
	ART CLINIC GÖTEBORG	21	2	2	9	10	3	2	15	25	1	10	38
	SÖDRA ÄLVSBERGS SJUKHUS	12	0	5	42	27	0	7	26	177	1	99	56
	CARLANDERSKA ORTOPEDI	4	0	0	0	10	0	6	60	34	0	14	41
	DROTTNING SILVIAS BARN- OCH UNGDOMSSJUKHUS	12	0	0	0	25	0	1	4	35	1	3	8
	FRÖLUNDAORTOPEDEN	6	0	3	50	4	0	2	50	13	0	5	38
	FRÖLUNDA SPECIALISTSJUKHUS	21	3	8	33	21	3	17	71	259	26	251	88
	ORTHOCENTER/IFK-KLINIKEN	241	31	221	81	156	21	159	90	1212	127	916	68
	KUNGÄLVS SJUKHUS	28	0	16	57	23	0	16	70	142	1	104	73
	CAPIO LUNDBY NÄRSJUKHUS	112	11	73	59	119	8	83	65	413	8	239	57
	LIDKÖPINGS SJUKHUS	0	0	0	0	0	0	0	0	226	8	30	13
	NU-SJUKVÅRDEN	69	7	43	57	81	6	73	84	1132	129	954	76
	PERAGO ORTOPEDKLINIK	0	0	0	0	0	0	0	0	124	14	48	35
	KÄRNSJUKHUSET I SKÖVDE	21	0	5	24	36	3	11	28	79	0	23	29
	SPORTSMED	15	2	7	41	26	1	13	48	79	4	41	49
	SAHLGRENSKA UNIVERSITETS-SJUKHUSET	159	25	126	68	153	27	140	78	1644	152	1016	57
	VARBERGS SJUKHUS	0	0	0	0	0	0	0	0	279	4	185	65
	Total	730	81	511	63	705	74	542	70	6189	505	4224	63

TABLE 2 continues on the next page.

Continuation of TABLE 2.

Region	Clinic	2018				2017				2005-2016			
		Primary	Revision	KOOS pre-op		Primary	Revision	KOOS pre-op		Primary	Revision	KOOS pre-op	
		N	N	N	%	N	N	N	%	N	N	N	%
Östergötland	LINKÖPINGS HEALTH CARE	0	0	0	0	0	0	0	0	1	0	1	100
	LINKÖPINGS UNIVERSITETSKLINIK	58	3	39	64	66	6	50	69	755	44	567	71
	VRINNEVISJUKHUSET	57	3	33	55	72	8	56	70	888	44	605	65
	Total	115	6	72	60	138	14	106	70	1644	88	1173	68
Norrland	ALFREDSON TENDON CLINIC	0	0	0	0	0	1	0	0	2	0	0	0
	GÄLLIVARE SJUKHUS	0	0	0	0	0	0	0	0	65	1	35	53
	LÄKARHUSET HERMELINEN	9	0	1	11	6	0	0	0	70	0	30	43
	MEDICIN DIREKT	0	0	0	0	2	0	1	50	468	35	334	66
	ÖRNSKÖLDSVIKS SJUKHUS	22	0	22	100	19	0	19	100	141	8	141	95
	ÖSTERSUNDS SJUKHUS	58	8	37	56	65	4	45	65	76	0	7	9
	PITEÅ ÄLVDAL SJUKHUS	0	0	0	0	0	0	0	0	71	0	51	72
	SKELLEFTEÅ SJUKHUS	16	0	4	25	2	0	1	50	30	0	29	97
	SPORTS MEDICINE UMEÅ	36	5	24	59	16	2	11	61	399	35	305	70
	SOLLEFTEÅ SJUKHUS	5	0	0	0	5	0	0	0	50	1	42	82
	SUNDERBY SJUKHUS	69	4	38	52	77	2	67	85	533	16	435	79
	LÄNSSJUKHUSET SUNDSVALL	0	0	0	0	1	0	1	100	76	0	41	54
	NORRLANDS UNIVERSITETS-SJUKHUS, UMEÅ	59	5	8	13	64	4	8	12	1056	63	702	63
	Total	274	22	134	45	257	13	153	57	3037	159	2152	67
Total	3763	359	2349	57	3866	334	2498	59	37461	2639	27007	67	

KOOS pre-op = Number/percentage of patients who responded to a preoperative KOOS questionnaire within 180 days prior to surgery

One prerequisite when it comes to following up patients is that the clinics ensure that the patients undergoing surgery complete their preoperative questionnaire. Otherwise, no comparisons can be made in individual cases.

Age and gender distribution at surgery

The average age of patients undergoing ACL surgery in 2018 was 28. This age has not change noticeably since the start of the registry in 2005. This can be interpreted as meaning that not only young, active sportsmen and sportswomen but also somewhat older individuals with unstable knees undergo surgery. For the first time since the registry was established, in 2005, the average age of men and women was the same in conjunction with primary ACL surgery. During the period 2005-2017, women were between one and three years younger than men when it came to primary ACL surgery. The probable explanation is that women reach senior levels in ball sports earlier than men and therefore expose themselves to greater risk of an ACL injury at a younger age. Men are probably also active as sportsmen for a longer period than women.

Over the years, the average age at revision surgery is 25 for women and 28 for men.

TABLE 3A
Average age for primary reconstructions distributed by gender and year of surgery 2005-2018

Year	Woman				Man				Total			
	N	Info missing	MV	SD	N	Info missing	MV	SD	N	Info missing	MV	SD
2018	1695	1	28	12	2064	3	28	10	3759	4	28	11
2017	1732	0	28	12	2119	15	29	10	3851	15	28	11
2016	1664	0	27	12	1927	5	28	10	3591	5	28	11
2015	1477	0	27	12	2004	3	28	10	3481	3	28	11
2014	1480	0	27	12	1939	1	28	10	3419	1	28	11
2013	1447	0	26	11	2006	2	28	9	3453	2	27	10
2012	1507	0	26	11	2020	0	27	9	3527	0	27	10
2011	1424	0	26	11	1915	1	28	9	3339	1	27	10
2010	1381	1	25	11	1970	1	28	9	3351	2	27	10
2009	1293	0	25	11	1781	0	28	9	3074	0	27	10
2008	1291	0	26	11	1686	2	28	9	2977	2	27	10
2007	1171	0	25	10	1576	0	28	9	2747	0	27	10
2006	1034	0	26	10	1464	0	28	9	2498	0	27	10
2005	827	0	26	10	1161	0	28	9	1988	0	27	10
Total	19423	2	26	11	25632	33	28	9	45055	35	27	10

MV = mean value; SD = standard deviation

TABLE 3B
Primary reconstructions distributed by age group at surgery and year of surgery 2005-2018

Year	Age range at surgery														Total	
	7-15 years		16-20 years		21-25 years		26-30 years		31-35 years		36-40 years		>40 years		N	%
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
2018	281	7	888	24	717	19	631	17	346	9	283	8	613	16	3759	100
2017	264	7	851	22	802	21	581	15	375	10	314	8	664	17	3851	100
2016	254	7	866	24	754	21	547	15	309	9	262	7	599	17	3591	100
2015	235	7	804	23	749	22	531	15	307	9	299	9	556	16	3481	100
2014	217	6	850	25	755	22	493	14	322	9	256	7	526	15	3419	100
2013	207	6	931	27	775	22	472	14	305	9	285	8	478	14	3453	100
2012	211	6	987	28	766	22	505	14	337	10	302	9	419	12	3527	100
2011	217	6	936	28	687	21	474	14	303	9	301	9	421	13	3339	100
2010	227	7	967	29	659	20	469	14	310	9	298	9	421	13	3351	100
2009	204	7	883	29	590	19	426	14	304	10	277	9	390	13	3074	100
2008	180	6	815	27	570	19	410	14	337	11	296	10	369	12	2977	100
2007	188	7	760	28	506	18	394	14	305	11	277	10	317	12	2747	100
2006	161	6	644	26	460	18	395	16	299	12	263	11	276	11	2498	100
2005	123	6	493	25	392	20	297	15	254	13	201	10	228	11	1988	100
Total	2969	7	11675	26	9182	20	6625	15	4413	10	3914	9	6277	14	45055	100

TABLE 4A
Average age for revisions distributed by gender and year of surgery 2005-2018

Year	Woman				Man				Total			
	N	Info missing	MV	SD	N	Info missing	MV	SD	N	Info missing	MV	SD
2018	172	0	27	10	187	0	28	9	359	0	28	9
2017	141	0	28	10	193	0	27	8	334	0	28	9
2016	137	0	26	9	168	0	28	9	305	0	27	9
2015	136	0	25	9	165	0	28	9	301	0	27	9
2014	122	0	25	9	159	0	27	8	281	0	26	9
2013	134	0	25	8	155	0	27	8	289	0	26	8
2012	108	0	24	8	136	0	28	9	244	0	26	8
2011	99	0	25	8	116	0	29	8	215	0	27	9
2010	88	0	26	10	135	0	29	8	223	0	28	9
2009	81	0	24	8	106	0	29	9	187	0	27	9
2008	78	0	27	9	112	1	29	8	190	1	28	9
2007	74	0	28	10	95	0	29	9	169	0	29	9
2006	60	0	28	10	68	0	29	8	128	0	29	9
2005	47	0	24	8	59	0	31	9	106	0	28	9
Total	1477	0	26	9	1854	1	28	9	3331	1	27	9

MV = mean value; SD = standard deviation

TABLE 4B
Revisions distributed by age group at surgery and year of surgery 2005-2018 Age range at surgery

Year	Age range at surgery															
	7-15 years		16-20 years		21-25 years		26-30 years		31-35 years		36-40 years		>40 years		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
2018	7	2	85	24	97	27	67	19	30	8	34	9	39	11	359	100
2017	2	1	70	21	104	31	76	23	20	6	17	5	45	13	334	100
2016	3	1	80	26	87	29	50	16	33	11	21	7	31	10	305	100
2015	2	1	82	27	95	32	44	15	22	7	24	8	32	11	301	100
2014	3	1	80	28	81	29	42	15	32	11	15	5	28	10	281	100
2013	2	1	75	26	89	31	49	17	31	11	18	6	25	9	289	100
2012	4	2	75	31	71	29	31	13	25	10	20	8	18	7	244	100
2011	0	0	63	29	50	23	33	15	32	15	19	9	18	8	215	100
2010	4	2	53	24	54	24	39	17	26	12	24	11	23	10	223	100
2009	1	1	55	29	40	21	36	19	23	12	15	8	17	9	187	100
2008	1	1	42	22	46	24	32	17	31	16	20	11	18	9	190	100
2007	2	1	34	20	42	25	27	16	22	13	18	11	24	14	169	100
2006	1	1	24	19	33	26	20	16	22	17	12	9	16	13	128	100
2005	1	1	31	29	18	17	18	17	13	12	11	10	14	13	106	100
Total	33	1	849	25	907	27	564	17	362	11	268	8	348	10	3331	100

The percentage of women has increased over the years and, in 2018, approximately 45% were women.

It may seem somewhat surprising that fewer women undergo surgery at an earlier age, as it is also known that women run a far higher risk of sustaining an ACL injury than men. One explanation could be that there are a number of unknown cases among women who voluntarily reduce their activity level, take part in a non-surgical rehabilitation program and thereby never undergo surgical treatment for their ACL injury. Another explanation could be that men are more risk prone than women. It is therefore important in the future also carefully to register and follow up patients with ACL injuries who seek medical care for their injuries but receive only rehabilitation.

TABLE 5
Primary reconstructions and revisions distributed by gender and year of surgery 2005-2018

Year	Primary				Revision				Total			
	Woman		Man		Woman		Man		Woman		Man	
	N	%	N	%	N	%	N	%	N	%	N	%
2018	1696	45	2067	55	172	48	187	52	1868	45	2254	55
2017	1732	45	2134	55	141	42	193	58	1873	45	2327	55
2016	1664	46	1932	54	137	45	168	55	1801	46	2100	54
2015	1477	42	2007	58	136	45	165	55	1613	43	2172	57
2014	1480	43	1940	57	122	43	159	57	1602	43	2099	57
2013	1447	42	2008	58	134	46	155	54	1581	42	2163	58
2012	1507	43	2020	57	108	44	136	56	1615	43	2156	57
2011	1424	43	1916	57	99	46	116	54	1523	43	2032	57
2010	1382	41	1971	59	88	39	135	61	1470	41	2106	59
2009	1293	42	1781	58	81	43	106	57	1374	42	1887	58
2008	1291	43	1688	57	78	41	113	59	1369	43	1801	57
2007	1171	43	1576	57	74	44	95	56	1245	43	1671	57
2006	1034	41	1464	59	60	47	68	53	1094	42	1532	58
2005	827	42	1161	58	47	44	59	56	874	42	1220	58
Total	19425	43	25665	57	1477	44	1855	56	20902	43	27520	57

Activity in connection with injury

Among both men and women, soccer is still the most common activity associated with an ACL injury and this situation does not change from year to year. In 2018, soccer was the cause of ACL injuries in 29% of women and 50% of men. The second most common activity during the past year was downhill skiing for both women (26%) and men (10%).

As soccer is the leading cause of ACL injuries, it is interesting that projects including prophylactic training for young people playing soccer are in progress in Sweden. This training is designed to create improved balance and proprioception in the lower extremities, thereby teaching ball-playing youngsters to avoid situations in which an ACL injury could occur.

TABLE 6
Activity in connection with injury in primary
reconstructions distributed by gender in 2017 and 2018

Activity	2018						2017					
	Woman			Man			Woman			Man		
	N	K%	R%	N	K%	R%	N	K%	R%	N	K%	R%
SOCCER	484	29	32	1034	50	68	501	29	33	1031	48	67
FLOORBALL	127	7	44	161	8	56	121	7	40	182	9	60
HANDBALL	132	8	64	74	4	36	137	8	68	64	3	32
BASKETBALL	27	2	42	38	2	58	43	2	60	29	1	40
AMERICAN FOOTBALL/RUGBY	19	1	38	31	1	62	11	1	26	32	1	74
ICE HOCKEY/BANDY	4	0	10	35	2	90	1	0	3	33	2	97
MARTIAL ARTS	35	2	43	46	2	57	41	2	42	56	3	58
WRESTLING	5	0	50	5	0	50	4	0	24	13	1	76
RACKET SPORTS	13	1	52	12	1	48	16	1	40	24	1	60
VOLLEYBALL	12	1	43	16	1	57	16	1	62	10	0	38
ALPINE/TELEMARK	434	26	67	210	10	33	445	26	64	249	12	36
SNOWBOARDING	5	0	33	10	0	67	6	0	30	14	1	70
CROSS-COUNTRY SKIING	3	0	60	2	0	40	4	0	67	2	0	33
SKATEBOARDING	3	0	17	15	1	83	5	0	31	11	1	69
WAKEBOARDING/SURFING	1	0	25	3	0	75	0	0	0	5	0	100
GYMNASTICS	40	2	87	6	0	13	52	3	95	3	0	5
CYCLING	13	1	45	16	1	55	13	1	39	20	1	61
ENDURO/MOTORCROSS	6	0	12	46	2	88	1	0	2	63	3	98
OTHER SPORT RECREATION	58	3	62	36	2	38	57	3	69	26	1	31
EQUESTRIAN SPORT	24	1	100	0	0	0	27	2	93	2	0	7
DANCING	28	2	74	10	0	26	29	2	94	2	0	6
EXERCISE	28	2	67	14	1	33	18	1	53	16	1	47
TRAMPOLINE	12	1	50	12	1	50	15	1	65	8	0	35
OUTDOOR LIFE	18	1	62	11	1	38	22	1	59	15	1	41
TRAFFIC	25	1	50	25	1	50	19	1	34	37	2	66
WORK	17	1	28	44	2	72	17	1	27	46	2	73
OTHER	123	7	44	155	7	56	111	6	44	141	7	56
Total	1696	100	45	2067	100	55	1732	100	45	2134	100	55

K% = column percent by gender; R% = row percent within activity

Duration of surgery and number of surgeons

In Sweden, as in a number of other countries, including the USA, many surgeons perform only a few ACL operations.

Of the Swedish ACL surgeons, 71% perform fewer than 30 operations a year. Over the years, there has definitely been an increase in the number of surgeons performing more than 30 operations a year and this is pleasing.

The average duration of surgery for a primary ACL reconstruction is around 75 minutes for a primary operation and just over 90 minutes for a revision.

TABLE 7
Total number of reconstructions and primary reconstructions per surgeon distributed by year of surgery 2005-2018

Year	Reconstructions by surgeon						Primary reconstructions by surgeon					
	<30		≥30		Surgeons		<30		≥30		Surgeons	
	N	%	N	%	N	%	N	%	N	%	N	%
2018	118	71	49	29	167	100	123	74	44	26	167	100
2017	111	67	54	33	165	100	115	70	50	30	165	100
2016	96	63	56	37	152	100	103	68	49	32	152	100
2015	111	69	50	31	161	100	116	72	45	28	161	100
2014	100	66	52	34	152	100	108	71	44	29	152	100
2013	103	65	56	35	159	100	108	68	51	32	159	100
2012	105	69	48	31	153	100	106	69	47	31	153	100
2011	106	69	47	31	153	100	106	69	47	31	153	100
2010	108	70	46	30	154	100	109	71	45	29	154	100
2009	109	74	39	26	148	100	112	76	36	24	148	100
2008	103	69	46	31	149	100	107	72	42	28	149	100
2007	105	74	37	26	142	100	109	77	33	23	142	100
2006	91	73	34	27	125	100	94	75	31	25	125	100
2005	81	77	24	23	105	100	82	78	23	22	105	100
Total	1447	69	638	31	2085	100	1498	72	587	28	2085	100

TABLE 8
Duration of surgery (mins) for primary reconstructions and revisions distributed by year of surgery 2005-2018

Year	Primary					Revision				
	N	Info				N	Info			
		missing	MV	SD	MD		missing	MV	SD	MD
2018	3615	148	73	29	68	325	34	94	35	90
2017	3668	198	75	30	70	316	18	94	32	90
2016	3464	132	76	30	70	293	12	99	37	92
2015	3334	150	73	28	69	284	17	95	38	90
2014	3262	158	75	29	70	262	19	96	35	91
2013	3275	180	76	28	72	274	15	102	41	96
2012	3315	212	73	28	70	224	20	95	36	90
2011	3214	126	75	29	72	208	7	89	36	87
2010	3173	180	73	28	70	213	10	89	34	89
2009	2884	190	76	26	72	169	18	88	32	90
2008	2745	234	76	27	70	174	17	87	32	83
2007	2584	163	76	28	71	155	14	86	31	80
2006	2290	208	75	27	72	115	13	90	32	89
2005	1778	210	76	27	70	93	13	90	36	80
Total	42601	2489	75	28	70	3105	227	93	35	90

MV = mean value; SD = standard deviation

Time between injury and surgery

Since 2009, the average time between injury and surgery has been between 400 and 500 days. There are no obvious differences between private and public caregivers. What can be seen in both 2017 and 2018 is that Norrland (north of Sweden) has the longest time between injury and surgery, between 700 and 800 days.

The reason why there is a relatively long period between injury and surgery throughout Sweden is not known. One reason could be that many patients are not identified at emergency departments or local medical centers after their injury. In other words, they are not given the correct diagnosis at the acute stage. This would be extremely unfortunate, as it would mean that treatment is not given, resulting in a major risk of new and repeated trauma to the knee (which is unstable). Another reason could be that Sweden has embraced a treatment algorithm which means that most patients first receive non-surgical treatment, thereby extending the time to surgery. This is completely in line with the recent discussion that patients with ACL injuries may not always require surgery but can instead eliminate their problems using rehabilitation and activity modification.

TABLE 9
Days between injury and primary reconstruction surgery distributed by region (clinic) in 2005-2016, 2017 and 2018

Region	Year	Days between injury and surgery						
		N	Info missing	MV	SD	MD	K1	K3
Greater Stockholm	2018	1163	37	528	1154	169	89	381
	2017	1248	27	419	944	155	90	282
	2005-2016	10965	759	482	1014	196	104	391
Svealand + Gotland	2018	524	24	589	912	262	152	549
	2017	607	17	735	1291	277	160	626
	2005-2016	4737	527	606	1000	302	174	586
Skåne	2018	416	2	818	1414	298	152	792
	2017	463	8	760	1344	272	138	673
	2005-2016	4372	367	605	1074	272	158	562
Halland	2018	238	4	543	860	221	121	571
	2017	199	3	432	698	213	124	363
	2005-2016	1673	267	482	776	247	145	490
Småland + Blekinge	2018	225	11	533	968	258	170	500
	2017	186	8	478	949	209	121	421
	2005-2016	2630	294	398	662	213	126	393
Västra Götaland	2018	716	14	507	1041	198	100	418
	2017	690	15	526	1064	220	110	405
	2005-2016	5504	685	455	853	227	128	426
Östergötland	2018	115	0	544	993	243	155	438
	2017	128	10	449	641	250	157	399
	2005-2016	1477	167	483	701	264	168	486
Norrland	2018	269	5	705	1130	304	157	621
	2017	257	0	791	1539	311	144	717
	2005-2016	2816	221	717	1196	319	165	679
Total	2018	3666	97	580	1104	222	114	492
	2017	3778	88	561	1120	211	115	442
	2005-2016	34174	3287	523	971	238	132	475

MV = mean value; SD = standard deviation; MD = median; K1 = 1st quartile (25%) K3 = 3rd quartile (75%)

Percentage of day surgery in relation to in-patient care

The percentage of patients who undergo day surgery is slowly increasing and now accounts for more than 88% of the total number of operations, both primary and revisions. In 2005, the corresponding figure was 51%.

One reason for performing in-patient surgery could be that long distances in the region prevent patients being discharged the same day. This is, however, contradicted by the fact that Norrland in northern Sweden, where the distances are very long, is characterized by an extremely high percentage of day surgery.

TABLE 10
Day surgery involving primary reconstructions and revisions distributed by year of surgery 2005-2018

Year	Primary				Revision				Total			
	Day surgery		Day surgery		Day surgery		Day surgery		Day surgery		Day surgery	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
	N	%	N	%	N	%	N	%	N	%	N	%
2018	3358	89	405	11	281	78	78	22	3639	88	483	12
2017	3377	87	489	13	254	76	80	24	3631	86	569	14
2016	3187	89	409	11	233	76	72	24	3420	88	481	12
2015	3012	86	472	14	242	80	59	20	3254	86	531	14
2014	2916	85	504	15	221	79	60	21	3137	85	564	15
2013	2922	85	533	15	223	77	66	23	3145	84	599	16
2012	2957	84	570	16	178	73	66	27	3135	83	636	17
2011	2754	82	586	18	154	72	61	28	2908	82	647	18
2010	2670	80	683	20	154	69	69	31	2824	79	752	21
2009	2450	80	624	20	140	75	47	25	2590	79	671	21
2008	2212	74	767	26	144	75	47	25	2356	74	814	26
2007	1688	61	1059	39	87	51	82	49	1775	61	1141	39
2006	1350	54	1148	46	72	56	56	44	1422	54	1204	46
2005	1004	51	984	49	54	51	52	49	1058	51	1036	49
Total	35857	80	9233	20	2437	73	895	27	38294	79	10128	21

TABLE 11
Day surgery involving primary reconstructions and revisions distributed by region 2005-2016, 2017 and 2018

Region	Year	Primary				Revision				Total			
		Day surgery				Day surgery				Day surgery			
		Ja		Nej		Ja		Nej		Ja		Nej	
		N	%	N	%	N	%	N	%	N	%	N	%
Greater Stockholm	2018	1077	90	123	10	90	70	38	30	1167	88	161	12
	2017	1125	88	150	12	74	62	45	38	1199	86	195	14
	2005-2016	8339	71	3385	29	601	64	339	36	8940	71	3724	29
Svealand + Gotland	2018	426	78	122	22	30	61	19	39	456	76	141	24
	2017	490	79	134	21	27	63	16	37	517	78	150	22
	2005-2016	3744	71	1520	29	234	65	125	35	3978	71	1645	29
Skåne	2018	405	97	13	3	33	97	1	3	438	97	14	3
	2017	455	97	16	3	36	95	2	5	491	96	18	4
	2005-2016	4304	91	435	9	274	87	42	13	4578	91	477	9
Halland	2018	205	85	37	15	20	74	7	26	225	84	44	16
	2017	160	79	42	21	19	86	3	14	179	80	45	20
	2005-2016	1337	69	603	31	62	43	81	57	1399	67	684	33
Småland + Blekinge	2018	204	86	32	14	11	92	1	8	215	87	33	13
	2017	151	78	43	22	11	100	0	0	162	79	43	21
	2005-2016	1961	67	963	33	99	77	30	23	2060	67	993	33
Västra Götaland	2018	679	93	51	7	69	85	12	15	748	92	63	8
	2017	634	90	71	10	61	82	13	18	695	89	84	11
	2005-2016	5412	87	777	13	421	83	84	17	5833	87	861	13
Östergötland	2018	109	95	6	5	6	100	0	0	115	95	6	5
	2017	124	90	14	10	13	93	1	7	137	90	15	10
	2005-2016	1557	95	87	5	82	93	6	7	1639	95	93	5
Norrland	2018	253	92	21	8	22	100	0	0	275	93	21	7
	2017	238	93	19	7	13	100	0	0	251	93	19	7
	2005-2016	2468	81	569	19	129	81	30	19	2597	81	599	19
Total	2018	3358	89	405	11	281	78	78	22	3639	88	483	12
	2017	3377	87	489	13	254	76	80	24	3631	86	569	14
	2005-2016	29122	78	8339	22	1902	72	737	28	31024	77	9076	23

ACL reconstruction in children under 15 years of age

It appears that substance ruptures in the ACL of children with open growth zones are increasing. The annual incidence has previously been estimated at 0.5/10,000 children under 15 years of age, but this figure may have doubled. The reason has not been identified, but increased awareness of the fact that children can also sustain this injury, improved MRI diagnostics and increasing performance demands in organized sport involving children and young people have been cited as some of the possible reasons. Even the associated meniscal injuries in association with ACL injuries are thought to be growing in number based on an historical comparison. In a Swedish study from 1996 of children under 15 years of age, 21% had meniscal injuries at the time the ACL injury was diagnosed, while this figure rose to 31% at surgery.

TABLE 12
Primary reconstructions in children under 15 years of age
distributed by gender, region and clinic in 2005-2016, 2017
and 2018

Region	Clinic	Children under 15 years of age							
		2018		2017		2005–2016		Total	
		Girl N	Boy N	Girl N	Boy N	Girl N	Boy N	Girl N	Boy N
Greater Stockholm	KAROLINSKA UNIVERSITETSSJUKHUSET	0	0	7	10	90	79	97	89
	ARTROCENTER	1	0	1	0	1	0	3	0
	ODENPLANS LÄKARHUS	0	0	0	0	1	3	1	3
	ORTOPEDISKA HUSET CAREMA	0	0	0	0	2	1	2	1
	PRAKTIKERTJÄNST ORTOPEDI STOCKHOLM	4	5	0	0	0	0	4	5
	SABBATSBERG NÄRSJUKHUSET	2	1	1	0	1	0	4	1
	SÖDERSJUKHUSET	0	0	0	0	3	1	3	1
	ORTHOCENTER STOCKHOLM	0	0	1	3	6	4	7	7
	CAPIO ARTRO CLINIC	14	30	13	11	190	109	217	150
Total	21	36	23	24	294	197	338	257	
Svealand + Gotland	ELISABETHSJUKHUSET	1	0	1	0	10	0	12	0
	FALU LASARETT	4	0	0	1	13	3	17	4
	GÄVLE SJUKHUS	0	0	0	1	5	1	5	2
	HUDIKSVALLS SJUKHUS	0	0	0	0	2	1	2	1
	KARLSTAD CENTRALSJUKHUS	2	1	1	0	10	4	13	5
	CAPIO LÄKARGRUPPEN I ÖREBRO AB	0	0	0	0	9	1	9	1
	MÄLARSJUKHUSET ESKILSTUNA	0	1	0	0	2	1	2	2
	NORRTÄLJE SJUKHUS	0	0	0	0	1	0	1	0
	NYKÖPINGS LASARETT	0	0	0	0	1	1	1	1
	ÖREBRO USÖ	4	0	3	1	10	2	17	3
	SPECIALISTCENTER SCANDINAVIA	1	0	0	0	0	0	1	0
	VÄSTERÅS CENTRALLASARETTET	0	0	1	0	2	3	3	3
	VISBY LASARETT	0	0	0	1	0	0	0	1
	VÄSTERÅS ORTOPEDPRAKTIK	0	0	2	0	2	2	4	2
Total	12	2	8	4	67	19	87	25	
Skåne	ALERIS ORTOPEDI ÄNGELHOLM	0	0	0	0	7	1	7	1
	HÄSLEHOLMS SJUKHUS	1	0	0	0	6	1	7	1
	HELSINGBORGS SJUKHUS	1	0	0	0	10	1	11	1
	LUNDS UNIVERSITET	0	0	0	0	12	1	12	1
	MALMÖ ALLMÄNNA SJUKHUS	0	0	0	0	11	9	11	9
	ORTHOCENTER I SKÅNE	0	0	0	0	0	1	0	1
	SKÅNES UNIVERSITETSSJUKHUS	2	0	6	5	29	8	37	13
Total	4	0	6	5	75	22	85	27	
Halland	HALMSTADS SJUKHUS	0	0	0	0	1	1	1	1
	KUNGSBACKA SJUKHUS	1	0	2	0	7	3	10	3
	MOVEMENT MEDICAL AB	0	0	0	0	6	1	6	1
	Total	1	0	2	0	14	5	17	5

TABLE 12 continues on the next page.

Continuation of TABLE 12.

Region	Clinic	Children under 15 years of age							
		2018		2017		2005–2016		Total	
		Girl N	Boy N	Girl N	Boy N	Girl N	Boy N	Girl N	Boy N
Småland + Blekinge	ART CLINIC	0	0	1	0	0	0	1	0
	HÖGLANDSSJUKHUSET	2	1	0	0	8	7	10	8
	KALMAR SJUKHUS	0	0	2	0	13	4	15	4
	BLEKINGESJUKHUSET	1	0	0	0	1	0	2	0
	LIUNGBY LASARETT	0	0	0	0	5	0	5	0
	OSKARSHAMNS SJUKHUS	2	0	0	0	9	3	11	3
	LÄNSSJUKHUSET RYHOV	1	1	1	2	5	2	7	5
	CENTRALLASARETTET VÄXJÖ	3	2	1	0	16	4	20	6
	VÄRNAMO SJUKHUS/ORTOPEDKLINIKEN	0	0	0	0	0	1	0	1
	VÄSTERVIKS SJUKHUS	0	0	1	0	4	0	5	0
	Total	9	4	6	2	61	21	76	27
Västra Götaland	ALINGSÅS LASARETT	0	0	1	0	6	0	7	0
	SÖDRA ÄLVSBOGERS SJUKHUS	0	0	0	0	2	0	2	0
	DROTTNING SILVIAS BARN- OCH UNGDOMSSJUKHUS	5	1	8	1	16	6	29	8
	ORTHOCENTER/IFK-KLINIKEN	7	2	4	1	20	3	31	6
	KUNGÄLVS SJUKHUS	0	0	0	0	2	0	2	0
	CAPIO LUNDBY NÄRSJUKHUS	1	0	4	0	8	0	13	0
	NU-SJUKVÅRDEN	2	1	3	1	23	11	28	13
	PERAGO ORTOPEDKLINIK	0	0	0	0	4	0	4	0
	KÄRNSJUKHUSET I SKÖVDE	1	0	0	0	3	2	4	2
	SAHLGRENSKA UNIVERSITETSSJUKHUSET	1	1	0	0	24	11	25	12
	VARBERGS SJUKHUS	0	0	0	0	5	2	5	2
	Total	17	5	20	3	113	35	150	43
Östergötland	LINKÖPINGS UNIVERSITETSKLINIK	2	0	1	0	13	1	16	1
	VRINNEVISJUKHUSET	0	0	1	0	6	1	7	1
	Total	2	0	2	0	19	2	23	2
Norrland	GÄLLIVARE SJUKHUS	0	0	0	0	1	0	1	0
	LÄKARHUSET HERMELINEN	1	0	0	0	2	0	3	0
	MEDICIN DIREKT	0	0	0	0	10	0	10	0
	ÖRNSKÖLDSVIKS SJUKHUS	0	0	2	0	4	0	6	0
	ÖSTERSUNDS SJUKHUS	0	0	1	0	2	0	3	0
	PITEÅ ÄLVDAL SJUKHUS	0	0	0	0	2	0	2	0
	SKELLEFTEÅ SJUKHUS	1	0	0	0	0	0	1	0
	SPORTS MEDICINE UMEÅ	0	0	0	0	7	4	7	4
	SOLLEFTEÅ SJUKHUS	0	0	0	0	2	0	2	0
	SUNDERBY SJUKHUS	2	2	4	0	22	1	28	3
	NORRLANDS UNIVERSITETSSJUKHUS, UMEÅ	0	1	0	1	19	5	19	7
	Total	4	3	7	1	71	10	82	14
Total		70	50	74	39	714	311	858	400

About half the patients had meniscal injuries, half of which were resected and half sutured. Girls accounted for 75% of the patients. The cause of accidents is similarly distributed between boys and girls. Soccer dominates, followed by alpine skiing.

Surgical variables

Graft selection

Since the knee ligament registry was created in 2005, the use of hamstring grafts rose from 80% to 98% in 2012, but, in conjunction with ACL reconstruction, different types of graft can be used. A reduction to 91% has taken place in recent years. By far the most common graft selection is the hamstring tendon, which can comprise the semitendinosus or the semitendinosus and the gracilis tendon. Surgery involving hamstrings is technically straightforward, but it can result in somewhat weaker flexion in the knee, first and foremost during the first year after surgery. When the use of hamstring tendons began, it was standard procedure to double the gracilis and the semitendinosus. Interest is, however, currently increasing in quadrupling the semitendinosus, as cadaver studies have revealed that this is a stronger option. Retaining the gracilis can reduce the problem of reduced flexion to some degree.

As ACL surgery developed during the 1980s and 1990s, using the patellar tendon was the standard method, but it has declined in popularity, probably because it is somewhat more technically complicated and the length of surgery can increase. More postoperative pain and problems with anterior knee pain, primarily during the first two years, have also been mentioned as disadvantages. One advantage when it comes to the patellar tendon is that a bone plug can be used at both ends, thereby guaranteeing the effective healing of the graft in the canal. During the past few years, registry studies have indicated that the risk of graft failure and rupture necessitating a revision is somewhat greater, if a hamstring graft is selected. During the past two years, the percentage of hamstring tendon grafts has declined in favor of the patellar tendon and, to some degree, also the quadriceps, even if the absolute figures are still low.

Increasing interest has also been shown in the use of quadriceps grafts. The quadriceps tendon can be used as a free graft or with a bone plug at one end. This can enable a thick graft, which makes it possible to divide the graft, thereby permitting the bone plug to be inserted in the femur, with two attachment points in the tibia. The quadriceps tendon probably results in less anterior knee pain than the patellar tendon. There is speculation about whether the patellar tendon and the quadriceps tendon should be considered more frequently in patient groups in which a greater risk of graft rupture can be anticipated.

The use of allografts is another alternative. In international terms, it is common for allografts to be used in ACL reconstruction. The advantages possibly include the lack of morbidity at the graft retrieval point and shorter surgery times. The disadvantages may include a probably greater risk of graft failure and, first and foremost, the high cost, as an allograft costs more than SEK 20,000 per graft, which is not always reimbursed via the reimbursement system in Sweden. Access to a freezer with a temperature of minus 70°C is also essential. Allografts are frequently used as a complement in conjunction with multiple-ligament injuries and revisions.

While hamstring grafts have been the dominant graft in primary ACL reconstruction in Sweden for many years, the patellar tendon is being used increasingly in revision surgery. Allografts and the quadriceps tendon are also frequently used in revision surgery.

TABLE 13
ACL grafts (groups) in primary reconstructions distributed
by region in 2005-2016, 2017 and 2018

Region	Graft	2018		2017		2005-2016		Total	
		N	%	N	%	N	%	N	%
Greater Stockholm	Patellar tendon	64	5	127	10	638	6	829	6
	Semitendinosus	979	82	1036	82	10441	92	12456	90
	Quadriceps	140	12	78	6	191	2	409	3
	Other*	9	1	20	2	78	1	107	1
	Total	1192	100	1261	100	11348	100	13801	100
Svealand + Gotland	Patellar tendon	12	2	12	2	320	6	344	5
	Semitendinosus	528	97	606	98	4852	93	5986	94
	Quadriceps	1	0			24	0	25	0
	Other*	3	1	1	0	19	0	23	0
	Total	544	100	619	100	5215	100	6378	100
Skåne	Patellar tendon	19	5	21	4	355	8	395	7
	Semitendinosus	370	89	438	94	4231	90	5039	90
	Quadriceps	13	3	3	1	11	0	27	0
	Other*	14	3	6	1	105	2	125	2
	Total	416	100	468	100	4702	100	5586	100
Halland	Patellar tendon	12	5	13	7	148	8	173	7
	Semitendinosus	226	95	184	93	1741	92	2151	92
	Quadriceps					1	0	1	0
	Other*					3	0	3	0
	Total	238	100	197	100	1893	100	2328	100
Småland + Blekinge	Patellar tendon	6	3	3	2	231	8	240	7
	Semitendinosus	228	97	187	97	2675	92	3090	92
	Quadriceps			2	1			2	0
	Other*			1	1	9	0	10	0
	Total	234	100	193	100	2915	100	3342	100
Västra Götaland	Patellar tendon	73	10	41	6	274	4	388	5
	Semitendinosus	633	87	627	89	5782	94	7042	93
	Quadriceps	13	2	16	2	8	0	37	0
	Other*	6	1	18	3	61	1	85	1
	Total	725	100	702	100	6125	100	7552	100
Östergötland	Patellar tendon	6	5			21	1	27	1
	Semitendinosus	108	95	137	100	1611	98	1856	98
	Quadriceps								
	Other*					7	0	7	0
	Total	114	100	137	100	1639	100	1890	100
Norrland	Patellar tendon			4	2	125	4	129	4
	Semitendinosus	254	93	238	93	2792	92	3284	92
	Quadriceps	15	6	14	5	107	4	136	4
	Other*	3	1			2	0	5	0
	Total	272	100	256	100	3026	100	3554	100
Total	Patellar tendon	192	5	221	6	2112	6	2525	6
	Semitendinosus	3326	89	3453	90	34125	93	40904	92
	Quadriceps	182	5	113	3	342	1	637	1
	Other*	35	1	46	1	284	1	365	1
	Total	3735	100	3833	100	36863	100	44431	100

*Allograft or some other graft

TABLE 14
ACL grafts (groups) in revisions distributed by year of
surgery 2005-2016, 2017 and 2018

Region	Graft	2018		2017		2005–2016		Total	
		N	%	N	%	N	%	N	%
Greater Stockholm	Patellar tendon	52	41	58	50	506	55	616	53
	Semitendinosus	35	28	29	25	294	32	358	31
	Quadriceps	29	23	21	18	72	8	122	10
	Other*	10	8	9	8	47	5	66	6
	Total	126	100	117	100	919	100	1162	100
Svealand + Gotland	Patellar tendon	34	71	27	63	169	48	230	52
	Semitendinosus	13	27	14	33	177	50	204	46
	Quadriceps	1	2	1	2	6	2	8	2
	Other*			1	2	1	0	2	0
	Total	48	100	43	100	353	100	444	100
Skåne	Patellar tendon	10	29	25	66	115	36	150	39
	Semitendinosus	8	24	5	13	106	34	119	31
	Quadriceps	10	29	6	16	8	3	24	6
	Other*	6	18	2	5	87	28	95	24
	Total	34	100	38	100	316	100	388	100
Halland	Patellar tendon	20	74	17	77	84	59	121	63
	Semitendinosus	7	26	2	9	49	35	58	30
	Quadriceps					2	1	2	1
	Other*			3	14	7	5	10	5
	Total	27	100	22	100	142	100	191	100
Småland + Blekinge	Patellar tendon	8	67	7	64	59	46	74	49
	Semitendinosus	3	25	4	36	65	51	72	48
	Quadriceps	1	8			2	2	3	2
	Other*					1	1	1	1
	Total	12	100	11	100	127	100	150	100
Västra Götaland	Patellar tendon	55	69	37	51	225	46	317	49
	Semitendinosus	9	11	5	7	188	38	202	31
	Quadriceps	12	15	12	17	17	3	41	6
	Other*	4	5	18	25	62	13	84	13
	Total	80	100	72	100	492	100	644	100
Östergötland	Patellar tendon	5	83	8	57	56	64	69	64
	Semitendinosus			4	29	31	35	35	32
	Quadriceps	1	17	2	14	1	1	4	4
	Other*								
	Total	6	100	14	100	88	100	108	100
Norrland	Patellar tendon	7	32	3	23	41	26	51	26
	Semitendinosus	7	32	6	46	81	51	94	48
	Quadriceps	6	27	3	23	35	22	44	23
	Other*	2	9	1	8	2	1	5	3
	Total	22	100	13	100	159	100	194	100
Total	Patellar tendon	191	54	182	55	1255	48	1628	50
	Semitendinosus	82	23	69	21	991	38	1142	35
	Quadriceps	60	17	45	14	143	6	248	8
	Other*	22	6	34	10	207	8	263	8
	Total	355	100	330	100	2596	100	3281	100

*Allograft or some other graft

Tibial fixation

The most common form of tibial fixation at the present time is the cortical button and, in 2018, the percentage was 57%. Resorbable screws and metal screws were used in 20% and 17% of operations respectively. The use of resorbable screws increased sharply between 2008 and 2013, but it has again declined steadily in recent years. One of the reasons for this is to avoid the removal of fixation material in revisions. The use of metal screws experienced a declining trend in 2005-2013, but it has since stabilized at around 20% during the past five years.

TABLE 15
Tibial fixations in primary reconstructions distributed by year of surgery 2005-2018

Tibial fixation	Year of surgery														Total
	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	
Metal screw	17%	19%	18%	16%	17%	23%	24%	31%	33%	34%	31%	39%	39%	40%	26%
Intrafix	<1%	<1%	1%	2%	3%	7%	8%	8%	10%	13%	21%	21%	26%	28%	9%
Rigidfix	<1%	<1%		<1%	<1%	<1%	<1%	<1%	2%	3%	6%	7%	8%	7%	2%
Cobra					<1%			<1%	<1%	<1%	1%	<1%	1%	1%	<1%
Staple	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
Metal screw / Staple	2%	2%	3%	4%	4%	6%	7%	9%	11%	12%	10%	11%	14%	11%	7%
Endobutton	<1%	<1%	<1%	1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
AO screw	24%	22%	21%	21%	21%	16%	18%	18%	18%	18%	13%	10%	7%	8%	17%
Retroscrew	<1%	<1%		<1%	<1%	<1%	<1%	2%	3%	2%	3%	4%	3%	2%	1%
Mitek anchor								<1%		<1%			<1%	<1%	<1%
Retrobutton	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%			<1%	<1%			<1%
Resorbable screw	20%	21%	21%	23%	28%	33%	34%	25%	20%	15%	14%	5%	<1%		20%
Metal screw / osteosutue	1%	1%	2%	2%	3%	3%	3%	3%	2%	1%	<1%				2%
ThighRope	28%	28%	27%	24%	20%	7%	1%	1%							11%
Resorbable / post	2%	2%	3%	2%	3%	4%	3%	2%							2%
Suture washer	4%	3%	3%	<1%											<1%
Other	1%	<1%	<1%	2%	<1%	1%	<1%	<1%	<1%	<1%	<1%	1%	1%	3%	<1%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Total N	3763	3857	3556	3439	3388	3427	3486	3314	3327	3047	2953	2701	2482	1966	44706

Tibial fixation (type) in primary reconstructions distributed by year of surgery 2005-2018

Tibial fixation	Year of surgery														Total
	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	
Cortical	57%	53%	51%	48%	41%	24%	19%	20%	19%	19%	15%	12%	9%	10%	30%
Intrafix / Rigidfix	<1%	<1%	1%	2%	3%	7%	9%	9%	12%	17%	26%	28%	33%	34%	11%
Close to joint	41%	46%	47%	48%	56%	68%	71%	71%	69%	63%	58%	59%	56%	53%	57%
Other	1%	<1%	<1%	2%	<1%	1%	<1%	<1%	<1%	<1%	<1%	1%	1%	3%	<1%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Total N	3763	3857	3556	3439	3388	3427	3486	3314	3327	3047	2953	2701	2482	1966	44706

Femoral fixation

The most common form of femoral fixation at the present time is the cortical button, which is used in 90% of all femoral fixations. The use of the TightRope has risen sharply in the past few years and has overtaken the Endobutton. When the TightRope is used, the cruciate ligament transplant can be tightened after it has been inserted in the canal and even after it has been fixed distally. The use of cortical buttons has increased every year, from 10% in 2005 to 90% in 2019. The reason for this increase is that the cortical button is easy to use without any alignment instruments. It can be inserted through the medial portal and, unlike the transtibial method, where it is necessary to drill through the lower part of the leg using alignment instruments, the surgeon is not obliged to use the tibial canal. Cortical buttons are also stable and there is no risk that the transplant will move or slip. Interference screws in the femur were used in some 27% of patients in 2005, when the knee ligament registry was created, but this figure has fallen steadily in recent years and is currently around 10%.

TABLE 16
Femoral fixations in primary reconstructions distributed by year of surgery 2005-2018

Femoral fixation	Year of surgery														Total
	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	
Metal screw	9%	7%	7%	9%	10%	8%	11%	15%	18%	18%	19%	22%	25%	27%	14%
Endobutton	24%	23%	38%	44%	49%	57%	59%	59%	54%	43%	31%	22%	19%	10%	39%
Staple		<1%			<1%		<1%	<1%		<1%	<1%	<1%	<1%	<1%	<1%
Rigidfix		<1%	<1%	<1%	<1%	2%	4%	7%	13%	21%	31%	38%	37%	46%	12%
Transfix		<1%		<1%	<1%	<1%	1%	4%	6%	11%	13%	16%	18%	15%	5%
AO screw	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
Retrobutton		<1%	<1%	<1%		<1%	<1%	2%	5%	4%	4%	2%			1%
Retroscrew	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%		<1%			<1%
Ezloc								<1%	<1%	1%	<1%				<1%
Metal screw / Endopearl		<1%		<1%	<1%	<1%		<1%		<1%	<1%				<1%
Toggleloc	<1%	<1%	<1%	1%	1%	1%	1%	3%	2%	<1%					<1%
ThighRope	58%	62%	50%	42%	38%	30%	22%	9%	1%						25%
Interference screw			<1%						<1%						<1%
Graftmax	<1%	<1%	<1%												<1%
Ultrabutton	7%	5%													<1%
XO button	<1%														<1%
Other	1%	2%	2%	2%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Total N	3763	3860	3558	3454	3396	3430	3492	3322	3329	3050	2963	2725	2486	1969	44797

Femoral fixation (type) in primary reconstructions distributed by year of surgery 2005-2018

Femoral fixation	Year of surgery														Total
	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	
Cortical	90%	91%	89%	88%	89%	88%	82%	71%	57%	43%	31%	22%	20%	11%	67%
Rigidfix / Transfix		<1%	<1%	<1%	<1%	3%	5%	11%	19%	33%	44%	54%	55%	62%	17%
Close to joint	9%	8%	7%	9%	10%	8%	12%	18%	23%	23%	24%	23%	25%	27%	15%
Other	1%	2%	2%	2%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Total N	3763	3860	3558	3454	3396	3430	3492	3322	3329	3050	2963	2725	2486	1969	44797

Revisions and surgery on the contralateral side

A total of 3,332 (6.9%) revisions were registered in the knee ligament registry in 2005-2018. No primary surgery has been registered for a number of these as it took place before the knee ligament registry was established. If we instead choose to follow the patients whose primary surgery and revision were registered, the figure for revisions is 2,140 (4.5%). Taken as a whole, 1,362 (3.4%) surgeries on the contralateral knee have also been registered during this period. In overall terms, women underwent revisions on a larger scale than men – 6.8% compared with 6.4% for the same knee and 3.7% compared with 3.2% for the contralateral knee. The total average age for revisions in 2016 was 27.1 years, but here, too, there appears to be a gender variation, as the average age of women was 25.6 years, while that of men was 28.3 years. Generally speaking, the report shows that the largest number of revisions are performed on the patient group under the age of 20 years at their first surgery. When it comes to ACL reconstructions on the contralateral knee, the younger population is also overrepresented. The very highest frequency of these operations is found in the patient group with an age range of 21-25 years, where 4.9% of all patients underwent surgery on the contralateral knee.

In almost half (48.4%) of revisions, the patellar tendon is used. This can be explained by the fact that a hamstring graft is by far the most common choice in primary surgery and this graft has therefore probably already been used in the patients requiring a revision. The following table shows the revision frequency within two years of the index operation and the total revision frequency, distributed by graft type at the index operation. The semitendinosus has a slightly higher revision frequency compared with the patellar tendon at two years (2.2% compared with 1.5%) but, as far more patients are given semitendinosus grafts, it is difficult to draw any conclusions about the impact of graft selection on the risk of revision.

TABLE 17
 ACL index grafts leading to revision within two years
 distributed by ACL graft index and ACL femoral fixation
 ACL index during the surgery period 1 January 2005 to
 31 December 2016

Graft	Tibial fixation	Revision within two years					ACL index	Revision				
		Yes		No		ACL index		Yes		No		ACL index
		N	%	N	%			N	%	N	%	
Patellar tendon	Cortical	1	1,0	96	99,0	97	1	1,0	96	99,0	97	
	Intrafix / Rigidfix	0	0,0	14	100,0	14	2	14,3	12	85,7	14	
	Close to joint	32	1,7	1824	98,3	1856	86	4,6	1770	95,4	1856	
	Other	0	0,0	4	100,0	4	0	0,0	4	100,0	4	
	Total	33	1,7	1938	98,3	1971	89	4,5	1882	95,5	1971	
Semitendinosus	Cortical	236	2,8	8246	97,2	8482	461	5,4	8021	94,6	8482	
	Intrafix / Rigidfix	74	1,5	4765	98,5	4839	217	4,5	4622	95,5	4839	
	Close to joint	437	2,3	18554	97,7	18991	1004	5,3	17987	94,7	18991	
	Other	9	2,9	298	97,1	307	24	7,8	283	92,2	307	
	Total	756	2,3	31863	97,7	32619	1706	5,2	30913	94,8	32619	
Quadriceps	Cortical	1	3,3	29	96,7	30	2	6,7	28	93,3	30	
	Intrafix / Rigidfix	0	0,0	1	100,0	1	0	0,0	1	100,0	1	
	Close to joint	2	0,7	276	99,3	278	4	1,4	274	98,6	278	
	Other	0	0,0	1	100,0	1	0	0,0	1	100,0	1	
	Total	3	1,0	307	99,0	310	6	1,9	304	98,1	310	
Allograft	Cortical	1	6,3	15	93,8	16	2	12,5	14	87,5	16	
	Close to joint	1	0,7	142	99,3	143	5	3,5	138	96,5	143	
	Other	0	0,0	4	100,0	4	0	0,0	4	100,0	4	
	Total	2	1,2	161	98,8	163	7	4,3	156	95,7	163	
Other	Cortical	0	0,0	24	100,0	24	1	4,2	23	95,8	24	
	Intrafix / Rigidfix	0	0,0	7	100,0	7	0	0,0	7	100,0	7	
	Close to joint	2	3,2	60	96,8	62	4	6,5	58	93,5	62	
	Other	1	16,7	5	83,3	6	1	16,7	5	83,3	6	
	Total	3	3,0	96	97,0	99	6	6,1	93	93,9	99	
Total	Cortical	239	2,8	8410	97,2	8649	467	5,4	8182	94,6	8649	
	Intrafix / Rigidfix	74	1,5	4787	98,5	4861	219	4,5	4642	95,5	4861	
	Close to joint	474	2,2	20856	97,8	21330	1103	5,2	20227	94,8	21330	
	Other	10	3,1	312	96,9	322	25	7,8	297	92,2	322	
	Total	797	2,3	34365	97,7	35162	1814	5,2	33348	94,8	35162	

TABLE 18
 ACL index leading to revision within two years distributed
 by ACL graft and ACL femoral fixation
*ACL index during the surgery period 1 January 2005 to
 31 December 2016*

Graft	Femoral fixation	Revision within two years					Revision				
		Yes		No		ACL index	Yes		No		ACL index
		N	%	N	%		N	%	N	%	
Patellar tendon	Cortical	6	2,2	264	97,8	270	12	4,4	258	95,6	270
	Rigidfix / Transfix	0	0,0	7	100,0	7	0	0,0	7	100,0	7
	Close to joint	26	1,5	1664	98,5	1690	76	4,5	1614	95,5	1690
	Other	1	14,3	6	85,7	7	2	28,6	5	71,4	7
	Total	33	1,7	1941	98,3	1974	90	4,6	1884	95,4	1974
Semitendinosus	Cortical	520	2,5	20315	97,5	20835	1090	5,2	19745	94,8	20835
	Rigidfix / Transfix	102	1,4	7443	98,6	7545	335	4,4	7210	95,6	7545
	Close to joint	129	3,1	3970	96,9	4099	273	6,7	3826	93,3	4099
	Other	5	2,3	216	97,7	221	9	4,1	212	95,9	221
	Total	756	2,3	31944	97,7	32700	1707	5,2	30993	94,8	32700
Quadriceps	Cortical	3	1,0	285	99,0	288	5	1,7	283	98,3	288
	Close to joint	0	0,0	24	100,0	24	1	4,2	23	95,8	24
	Other	0	0,0	3	100,0	3	0	0,0	3	100,0	3
	Total	3	1,0	312	99,0	315	6	1,9	309	98,1	315
Allograft	Cortical	2	1,6	125	98,4	127	7	5,5	120	94,5	127
	Rigidfix / Transfix	0	0,0	10	100,0	10	0	0,0	10	100,0	10
	Close to joint	0	0,0	26	100,0	26	0	0,0	26	100,0	26
	Total	2	1,2	161	98,8	163	7	4,3	156	95,7	163
Other	Cortical	1	1,6	61	98,4	62	4	6,5	58	93,5	62
	Rigidfix / Transfix	0	0,0	4	100,0	4	0	0,0	4	100,0	4
	Close to joint	1	4,5	21	95,5	22	1	4,5	21	95,5	22
	Other	1	9,1	10	90,9	11	1	9,1	10	90,9	11
	Total	3	3,0	96	97,0	99	6	6,1	93	93,9	99
Total	Cortical	532	2,5	21050	97,5	21582	1118	5,2	20464	94,8	21582
	Rigidfix / Transfix	102	1,3	7464	98,7	7566	335	4,4	7231	95,6	7566
	Close to joint	156	2,7	5705	97,3	5861	351	6,0	5510	94,0	5861
	Other	7	2,9	235	97,1	242	12	5,0	230	95,0	242
	Total	797	2,3	34454	97,7	35251	1816	5,2	33435	94,8	35251

The following table presents the number of revisions on the same knee within two years and per clinic. The clinics that are presented are those that initially performed the first operation but not necessarily the revision. The steering committee has chosen to present all the clinics without taking account of the number of primary operations.

TABLE 19
 ACL index grafts leading to revision within two years
 distributed by region and clinic
*ACL index during the surgery period 1 January 2005 to
 31 December 2016*

Region	Clinic	Revision within two years					Revision				
		Yes		No		ACL index	Yes		No		ACL index
		N	%	N	%		N	%	N	%	
Greater Stockholm	KAROLINSKA UNIVERSITETS-SJUKHUSET	2	1,1	185	98,9	187	9	4,8	178	95,2	187
	ARTROCENTER	1	3,8	25	96,2	26	1	3,8	25	96,2	26
	S:T GÖRANS SJUKHUS CAPIO, STOCKHOLM	3	3,0	97	97,0	100	6	6,0	94	94,0	100
	CITYAKUTEN PRIVATVÅRD	0	0,0	51	100,0	51	0	0,0	51	100,0	51
	DANDERYDS SJUKHUS	7	2,2	318	97,8	325	17	5,2	308	94,8	325
	LÖWETS SPECIALISTMOTTAGNING	5	2,1	238	97,9	243	17	7,0	226	93,0	243
	KAROLINSKA UNIVERSITETS- SJUKHUSET/ORTOPEDKLINIKEN	16	2,6	607	97,4	623	29	4,7	594	95,3	623
	NACKA NÄRSJUKHUS	2	1,9	102	98,1	104	6	5,8	98	94,2	104
	ODENPLANS LÄKARHUS	4	2,2	180	97,8	184	14	7,6	170	92,4	184
	ORTOPEDISKA HUSET CAREMA	14	2,0	696	98,0	710	25	3,5	685	96,5	710
	SABBATSBERG NÄRSJUKHUSET	2	1,4	138	98,6	140	3	2,1	137	97,9	140
	SÖDERMALMS ORTOPEDI	0	0,0	50	100,0	50	0	0,0	50	100,0	50
	SÖDERTÄLJE SJUKHUS	3	3,8	77	96,3	80	5	6,3	75	93,8	80
	SÖDERSJUKHUSET	32	2,5	1263	97,5	1295	71	5,5	1224	94,5	1295
	SOPHIAHEMMET	0	0,0	51	100,0	51	0	0,0	51	100,0	51
	ORTHOCENTER STOCKHOLM	10	2,8	352	97,2	362	22	6,1	340	93,9	362
	CAPIO ARTRO CLINIC	166	2,5	6528	97,5	6694	379	5,7	6315	94,3	6694
Total	267	2,4	10958	97,6	11225	604	5,4	10621	94,6	11225	
Svealand + Gotland	AKADEMISKA SJUKHUSET	4	2,9	132	97,1	136	9	6,6	127	93,4	136
	BOLLNÄS SJUKHUS	0	0,0	9	100,0	9	0	0,0	9	100,0	9
	LASARETTET I ENKÖPING	2	2,8	70	97,2	72	2	2,8	70	97,2	72
	ELISABETHSJUKHUSET	19	2,6	712	97,4	731	49	6,7	682	93,3	731
	FALU LASARETT	9	1,8	501	98,2	510	22	4,3	488	95,7	510
	GÄVLE SJUKHUS	4	1,1	376	98,9	380	16	4,2	364	95,8	380
	HUDIKSVALLS SJUKHUS	7	2,5	277	97,5	284	12	4,2	272	95,8	284
	KARLSTAD CENTRALSJUKHUS	13	1,6	785	98,4	798	40	5,0	758	95,0	798
	KARLSKOGA LASARETT	0	0,0	11	100,0	11	3	27,3	8	72,7	11
	CAPIO LÄKARGRUPPEN I ÖREBRO AB	23	4,3	517	95,7	540	40	7,4	500	92,6	540
	MÄLARSJUKHUSET ESKILSTUNA	6	1,6	369	98,4	375	12	3,2	363	96,8	375
	NORRTÄLJE SJUKHUS	2	1,5	134	98,5	136	6	4,4	130	95,6	136
	NYKÖPINGS LASARETT	2	1,6	125	98,4	127	6	4,7	121	95,3	127
	ÖREBRO USÖ	9	2,7	324	97,3	333	20	6,0	313	94,0	333
	SAMARITERHEMMETS SJUKHUS	1	0,5	217	99,5	218	9	4,1	209	95,9	218
	SPECIALISTCENTER SCANDINAVIA	0	0,0	9	100,0	9	0	0,0	9	100,0	9
	VÄSTERÅS CENTRALLASARETTET	1	0,4	241	99,6	242	6	2,5	236	97,5	242
	VISBY LASARETT	3	3,3	87	96,7	90	6	6,7	84	93,3	90
	VÄSTERÅS ORTOPEDPRAKTIK	4	3,2	121	96,8	125	4	3,2	121	96,8	125
	Total	109	2,1	5017	97,9	5126	262	5,1	4864	94,9	5126

TABLE 19 continues on the next page.

Continuation of TABELL 19.

Region	Clinic	Revision within two years					Revision				
		Yes		No		ACL index	Yes		No		ACL index
		N	%	N	%		N	%	N	%	
Skåne	ALERIS ORTOPEDI ÄNGELHOLM	10	1,6	599	98,4	609	26	4,3	583	95,7	609
	HÄSSLEHOLMS SJUKHUS	12	1,5	779	98,5	791	38	4,8	753	95,2	791
	HELSINGBORGS SJUKHUS	13	2,6	492	97,4	505	22	4,4	483	95,6	505
	LUNDS UNIVERSITET	6	1,5	397	98,5	403	25	6,2	378	93,8	403
	MALMÖ ALLMÄNNA SJUKHUS	17	2,2	745	97,8	762	46	6,0	716	94,0	762
	ORTHOCENTER I SKÅNE	4	4,0	97	96,0	101	4	4,0	97	96,0	101
	SKÅNES UNIVERSITETSSJUKHUS	26	1,8	1389	98,2	1415	61	4,3	1354	95,7	1415
	Total	88	1,9	4498	98,1	4586	222	4,8	4364	95,2	4586
Halland	HALMSTADS SJUKHUS	3	4,6	62	95,4	65	7	10,8	58	89,2	65
	KUNGSBACKA SJUKHUS	19	2,6	711	97,4	730	38	5,2	692	94,8	730
	MOVEMENT MEDICAL AB	36	3,4	1016	96,6	1052	72	6,8	980	93,2	1052
	ORTOPEDSPECIALISTERNA	0	0,0	17	100,0	17	0	0,0	17	100,0	17
	Total	58	3,1	1806	96,9	1864	117	6,3	1747	93,7	1864
Småland + Blekinge	ART CLINIC	0	0,0	45	100,0	45	0	0,0	45	100,0	45
	HÖGLANDSSJUKHUSET	7	1,5	452	98,5	459	18	3,9	441	96,1	459
	KALMAR SJUKHUS	15	2,4	599	97,6	614	30	4,9	584	95,1	614
	BLEKINGESJUKHUSET	0	0,0	108	100,0	108	2	1,9	106	98,1	108
	LUNGBY LASARETT	5	2,6	190	97,4	195	8	4,1	187	95,9	195
	OSKARSHAMNS SJUKHUS	0	0,0	327	100,0	327	6	1,8	321	98,2	327
	LÄNSSJUKHUSET RYHOV	9	2,9	306	97,1	315	16	5,1	299	94,9	315
	CENTRALLASARETTET VÄXJÖ	7	1,3	526	98,7	533	23	4,3	510	95,7	533
	VÄRNAMO SJUKHUS/ORTOPED- KLINIKEN	1	1,3	74	98,7	75	4	5,3	71	94,7	75
	VÄSTERVIKS SJUKHUS	1	0,7	140	99,3	141	4	2,8	137	97,2	141
Total	45	1,6	2767	98,4	2812	111	3,9	2701	96,1	2812	
Västra Götaland	ALINGSÅS LASARETT	12	3,9	295	96,1	307	25	8,1	282	91,9	307
	ART CLINIC GÖTEBORG	1	4,3	22	95,7	23	3	13,0	20	87,0	23
	SÖDRA ÄLVSBOGGS SJUKHUS	2	1,2	170	98,8	172	5	2,9	167	97,1	172
	CARLANDERSKA ORTOPEDI	2	6,1	31	93,9	33	2	6,1	31	93,9	33
	DROTTNING SILVIAS BARN- OCH UNGDOMSSJUKHUS	2	5,7	33	94,3	35	2	5,7	33	94,3	35
	FRÖLUNDAORTOPEDEN	0	0,0	13	100,0	13	0	0,0	13	100,0	13
	FRÖLUNDA SPECIALISTSJUKHUS	9	3,6	243	96,4	252	16	6,3	236	93,7	252
	ORTHOCENTER/IFK-KLINIKEN	59	5,2	1084	94,8	1143	98	8,6	1045	91,4	1143
	KUNGÄLVS SJUKHUS	3	2,1	138	97,9	141	6	4,3	135	95,7	141
	CAPIO LUNDBY NÄRSJUKHUS	12	3,0	383	97,0	395	18	4,6	377	95,4	395
	LIDKÖPINGS SJUKHUS	3	1,4	215	98,6	218	6	2,8	212	97,2	218
	NU-SJUKVÅRDEN	41	3,8	1044	96,2	1085	85	7,8	1000	92,2	1085
	PERAGO ORTOPEDKLINIK	6	5,0	113	95,0	119	7	5,9	112	94,1	119
	KÄRNSJUKHUSET I SKÖVDE	3	4,0	72	96,0	75	3	4,0	72	96,0	75
	SPORTSMED	0	0,0	78	100,0	78	1	1,3	77	98,7	78
	SAHLGRENSKA UNIVERSITETS- SJUKHUSET	36	2,3	1555	97,7	1591	75	4,7	1516	95,3	1591
	VARBERGS SJUKHUS	4	1,5	270	98,5	274	11	4,0	263	96,0	274
	Total	195	3,3	5759	96,7	5954	363	6,1	5591	93,9	5954

TABELL 19 continues on the next page.

Continuation of TABELL 19.

Region	Clinic	Revision within two years					Revision				
		Yes		No		ACL index	Yes		No		ACL index
		N	%	N	%		N	%	N	%	
Östergötland	LINKÖPINGS HEALTH CARE	0	0,0	1	100,0	1	0	0,0	1	100,0	1
	LINKÖPINGS UNIVERSITETSKLINIK	7	1,0	720	99,0	727	30	4,1	697	95,9	727
	VRINNEVISJUKHUSET	7	0,8	842	99,2	849	31	3,7	818	96,3	849
	Total	14	0,9	1563	99,1	1577	61	3,9	1516	96,1	1577
Norrländ	ALFREDSON TENDON CLINIC	0	0,0	2	100,0	2	0	0,0	2	100,0	2
	GÄLLIVARE SJUKHUS	0	0,0	64	100,0	64	0	0,0	64	100,0	64
	LÄKARHUSET HERMELINEN	2	3,0	65	97,0	67	3	4,5	64	95,5	67
	MEDICIN DIREKT	9	2,1	428	97,9	437	29	6,6	408	93,4	437
	ÖRNSKÖLDSVIKS SJUKHUS	1	0,7	139	99,3	140	6	4,3	134	95,7	140
	ÖSTERSUNDS SJUKHUS	2	2,7	73	97,3	75	6	8,0	69	92,0	75
	PITEÅ ÄLVDAL SJUKHUS	0	0,0	68	100,0	68	2	2,9	66	97,1	68
	SKELLEFTEÅ SJUKHUS	0	0,0	30	100,0	30	2	6,7	28	93,3	30
	SPORTS MEDICINE UMEÅ	12	3,2	367	96,8	379	21	5,5	358	94,5	379
	SOLLEFTEÅ SJUKHUS	0	0,0	49	100,0	49	0	0,0	49	100,0	49
	SUNDERBY SJUKHUS	4	0,8	515	99,2	519	16	3,1	503	96,9	519
	LÄNSSJUKHUSET SUNDSVALL	1	1,4	73	98,6	74	3	4,1	71	95,9	74
	NORRLANDS UNIVERSITETS-SJUKHUS, UMEÅ	12	1,2	1007	98,8	1019	42	4,1	977	95,9	1019
	Total	43	1,5	2880	98,5	2923	130	4,4	2793	95,6	2923
Total		819	2,3	35248	97,7	36067	1870	5,2	34197	94,8	36067

KOOS knee-related quality of life

Only looking at revisions as an indication of a failed index operation does not tell the whole story, as it is not certain that a patient will undergo a revision in spite of poor knee function. One way of identifying patients who probably do not have a fully functional ACL is to look at the percentage who have given an rating of < 44 in the category for knee-related quality of life on the KOOS two years after the primary operation. The following table shows the response frequency for KOOS knee-related quality of life at two years and the percentage with < 44, distributed by region and clinic.

TABLE 20
 KOOS knee-related quality of life at two years postop of
 the ACL index distributed by region and clinic
*ACL index during the surgery period 1 January 2005 to
 31 December 2016*

Region	Clinic	KOOS knee-related quality of life at two years postop								ACL index
		QoL < 44		QoL ≥ 44		Response rate		No response, new operation		
		N	%	N	%	N	%	N	%	
Greater Stockholm	KAROLINSKA UNIVERSITETS-SJUKHUSET	13	13	91	88	104	57	6	3	187
	ARTROCENTER	3	38	5	63	8	35	3	12	26
	S:T GÖRANS SJUKHUS CAPIO, STOCKHOLM	9	16	46	84	55	57	3	3	100
	CITYAKUTEN PRIVATVÅRD	7	33	14	67	21	41	0	0	51
	DANDERYDS SJUKHUS	44	35	82	65	126	40	9	3	325
	LÖWETS SPECIALISTMOTTAGNING	24	19	104	81	128	55	11	5	243
	KAROLINSKA UNIVERSITETS- SJUKHUSET/ORTOPEDKLINIKEN	74	29	178	71	252	42	24	4	623
	NACKA NÄRSJUKHUS	15	31	33	69	48	47	2	2	104
	ODENPLANS LÄKARHUS	14	19	59	81	73	41	8	4	184
	ORTOPEDISKA HUSET CAREMA	70	23	241	77	311	45	22	3	710
	SABBATSBERG NÄRSJUKHUSET	20	38	32	62	52	39	5	4	140
	SÖDERMALMS ORTOPEDI	3	15	17	85	20	41	1	2	50
	SÖDERTÄLJE SJUKHUS	12	44	15	56	27	35	3	4	80
	SÖDERSJUKHUSET	142	28	371	72	513	41	43	3	1295
	SOPHIAHEMMET	5	23	17	77	22	44	1	2	51
	ORTHOCENTER STOCKHOLM	41	26	114	74	155	45	16	4	362
	CAPIO ARTRO CLINIC	651	20	2569	80	3220	50	289	4	6694
Total	1147	22	3988	78	5135	48	446	4	11225	
Svealand + Gotland	AKADEMISKA SJUKHUSET	10	29	25	71	35	27	6	4	136
	BOLLNÄS SJUKHUS	1	33	2	67	3	33	0	0	9
	LASARETTET I ENKÖPING	7	33	14	67	21	30	2	3	72
	ELISABETHSJUKHUSET	72	26	206	74	278	39	27	4	731
	FALU LASARETT	82	36	146	64	228	46	13	3	510
	GÄVLE SJUKHUS	68	41	98	59	166	45	9	2	380
	HUDIKSVALLS SJUKHUS	33	29	79	71	112	41	9	3	284
	KARLSTAD CENTRALSJUKHUS	122	35	227	65	349	45	20	3	798
	KARLSKOGA LASARETT	3	60	2	40	5	45	0	0	11
	CAPIO LÄKARGRUPPEN I ÖREBRO AB	91	34	178	66	269	53	30	6	540
	MÄLARSJUKHUSET ESKILSTUNA	59	34	115	66	174	48	10	3	375
	NORRTÄLJE SJUKHUS	11	26	31	74	42	32	3	2	136
	NYKÖPINGS LASARETT	19	40	29	60	48	39	5	4	127
	ÖREBRO USÖ	55	37	92	63	147	46	12	4	333
	SAMARITERHEMMETS SJUKHUS	28	28	72	72	100	47	5	2	218
	SPECIALISTCENTER SCANDINAVIA	3	43	4	57	7	78	0	0	9
	VÄSTERÅS CENTRALLASARETTET	49	46	58	54	107	45	3	1	242
	VISBY LASARETT	15	37	26	63	41	48	4	4	90
	VÄSTERÅS ORTOPEDPRAKTIK	13	36	23	64	36	31	7	6	125
	Total	741	34	1427	66	2168	44	165	3	5126

TABLE 20 continues on the next page.

Continuation of TABLE 20.

Region	Clinic	KOOS knee-related quality of life at two years postop								ACL index
		QoL < 44		QoL ≥ 44		Response rate		No response, new operation		
		N	%	N	%	N	%	N	%	
Skåne	ALERIS ORTOPEDI ÄNGELHOLM	61	25	181	75	242	41	22	4	609
	HÄSSLEHOLMS SJUKHUS	96	28	243	72	339	44	18	2	791
	HELSINGBORGS SJUKHUS	73	36	128	64	201	42	22	4	505
	LUNDS UNIVERSITET	52	26	150	74	202	52	12	3	403
	MALMÖ ALLMÄNNA SJUKHUS	123	37	212	63	335	46	30	4	762
	ORTHOCENTER I SKÅNE	10	24	32	76	42	43	4	4	101
	SKÅNES UNIVERSITETSSJUKHUS	210	34	408	66	618	45	44	3	1415
	Total	625	32	1354	68	1979	45	152	3	4586
Halland	HALMSTADS SJUKHUS	11	32	23	68	34	55	3	5	65
	KUNGSBACKA SJUKHUS	86	27	237	73	323	46	32	4	730
	MOVEMENT MEDICAL AB	156	33	323	67	479	48	53	5	1052
	ORTOPEDSPECIALISTERNA	0	0	6	100	6	35	0	0	17
	Total	253	30	589	70	842	47	88	5	1864
Småland + Blekinge	ART CLINIC	4	18	18	82	22	49	0	0	45
	HÖGLANDSSJUKHUSET	65	28	169	72	234	53	15	3	459
	KALMAR SJUKHUS	69	27	188	73	257	43	23	4	614
	BLEKINGESJUKHUSET	15	35	28	65	43	40	1	1	108
	LIUNGBY LASARETT	21	24	68	76	89	48	8	4	195
	OSKARSHAMNS SJUKHUS	45	28	118	72	163	50	3	1	327
	LÄNSSJUKHUSET RYHOV	48	33	98	67	146	48	11	3	315
	CENTRALLASARETTET VÄXJÖ	61	25	179	75	240	47	17	3	533
	VÄRNAMO SJUKHUS/ORTOPED-KLINIKEN	8	33	16	67	24	32	1	1	75
	VÄSTERVIKS SJUKHUS	21	33	42	67	63	45	2	1	141
Total	357	28	924	72	1281	47	81	3	2812	
Västra Götaland	ALINGSÅS LASARETT	50	37	85	63	135	47	17	6	307
	ART CLINIC GÖTEBORG	5	50	5	50	10	45	1	4	23
	SÖDRA ÄLVSBORGS SJUKHUS	37	48	40	52	77	45	2	1	172
	CARLANDERSKA ORTOPEDI	3	21	11	79	14	45	2	6	33
	DROTTNING SILVIAS BARN- OCH UNGDOMSSJUKHUS	4	27	11	73	15	47	3	9	35
	FRÖLUNDAORTOPEDEN	1	33	2	67	3	23	0	0	13
	FRÖLUNDA SPECIALISTSJUKHUS	32	26	90	74	122	51	12	5	252
	ORTHOCENTER/IFK-KLINIKEN	134	24	421	76	555	52	85	7	1143
	KUNGÄLVSSJUKHUS	28	35	52	65	80	59	5	4	141
	CAPIO LUNDBY NÄRSJUKHUS	53	29	131	71	184	49	20	5	395
	LIDKÖPINGS SJUKHUS	45	42	62	58	107	50	5	2	218
	NU-SJUKVÅRDEN	165	30	388	70	553	54	61	6	1085
	PERAGO ORTOPEDKLINIK	12	23	41	77	53	47	6	5	119
	KÄRNSJUKHUSET I SKÖVDE	10	27	27	73	37	53	5	7	75
	SPORTSMED	10	25	30	75	40	52	1	1	78
	SAHLGRENSKA UNIVERSITETS-SJUKHUSET	258	35	472	65	730	48	59	4	1591
	VARBERGS SJUKHUS	46	31	101	69	147	55	6	2	274
	Total	893	31	1969	69	2862	51	290	5	5954

TABLE 20 continues on the next page.

Continuation of TABLE 20.

Region	Clinic	KOOS knee-related quality of life at two years postop								
		QoL < 44		QoL ≥ 44		Response rate		No response, new operation		ACL index
		N	%	N	%	N	%	N	%	
Östergötland	LINKÖPINGS HEALTH CARE	0	0	1	100	1	100	0	0	1
	LINKÖPINGS UNIVERSITETSKLINIK	116	36	204	64	320	45	15	2	727
	VRINNEVISJUKHUSET	133	36	237	64	370	44	17	2	849
	Total	249	36	442	64	691	45	32	2	1577
Norrländ	ALFREDSON TENDON CLINIC	0	0	0	0	0	0	0	0	2
	GÄLLIVARE SJUKHUS	10	25	30	75	40	63	1	2	64
	LÄKARHUSET HERMELINEN	7	21	26	79	33	52	3	4	67
	MEDICIN DIREKT	59	29	144	71	203	48	15	3	437
	ÖRNSKÖLDSVIKS SJUKHUS	35	47	39	53	74	54	2	1	140
	ÖSTERSUNDS SJUKHUS	11	37	19	63	30	42	4	5	75
	PITEÅ ÄLVDAL SJUKHUS	10	29	24	71	34	50	0	0	68
	SKELLEFTEÅ SJUKHUS	4	31	9	69	13	43	0	0	30
	SPORTS MEDICINE UMEÅ	47	28	119	72	166	46	17	4	379
	SOLLEFTEÅ SJUKHUS	9	50	9	50	18	37	0	0	49
	SUNDERBY SJUKHUS	78	35	144	65	222	44	11	2	519
	LÄNSSJUKHUSET SUNDSVALL	10	36	18	64	28	39	2	3	74
	NORRLANDS UNIVERSITETS-SJUKHUS, UMEÅ	150	33	311	67	461	47	29	3	1019
	Total	430	33	892	67	1322	47	84	3	2923
Total		4695	29	11585	71	16280	47	1338	4	36067

Multiligament injuries

Even if the majority of injuries registered in the knee ligament registry are anterior cruciate ligament injuries, multiligament and isolated injuries to other ligaments are also registered. In all, 90 multiligament injuries were registered in 2018, corresponding to 2.4% of all operations. By far the most common combination was the reconstruction of the ACL with an injury to the medial cruciate ligament (MCL), where 38 operations were performed. Twenty-five operations involved different combinations of the ACL and collateral ligament (LCL). On 32 occasions, there was a combined injury to both the ACL and posterior cruciate ligament (PCL) and, on one occasion, there was an extremely extensive injury involving the ACL, PCL, MCL, LCL and the “outer rear complex” posterolateral cruciate (PLC).

The following table shows combinations of all multiligament injuries that were registered in conjunction with primary operations in the knee ligament registry.

TABLE 21
Combinations of multiligament injuries in primary reconstructions during the period 2005-2028

					2018		2017		2005-2016		Total	
					N	%	N	%	N	%	N	%
ACL*	---	---	---	---	3673	97,6	3777	97,7	36644	97,8	44094	97,8
ACL*	---	MCL	---	---	38	1,0	41	1,1	338	0,9	417	0,9
ACL*	PCL	---	---	---	19	0,5	13	0,3	162	0,4	194	0,4
ACL*	---	---	LCL	---	10	0,3	13	0,3	93	0,2	116	0,3
ACL*	---	---	LCL	PLC	6	0,2	4	0,1	65	0,2	75	0,2
ACL*	PCL	MCL	---	---	6	0,2	10	0,3	58	0,2	74	0,2
ACL*	PCL	---	LCL	PLC	0	0,0	5	0,1	31	0,1	36	0,1
ACL*	PCL	---	LCL	---	5	0,1	1	0,0	18	0,0	24	0,1
ACL*	---	---	---	PLC	1	0,0	0	0,0	19	0,1	20	0,0
ACL*	PCL	---	---	PLC	1	0,0	1	0,0	13	0,0	15	0,0
ACL*	PCL	MCL	LCL	PLC	1	0,0	0	0,0	9	0,0	10	0,0
ACL*	---	MCL	LCL	PLC	2	0,1	0	0,0	4	0,0	6	0,0
ACL*	---	MCL	LCL	---	1	0,0	1	0,0	4	0,0	6	0,0
ACL*	---	MCL	---	PLC	0	0,0	0	0,0	2	0,0	2	0,0
ACL*	PCL	MCL	---	PLC	0	0,0	0	0,0	1	0,0	1	0,0
ACL*	PCL	MCL	LCL	---	0	0,0	0	0,0	0	0,0	0	0,0
Total					3763	100,0	3866	100,0	37461	100,0	45090	100,0

* Also includes the ACLs without information on grafts

Meniscal sutures

The registry data from 2005 to 2018 from the whole of Sweden clearly demonstrate that there has been an increase in the number of cases of meniscal suturing in conjunction with an ACL reconstruction. The frequency has successively increased from just under 4% to just over 17% when both primary and revision ACL surgery are included. There was no real difference in the frequency of meniscal suturing between primary ACL reconstructions and revisions between 2005 and 2018.

There are large differences between different clinics/regions when reporting the number of meniscal suturing cases to the registry.

A worrying number of clinics report a frequency of 0% or close to 0% of meniscal suture cases, which appears to be indefensible based on the current consensus relating to the occurrence and treatment of these injuries at the present time. It is probably possible to suture a meniscal injury in purely technical surgical terms in as many as a quarter of all ACL reconstructions, but there is no strict consensus and no established selection criteria and more research therefore needs to be focused on following this up in the future.

Patient-reported function and quality of life (PROM)

All patients are asked to complete two questionnaires, the KOOS and the EQ5D.

The KOOS (Knee injury and Osteoarthritis Outcome Score) is a knee-specific instrument for evaluating the patient's perception of his/her knees and knee-related problems. The instrument evaluates five aspects: pain, other symptoms, such as swelling, joint mobility and mechanical symptoms, functional impairment in connection with daily activities, functional impairment in connection with sport and recreational activities and knee-related quality of life.

The EQ5D is a questionnaire on non-illness-specific health-related quality of life. It comprises five questions with three alternative answers. Each question covers a separate dimension: mobility, hygiene, main activities, pain/problems and fear/depression. The results are presented as an index, a quality of life weighting between 0 (death) and 1 (complete health). A negative index is also possible and it then indicates a state of health worse than death. This self-rated health status is also assessed using a thermometer-like scale, the EQ5D-VAS, with the end-points of "worst conceivable health status" (assessed as 0) and "best conceivable health status" (assessed as 100).

Prior to surgery, the patients experience an impairment in their self-rated function. The steering committee sees a clear-cut improvement in self-rated knee function one year after surgery, followed by a successive improvement two and five years after surgery. A comparison with reference data from 118 soccer players with healthy knees reveals that patients do not achieve normal function one, two or five years after surgery. The greatest differences between patients before and after surgery and the reference group can be seen in the aspects of "functional impairment in connection with sport and recreational activities" and "knee-related quality of life". The results for 2016 do not differ markedly from those in previous years.

The following table shows the data for the KOOS, clinic by clinic, two years postoperatively. We have only included patients aged between 20 and 30 who underwent surgery with hamstring grafts in 2007-2016. The table presents two constructed average values, the first for the first three dimensions of the KOOS, i.e. pain, other symptoms, such as swelling, joint mobility and mechanical symptoms, and functional impairment in connection with daily activity, while the second presents the dimensions of functional impairment in connection with sport and recreational activities and knee-related quality of life.

TABLE 22
 KOOS pain, symptoms and ADL (mean value) and function
 and knee-related quality of life (mean value) two years
 postoperatively distributed by region and clinic
*Primary hamstring grafts during the surgery period
 2007-2016 for the age range of 20-30 years*

		KOOS two years postoperatively									
		Pain, Symptoms & ADL			Function & Quality of life			Response rate		Primary ACL	
		N	MV	SD	N	MV	SD	N	%		Loss*
Greater Stockholm	ARTROCENTER	2	99,1	0,0	2	97,2	4,0	2	22,2	1	10
	CITYAKUTEN PRIVATVÅRD	6	88,1	9,9	6	64,4	17,6	6	35,3	0	17
	DANDERYDS SJUKHUS	35	76,2	19,0	35	53,2	28,5	35	33,3	3	108
	LÖWETS SPECIALISTMOTTAGNING	43	86,9	15,4	43	68,7	25,9	43	50,6	2	87
	KAROLINSKA UNIVERSITETS-SJUKHUSET/ORTOPEDKLINIKEN	82	84,2	14,4	82	61,0	26,6	82	42,3	4	198
	NACKA NÄRSJUKHUS	11	86,8	9,3	11	74,0	17,5	11	33,3	2	35
	ODENPLANS LÄKHUS	27	84,3	14,0	27	63,5	22,0	27	36,0	6	81
	ORTOPEDISKA HUSET CAREMA	76	87,2	11,8	76	67,5	23,7	76	34,2	7	229
	SABBATSBERG NÄRSJUKHUSET	10	79,7	15,2	10	52,1	24,5	10	38,5	0	26
	SÖDERMALMS ORTOPEDI	1	75,7		1	44,4		1	33,3	0	3
	SÖDERTÄLJE SJUKHUS	6	80,3	12,8	6	55,4	20,5	6	20,0	1	31
	SÖDERSJUKHUSET	165	84,4	14,6	165	63,5	23,5	165	37,0	15	461
	SOPHIAHEMMET	3	69,5	10,0	3	45,6	10,7	3	27,3	1	12
	ORTHOCENTER STOCKHOLM	39	82,8	14,6	39	60,8	24,1	39	37,9	6	109
	CAPIO ARTRO CLINIC	749	87,2	12,5	749	68,3	22,2	749	43,8	83	1795
Total	1255	86,0	13,5	1255	66,2	23,3	1255	40,9	131	3202	
Svealand + Gotland	AKADEMISKA SJUKHUSET	14	85,8	11,9	14	64,2	18,8	14	20,0	2	72
	BOLLNÄS SJUKHUS	1	62,4		1	21,9		1	25,0	0	4
	LASARETTET I ENKÖPING	7	73,0	18,8	7	50,6	34,1	7	18,4	0	38
	ELISABETHSJUKHUSET	111	87,4	12,1	111	67,2	19,7	111	34,5	13	335
	FALU LASARETT	63	80,6	15,1	63	58,4	23,8	63	38,0	6	172
	GÄVLE SJUKHUS	52	79,6	17,5	52	55,4	25,5	52	43,7	3	122
	HUDIKSVALLS SJUKHUS	46	79,1	15,2	46	57,5	23,9	46	35,4	2	132
	KARLSTAD CENTRALSJUKHUS	96	79,9	17,0	95	57,7	25,4	96	43,6	5	225
	CAPIO LÄKARGRUPPEN I ÖREBRO AB	85	82,3	15,0	85	60,0	24,9	85	47,0	6	187
	MÄLARSJUKHUSET ESKILSTUNA	49	85,5	12,0	49	63,5	23,2	49	40,8	1	121
	NORRTÄLJE SJUKHUS	16	86,4	15,0	16	66,3	26,0	16	24,6	2	67
	NYKÖPINGS LASARETT	14	79,2	21,1	14	55,8	23,4	14	33,3	1	43
	ÖREBRO USÖ	48	83,1	15,9	48	62,7	26,0	48	40,0	5	125
	SAMARITERHEMMETS SJUKHUS	18	82,0	15,2	18	63,7	21,2	18	39,1	0	46
	SPECIALISTCENTER SCANDINAVIA	2	71,9	39,8	2	63,8	51,3	2	100,0	0	2
	VÄSTERÅS CENTRALLASARETTET	27	82,2	16,6	27	58,4	24,4	27	34,2	0	79
	VISBY LASARETT	12	87,3	8,1	12	64,2	21,4	12	31,6	1	39
	VÄSTERÅS ORTOPEDPRAKTIK	14	84,0	13,2	14	59,8	25,4	14	25,5	4	59
Total	675	82,6	15,3	674	60,8	24,0	675	37,1	51	1868	
Skåne	ALERIS ORTOPEDI ÄNGELHOLM	52	83,4	11,8	52	56,8	22,8	52	40,0	4	134
	HÄSLEHOLMS SJUKHUS	151	83,4	16,1	151	62,3	24,5	151	47,6	5	322
	HELSINGBORGS SJUKHUS	58	76,8	18,7	58	54,8	27,1	58	33,3	7	181
	LUNDS UNIVERSITET	52	85,2	12,2	52	64,0	21,6	52	53,6	1	98
	MALMÖ ALLMÄNNA SJUKHUS	81	81,6	16,4	81	57,7	26,3	81	45,8	6	183
	ORTHOCENTER I SKÅNE	18	85,4	13,7	18	70,9	24,8	18	51,4	0	35
	SKÅNES UNIVERSITETSSJUKHUS	227	80,4	16,8	227	56,5	25,2	227	39,3	12	590
Total	639	81,7	16,1	639	58,9	25,0	639	42,4	35	1543	

TABLE 22 continues on the next page.

Continuation of TABLE 22.

		KOOS two years postoperatively									
		Pain, Symptoms & ADL			Function & Quality of life			Response rate			Primary
		N	MV	SD	N	MV	SD	N	%	Loss*	ACL
Halland	HALMSTADS SJUKHUS	6	74,7	11,7	6	45,0	22,5	6	26,1	3	26
	KUNGSBACKA SJUKHUS	113	82,9	15,1	113	61,0	23,0	113	40,6	21	299
	MOVEMENT MEDICAL AB	166	83,4	15,2	166	62,6	24,4	166	43,6	17	398
	ORTOPEDSPECIALISTERNA	3	88,6	3,7	3	78,1	5,1	3	42,9	0	7
	Total	288	83,1	15,0	288	61,8	23,8	288	41,8	41	730
Småland + Blekinge	ART CLINIC	5	92,5	5,5	5	77,0	13,9	5	29,4	0	17
	HÖGLANDSSJUKHUSET	68	84,1	15,1	68	64,6	27,1	68	47,6	3	146
	KALMAR SJUKHUS	94	82,0	16,2	94	58,6	25,5	94	41,0	7	236
	BLEKINGESJUKHUSET	14	76,0	18,5	14	51,0	17,6	14	28,0	0	50
	LJUNGBY LASARETT	41	83,3	14,0	41	62,7	23,3	41	45,6	3	93
	OSKARSHAMNS SJUKHUS	54	83,6	11,7	53	60,4	21,6	54	47,8	2	115
	LÄNSSJUKHUSET RYHOV	53	85,7	12,7	53	64,0	22,3	53	43,8	5	126
	CENTRALLASARETTET VÄXJÖ	70	85,2	12,6	70	65,2	21,8	70	38,5	5	187
	VÄRNAMO SJUKHUS/ORTOPED-KLINIKEN	9	78,3	15,3	9	53,5	22,2	9	28,1	1	33
	VÄSTERVIKS SJUKHUS	19	76,4	17,9	19	53,7	21,2	19	30,2	3	66
	Total	427	83,2	14,5	426	61,6	23,7	427	41,1	29	1069
Västra Götaland	ALINGSÅS LASARETT	39	82,5	15,0	39	54,5	25,5	39	41,9	4	97
	ART CLINIC GÖTEBORG	5	88,4	9,4	5	68,4	18,3	5	31,3	0	16
	SÖDRA ÄLVSBORGS SJUKHUS	29	77,6	20,4	29	49,2	24,1	29	40,8	2	73
	CARLANDERSKA ORTOPEDI	5	90,0	9,6	5	66,1	26,5	5	35,7	1	15
	FRÖLUNDA SPECIALISTSJUKHUS	47	83,3	14,7	47	61,4	24,7	47	49,0	6	102
	ORTHOCENTER/IFK-KLINIKEN	157	85,2	14,6	157	67,4	25,3	157	45,2	27	374
	KUNGÄLVS SJUKHUS	19	84,6	9,9	19	60,7	21,6	19	46,3	1	42
	CAPIO LUNDBY NÄRSJUKHUS	84	88,0	11,3	84	67,6	22,4	84	47,7	10	186
	LIDKÖPINGS SJUKHUS	43	77,8	19,0	43	50,3	23,4	43	47,8	2	92
	NU-SJUKVÅRDEN	135	83,6	15,0	135	61,2	24,7	135	46,6	16	306
	PERAGO ORTOPEDKLINIK	17	82,2	13,5	17	59,9	24,4	17	34,0	3	53
	KÄRN SJUKHUSET I SKÖVDE	12	85,9	16,8	12	63,7	25,3	12	42,9	1	29
	SPORTSMED	12	86,2	17,6	12	64,1	26,9	12	57,1	0	21
	SAHLGRENSKA UNIVERSITETS-SJUKHUSET	231	84,4	14,9	231	62,0	24,5	231	42,7	18	559
	VARBERGS SJUKHUS	27	83,4	13,6	27	58,5	28,3	27	50,0	0	54
	Total	862	84,1	14,9	862	62,0	24,9	862	42,7	91	2019
Östergötland	LINKÖPINGS UNIVERSITETSKLINIK	107	81,0	17,2	107	56,5	25,9	107	41,6	1	258
	VRINNEVISJUKHUSET	132	82,1	13,9	133	60,4	24,0	133	37,4	4	360
	Total	239	81,6	15,5	240	58,6	24,9	240	39,2	5	618
Norrland	LÄKARHUSET HERMELINEN	12	85,6	9,9	12	60,1	17,5	12	63,2	0	19
	MEDICIN DIREKT	49	84,2	13,2	49	63,9	18,8	49	37,7	4	134
	ÖRNSKÖLDSVIKS SJUKHUS	16	77,1	15,8	16	45,1	21,4	16	44,4	0	36
	ÖSTERSUNDS SJUKHUS	7	85,1	13,1	7	57,6	20,6	7	46,7	1	16
	PITEÅ ÄLVDAL SJUKHUS	8	89,6	12,3	8	67,9	20,6	8	44,4	0	18
	SPORTS MEDICINE UMEÅ	65	84,2	13,4	65	63,0	22,6	65	40,4	2	163
	SOLLEFTEÅ SJUKHUS	10	73,3	13,1	10	50,6	23,5	10	41,7	0	24
	SUNDERBY SJUKHUS	65	83,7	15,1	65	63,5	22,3	65	38,7	3	171
	LÄNSSJUKHUSET SUNDSVALL	8	82,3	15,2	8	58,8	18,1	8	29,6	2	29
	NORRLANDS UNIVERSITETS-SJUKHUS, UMEÅ	154	84,4	13,9	154	60,2	24,0	154	41,5	7	378
	Total	394	83,7	13,9	394	60,9	22,5	394	39,9	19	988
Total		4779	83,8	14,8	4778	62,2	24,1	4780	41,1	402	12040

*Anticipated loss due to new operation; MV = median value; SD = standard deviation

Antibiotic prophylaxis

Antibiotics are basically administered in connection with all surgery (99.2%). The most common choice of drug is cloxacillin (95.9%), followed by clindamycin (3.4%). In 60% of operations, a dose of antibiotics is administered. The remaining patients receive two or more doses.

Septic arthritis following ACL reconstruction is a feared complication where the reported incidence varies significantly in different studies, 0.5-1.5% (Boström Widhamre 2014, Torres-Claramunt 2013). Septic arthritis results in the need for long-term antibiotic treatment, a number of arthroscopic irrigation procedures and the risk of a poorer subjective outcome. In serious cases, the removal of the graft or the material used for graft fixation may be necessary (Burks 2003). According to the register, almost 100% of patients are given preoperative antibiotics. According to PRISS (a Swedish acronym meaning prosthesis-related infections must be stopped), 2 g of cloxacillin i.v. 30-45 minutes prior to the start of surgery is recommended and we also ought to have this as a guideline prior to ACL surgery. Cloxacillin also has a good effect on the pathogens that are common after knee surgery. Clindamycin has been regarded as a second-line drug in connection with a suspicion of allergy, but recent data indicate that clindamycin has a poorer effect as a prophylactic and a more detailed allergy history is therefore recommended (Robertson 2017). If the patient has only has a limited rash without itching, administer 2g of cloxacillin, in the event of a widespread rash and/or angioedema 2 g of cefotaxin, but, if there are signs of anaphylaxis with airway symptoms and/or a fall in blood pressure, administer 600 mg of clindamycin. There are currently no clear-cut guidelines for when extended prophylaxis, more than one dose, should be administered. Risk factors that are mentioned are smoking, diabetes, overweight and perhaps long surgery times. In some 40% of operations, two or more doses of antibiotics are administered. A research project leading to a dissertation, which is based on Swedish registry data and is mapping the incidence of infections and subjectively perceived function, is currently in progress. The preliminary data reveal an infection incidence of just under 1% and that patients with infections feel significantly worse at follow-up after two and five years (Jesper Kraus Schmitz, personal communication).

A number of studies, describing a reduced risk of infection if the graft is prepared peroperatively with vancomycin, have recently been published (Vertullo 2012, Phegan 2016). These initial studies reveal a very marked reduction in the incidence of infection, but they may be biased in terms of their design as a comparison has been made with historic material and the result may have been influenced by other improvement measures that were implemented during the study period. In 2018, vancomycin was administered at 18 clinics in around 18% of all ACL operations in the registry. Preoperative intravenous prophylaxis was also administered by all these clinics. The studies that have been published report a dramatic reduction in infection incidence, but the risk of antibiotic resistance, fear of the way vancomycin could affect the graft and possibly the result of surgery, together with the risk of revision, are current the subject of discussion. The publications that are currently available report no proven increase in the risk of an impact on tendon structure or articular cartilage or the risk of a poorer subjective result or risk of revision (Naendrup 2018).

The question today is whether the available data give us reason to recommend administering vancomycin to every patient undergoing an ACL reconstruction or whether it should be reserved for patient groups among whom an increase in the risk of infection can be assumed to exist. A large randomized study or registry-based study of more extensive material should perhaps be conducted. A study of the registry is planned in 2020 when a sufficient number of operations with vancomycin have been registered to enable conclusions to be drawn.

Increased use of quadriceps tendons in surgery

For many years, the central portion of the patellar tendon was the most common graft in Sweden, but, since the mid-2000s, hamstring tendons (the semitendinosus, sometimes combined with the gracilis) have been increasing in popularity. There are a number of studies comparing patellar tendon grafts with hamstring grafts. Many of these studies are small, with poor statistical strength. Meta-analyses have produced varying results. Yunes et al. state that patients undergoing surgery involving patellar tendon grafts have greater potential to return to their previous activity levels, with improved stability (Yunes 2001). Improved sagittal stability with patellar tendon grafts is confirmed by a Swedish study by the Capio Artro Clinic (Cristiani et al. 2019). Goldblatt et al. were, however, unable to find any difference in stability when comparing hamstring tendons with patellar tendons, but patients undergoing surgery involving hamstring tendon grafts experience less patellofemoral pain and have less pain when kneeling (Goldblatt 2005). In a meta-analysis, Samuelsson et al. found no difference in subjectively perceived knee function, the ability to return to the previous activity level or measured laxity. Choosing patellar tendon grafts increases the risk of patellofemoral pain and patellofemoral crepitations and there are indications that patients undergoing reconstruction with patellar tendon grafts run an increased risk of developing arthrosis. Patients undergoing surgery involving hamstring tendons experience less hamstring strength, which could be important up to one year after surgery and they also run an increased risk of tunnel expansion, which could play an important role if a need for revision surgery occurs (Samuelsson 2009). In their meta-analysis, Reinhardt et al. reveal that the risk of re-rupture is probably smaller if patellar tendon grafts are chosen (Reinhardt 2010) and this is confirmed by subsequent registry studies (Gifstad 2014). The use of hamstring tendon grafts increased in the knee ligament registry between 2005 and 2013 and, at most, it was higher than 95%. Since 2013, there has been a weak trend towards renewed and increasing interest in patellar tendon grafts, but there are still only a few clinics that use patellar tendons as grafts in primary reconstruction, 32 clinics of 69. In revisions, the patellar tendon has been the most frequently used graft, but a sharp increase in the use of the quadriceps tendon has been seen over the past few years. The use of the quadriceps tendon has also increased in primary reconstructions. At the same time, however, only nine of 69 clinics use this graft.

There is limited scientific evidence describing the use of the quadriceps tendon in ACL reconstructions. A few small studies compare the quadriceps tendon with the patellar tendon and the results reveal small differences, such as a reduced risk of anterior knee pain in the quadriceps tendon group (Han 2008, Lee 2004, Geib 2009, Sloane 2015). A few years ago, a systematic review came to the same conclusion: the clinical and subjective outcome was on a par with that of the hamstring and patellar tendons, with low donor-site morbidity (Mulford 2013). A recently published report from the Danish knee ligament registry (Lind, ISAKOS 2019) reports an increase in the risk of revision and laxity after primary reconstruction using the quadriceps in comparison with the patellar and hamstring tendons. On the other hand, a prospective, randomized study from Denmark a few years earlier reported that the quadriceps produced the same subjective function with few donor-site problems and an implied lower risk of remaining pivoting in comparison with the patellar tendon (Lund 2014). More research is, however, needed.

The quadriceps tendon is 1.8 times thicker and has 20% more collagen than the patellar tendon. The quadriceps tendon is stronger and greater force is needed for it to rupture in biomechanical tests (Shani 2016). Moreover, the quadriceps tendon has better graft maturity according to MRI six months after reconstruction compared with the hamstring tendon (Ma 2015). The quadriceps is currently an accepted, albeit not so frequently used, graft. It can be harvested with or without a bone plug. The few studies of the clinical results of a quadriceps tendon graft in conjunction with an ACL reconstruction are small, with low statistical power. A study comparing the quadriceps with what is currently the most common graft – the hamstring tendon – is lacking. In 2019, the Capio Artro Clinic is starting a prospective, randomized study comparing the quadriceps tendon with the hamstring tendon in highly active patients, with a Tegner activity level above 6.

Functional assessments

The registry is constantly developing and the target now is to include functional assessments made by physical therapists. This will make it possible to create a more complete picture of the results following an ACL injury and a possible ACL reconstruction.

Patients with an ACL injury are normally in regular contact with a physical therapist, regardless of whether they have been treated with or without an ACL reconstruction. The physical therapist regularly evaluates the result of rehabilitation. The functional assessments that are made normally include measurements of knee mobility, measurements of stability manually or with the KT 1000, any loss of sensibility, strength tests of the quadriceps and hamstrings, different hop tests and patient-reported outcome measurements. When a patient has undergone an ACL reconstruction, it is common for these tests and assessments to be conducted six, nine and 12 months postoperatively, for example. The current test results are entered into the patient's notes by the person making the assessments. The idea is that it should be possible for these data to be entered in the Swedish knee ligament registry and for the results to be entered in a template which can then be given to the patient for feedback, to increase motivation and to be entered directly in the patient's notes. The aim here is to link the test data with the surgery data and patient-reported outcome measurements. The functional assessments that are made of patients who do not undergo surgery are also entered. Just like the surgeon, the physical therapist can obtain feedback on how his/her particular patients have progressed and compare the results between different hospitals and caregivers in different parts of the country. The results are also important for the surgeon to obtain a complete picture of the patient's function. The results can subsequently be used in improvement programs, when it comes to the care and rehabilitation of people who have suffered an ACL injury, and for research purposes.

Work on structuring the entry of functional assessments is in full swing and it is to be hoped that the entry of data will begin in 2019. An overview of patient-reported outcome measurements is also being conducted. The quality registry is contributing to new knowledge when it comes to the way we are going to treat ACL injuries and, the more people who participate, the more statistically secure and reliable the results will be. Information on the addition of functional assessments in the Swedish knee ligament registry will be distributed to physical therapists working with patients with ACL injuries via email, conferences and networks.

Fifteen years with the Scandinavian ACL registries

High-quality national quality registries aim to 1) improve treatment results at national level by giving hospitals and clinics relevant feedback, 2) identify poorer treatment alternatives and 3) identify prognostic factors for good and poor results. The Scandinavian knee ligament registries were set up in 2004 and 2005 and contain data from more than 70,000 patients, resulting so far in more than 70 publications (2019). This summary reports the information that has been obtained, limitations and what the future may hold for the Scandinavian knee ligament registries.

What has been learned

Två systematiska översiktsartiklar som inkluderade alla studier från registerna publicerades under 2018 och belyste faktorer som 1) ökar risker för ny ACL-skada 2) påverkar patientrapporterad knäfunktion efter ACL-skada och rekonstruktion. Huvudfynd från dessa översiktsartiklar sammanfattas i tabell 1.

TABLE 1
Risk factors identified from the Scandinavian knee ligament registries

Patient factors	Younger patients report better knee function and run an increased risk of re-operation.
	There are no gender differences in terms of the risk of re-operation.
	Women run an increased risk of contralateral ACL reconstruction.
Surgical factors	More than 90% of all ACL reconstructions in Sweden and more than 80% in Denmark are performed with hamstring tendon grafts. In Norway, the majority of ACL reconstructions in 2016 were performed with patellar tendon grafts.
	Hamstring tendon grafts are associated with slightly better knee function in the short term compared with patellar tendon grafts.
	There is a slightly increased risk of re-operation with hamstring tendon grafts compared with patellar tendon grafts.
	The risk of re-operation is reduced by 14% for every 0.5 mm increase in diameter in conjunction with a hamstring tendon graft.
Injury factors	Associated knee injuries produce poorer patient-reported knee function.
	Associated cartilage injuries are associated with a lower risk of re-operation.

Limitations

The three most commonly used outcome measurements in the Scandinavian knee ligament registries have been: 1) re-operation, 2) quality of life (EQ-5D) and 3) patient-reported knee function (KOOS). Even though re-operation is a definitive outcome measurement, there are limitations in the validity of the outcome, as not all patients who re-injure their ACL choose a re-operation. The percentage of patients who choose not to be re-operated is as yet unknown at national level. For several years, the KOOS outcome measurement has been the subject of discussion, as it is not specific to patients with an ACL injury. A publication by Ingelsrud et al. from 2016 reported that the minimal important change, MIC, that is regarded as important for the patient on the subscale of function in sport and motion on the KOOS is 12.1, while it is 18.3 points for quality of life. A review of all the published results from the registries makes it clear that changes in patient-reported knee function rarely exceeded the MIC, which is worrying. As a result, the way the KOOS can be improved is currently being evaluated by determining which questions on the KOOS subscales are most relevant to patients with an ACL. It is hoped that it will be possible for the data that have already been collected from several hundred thousand follow-ups over 10 years to be safeguarded and re-analyzed. We shall also be deciding whether the patient-reported outcome measurements from the Scandinavian knee ligament registries need to be replaced by a more responsive, specific outcome. The interesting point when it comes to this question is that an improvement in knee function that exceeds the MIC has been reported in patients who receive high-quality rehabilitation. At the present time, the quality of rehabilitation is not reported to the registries and this has initiated a program to set up a physical therapy section in the registries in the future.

Three proposals for the future for the Scandinavian knee ligament registries

1. Actively recruit patients who are treated non-surgically following an ACL injury: ten years ago, Granan et al. reported that as many as 50% of patients who sustained an ACL injury were treated non-surgically. In spite of this, there is only one study of patients from the Swedish registry who have undergone non-surgical treatment. In this cross-sectional analysis, patients who were treated non-surgically reported poorer KOOS scores on virtually all the subscales at follow-ups of up to five years. We need to learn more about what characterizes these patients, whether they achieve acceptable function and reasonable clinical results and, first and foremost, whether there is a selection bias for the patients who are treated either surgically or non-surgically.

2. Conduct randomized, controlled studies (RCTs) in the registries: registry RCTs are an innovative, promising method that can be performed using data from the Scandinavian knee ligament registries. This method is particularly suitable for studying the effect of treatment, as studies will be facilitated by the speedy recruitment of patients, the generation of generalizable results and the potential for conducting these studies at a low cost compared with conventional RCTs. At the same time, an update of the registries, comprising challenges to secure data quality and obtain consent from participating patients and hospitals/clinics, will be necessary. One example of a registry RCT in Sweden is the TASTE (Thrombus Aspiration under ST segment Elevation myocardial infarction) study, a large-scale registry-based RCT, which used the SWEDEHEART registry to study the effect of percutaneous coronary intervention alone compared with thrombectomy on 30-day mortality. As the registry contained existing information, data collection could be performed rapidly, no patient missed the follow-up and the cost of the study was approximately SEK 500 per patient.

3. International collaboration: international collaboration between knee ligament registries enables analyses of large cohorts and extremely generalizable results, together with the opportunity to study the effect on treatment in specific subgroups. To facilitate international collaboration, the data elements that will be reported in the registries will be standardized. The Scandinavian knee ligament registries are making good progress on all three development suggestions thanks to studies at both the planning and analysis stage. The success of the Scandinavian knee ligament registries has always been made possible by the contributing clinics which reliably report data to the registries, together with all the excellent collaboration between the registries. We shall continue to work as a team to overcome the challenges that lie ahead. Together we are stronger!

Discussion

The Swedish knee ligament registry was started in 2005 and it is estimated that it now covers more than 90% of all the ACL operations performed in Sweden. ACL reconstruction improves both function and knee-related quality of life compared with the situation prior to surgery, but there are still limitations after ACL surgery. Patients with an ACL injury who undergo stabilization surgery do not achieve the same function as an uninjured, age-matched population. Self-reported, patient-perceived quality indicators reveal that these patients experience a deterioration in quality of life one, two, five and 10 years after surgery and that it is primarily related to restricted knee-related quality of life.

The steering committee is discussing a number of improvement projects. This is necessary in order to improve the applicability of the registry. The project with the highest priority aims to transform the knee ligament register from a surgery registry to a diagnosis registry. It is already possible to register untreated patients with an ACL injury, but a real effort needs to be made to improve reporting.

The response rate to questionnaires has improved in recent years. The steering committee believes that national collaboration with web portals and the improved registration of e-mail addresses, for example, would further facilitate this process and would also contribute to increased reporting and reduced costs.

The steering committee also feels that there is a need for continuous training for ACL surgeons in Sweden, especially those that perform fewer than 10 operations a year.

Conclusions

One important conclusion from the analyses conducted in previous years is that smoking has a negative effect on the result of an ACL reconstruction. The steering committee therefore recommends that patients should be informed of the negative impact of smoking prior to possible surgery.

The national knee ligament registry is collaborating with other orthopedic registries and with a number of other quality registries. The aim is to help in the development of simplified methods for the collection and feedback of data. The knee ligament registry's steering committee would like to express its gratitude for excellent collaboration during the past year. It is clear that collaboration relating to the follow-up of patient-perceived health is becoming increasingly interactive, which is leading to constructive in-depth studies. The steering committee welcomes comments and views on this annual report and looks forward to continued good collaboration.

The registry would like to thank all the participating clinics and users. Without your contributions, this kind of registry cannot survive.

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