

**XBase**

THE SWEDISH NATIONAL  
KNEE LIGAMENT REGISTRY

# The Swedish knee ligament registry. Annual Report 2020.

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## 3564 primary operations and 319 revisions. 69 clinics performing surgery in 2020:

AKADEMISKA SJUKHUSET ALERIS ELISABETHSJUKHUSET ALERIS ORTOPEDI ÄNGELHOLM  
ALERIS SPORTS MEDICINE & ORTOPEDI, SABBATSBERG ANGERED NÄRSJUKHUS ART  
CLINIC GÖTEBORG ART CLINIC JÖNKÖPING ARTROCENTER BLEKINGESJUKHUSET CAPIO  
ARTRO CLINIC CAPIO LUNDBY NÄRSJUKHUS CAPIO LÄKARGRUPPEN I ÖREBRO AB  
CAPIO ORTOPEDISKA HUSET CENTRALLASARETTET VÄXJÖ CITYAKUTEN PRIVATVÅRD  
DANDERYDS SJUKHUS DBI VÄSTERÅS ORTOPEDI FALU LASARETT FRÖLUNDA SPECIALIST-  
SJUKHUS FRÖLUNDAORTOPEDEN GHP ORTHOCENTER STOCKHOLM GÄLLIVARE SJUKHUS  
GÄVLE SJUKHUS HELSINGBORGS SJUKHUS HUDIKSVALLS SJUKHUS HÄSSLEHOLMS SJUKHUS  
HÖGLANDSSJUKHUSET KALMAR SJUKHUS KARLSTAD CENTRALSJUKHUS KAROLINSKA  
UNIVERSITETSSJUKHUSET / ORTOPEDKLINIKEN KUNGSBACKA SJUKHUS KUNGÄLVS SJUK-  
HUS KÄRNSJUKHUSET I SKÖVDE LINKÖPINGS UNIVERSITETSKLINIK LJUNGBY LASARETT  
LÄKARHUSET HERMELINEN LÄNSSJUKHUSET RYHOV LÄNSSJUKHUSET SUNDSVALL MOVEMENT  
MEDICAL AB MÅLARSJUKHUSET ESKILSTUNA NORRLANDS UNIVERSITETSSJUKHUS,  
UMEÅ NORRTÄLJE SJUKHUS NU-SJUKVÅRDEN NYKÖPINGS LASARETT ORTHOCENTER  
I SKÅNE ORTHOCENTER/IFK-KLINIKEN ORTOPEDISKA KLINIKEN REGION ÖREBRO  
LÄN ORTOPEDSPECIALISTERNA OSKARSHAMNS SJUKHUS PRAKTIKERTJÄNST ORTOPEDI  
STOCKHOLM SAHLGRENSKA UNIVERSITETSSJUKHUSET SKELLEFTEÅ SJUKHUS SKÅNES  
UNIVERSITETSSJUKHUS SOPHIAHEMMET SPECIALISTCENTER SCANDINAVIA SPORTS  
MEDICINE UMEÅ SPORTSMED SUNDERBY SJUKHUS SÖDERMALMS ORTOPEDI SÖDER-  
SJUKHUSET SÖDRA ÄLVSBORGS SJUKHUS VISBY LASARETT VRINNEVISJUKHUSET VÄRNAMO  
SJUKHUS/ORTOPEDKLINIKEN VÄSTERVIKS SJUKHUSVÄSTERÅS CENTRALLASARETTET  
VÄSTERÅS ORTOPEDPRAKTIK 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. More recent Swedish studies based on national data from population-based studies indicate an incidence of around 80/100,000 inhabitants/year. An 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 8,000 individuals suffer anterior cruciate ligament injuries every year and that approximately 4,000 undergo surgery. More 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 poor function in the reconstructed cruciate ligament. The results after revision are somewhat poorer than those 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. Over the years, an increasing number of operations have been performed by surgeons performing more than 30 surgeries a year, which is a positive, clearly expressed target.

To begin with, the knee ligament registry was a surgical registry, but attempts are now being made to register more and more 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 continuing to work 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 100 clinics in Sweden that provide orthopedic care. Of these, 69 (basically unchanged over time) have informed the knee ligament registry that they performed ACL surgery in 2020, while 93 clinics have been reporting since 2005.

## 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 which we performed.

## 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 to English 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 has therefore commissioned a translation since then.

## 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 convincing 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 fewer than half of all patients respond after five years.

The database is run by Karolinska University Hospital in its capacity as registry owner. Future collaboration with other orthopedic registries has now begun and the Swedish ACL Registry is involved in this work.

## Effect of Covid-19

Since the start of the pandemic in March 2020, there has been a huge impact on Swedish health care. The load on intensive care and hospitalizations has been extreme. Elective surgery has been impacted by the loaning of personnel and a shortage of material/medication. The number of ACL operations has been reduced by around 10%, similar to the reduction in Denmark and Norway. The total number of elective surgeries in Sweden has decreased by as much as 40%. Some of the decrease in ACL surgeries can be clearly attributed to the sporting restrictions the Swedish government and Public Health Agency have introduced. A large percentage of youth sport and the level “just below” elite sport has been stopped. The time between injury and surgery has been extended. Surgeries have also been transferred from hospitals to private clinics. It is hoped that these activities will normalize during the second half of 2021.

## Areas for improvement and action

### Inclusion of all injured individuals regardless of treatment

The registry is still largely a surgery registry, even if the aim for several years has 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. This work has, however, been delayed by GDPR and security-related issues.

### Preoperative patient-reported data

In the case of patients who undergo surgery, the frequency of patients' self-reported data prior to surgery is around 60%. There is a large difference between clinics. The steering committee has access to an administrator 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%).

### 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. Instead, a deterioration has been observed. The follow-up data after one (55%), two (49%), five (45%) and ten years (40%), however, still have a low response rate. It is pleasing to report that the 10-year follow-up for 2005-2020 produced a response rate of around 40%, see Table 1A below. 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 patient-reported (PROM) questionnaires, first and foremost the Knee injury and Osteoarthritis Outcome Score (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.

**TABLE 1A**  
*Response frequency 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	%
2020	2497	63								
2019	2855	65	1902	43						
2018	2520	61	2001	49	1491	37				
2017	2592	62	2122	51	1891	46				
2016	2698	69	2058	53	1719	46				
2015	2795	74	1882	50	1754	48	1180	34		
2014	2663	72	2147	58	1406	39	1456	43		
2013	2830	76	2421	65	1894	52	1465	42		
2012	2671	71	2315	62	1934	53	1532	44		
2011	2539	71	2343	66	1858	54	1252	38		
2010	2520	70	2185	61	2191	63	1587	48	1131	36
2009	2427	74	1973	61	1664	53	1659	54	1379	47
2008	2113	67	1927	61	1533	50	1612	54	1199	42
2007	1680	58	1631	56	1501	53	1585	58	1182	45
2006	1545	59	1355	52	1309	51	1293	52	879	37
2005	1211	58	1082	52	1199	59	980	50	1102	59
Total	38156	67	29344	55	23344	49	15601	45	6872	40

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

Year	EQ-5D-3L index and/or EQ-VAS									
	Pre-op		One year postop		Two years postop		Five years postop		10 years postop	
	N	%	N	%	N	%	N	%	N	%
2020	2271	57								
2019	2577	58	1844	42	166	13				
2018	2370	57	1954	48	1449	36				
2017	2402	57	2102	50	1861	46				
2016	2459	63	2026	52	1682	45				
2015	2634	70	1819	48	1736	47	1141	33		
2014	2514	68	2093	57	1374	38	1424	42		
2013	2705	72	2376	64	1856	51	1437	41		
2012	2495	66	2266	60	1897	52	1506	43		
2011	2302	65	2294	65	1827	53	1229	37		
2010	2328	65	2122	60	2166	62	1561	47	1096	35
2009	2296	70	1921	59	1626	51	1630	54	1347	46
2008	2008	63	1970	62	1487	48	1584	53	1171	41
2007	1681	58	1788	62	1447	51	1562	57	1162	44
2006	1334	51	1474	56	1311	51	1248	51	864	36
2005	977	47	1037	50	1226	60	920	47	1087	58
Total	35353	62	29086	54	23111	48	15242	44	6727	39

## Improvement seminar

The work of starting a national research network focusing on ACL injuries has now been initiated and additional improvements will begin within this framework.

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 4,282 ACL operations (both primary operations and revisions with surgery code NGE41) in 2019. The knee ligament registry contained 4,417 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 4,918 unique ACL operations.

The exact agreement on the number of ACL operations in the two registries was 76.9% in 2019. The reason for the small number of operations in the Swedish National Board of Health and Welfare's patient registry is probably due to shortcomings in reports to the registry and the fact that the Swedish National Board of Health and Welfare changed its data registration routines in 2015.

Another possible reason could be an incorrect surgery code (NGE41 being selected for an arthroscopy, for example). It goes without saying that these differences also reflect shortcomings in coverage. In spite of this, it is estimated that the knee ligament registry covers more than 90% of all the ACL operations in Sweden. Data for 2020 are not yet available and this comparison has therefore been made with 2019.

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

Taking balanced funds into account, no allocation was granted for 2019. Compared with previous years, allocations have declined slightly and new reductions can be expected in the future. New allocations have been granted for 2020 and 2021. The registrar, Magnus Forssblad, is employed on a part-time basis at the Orthopedic Clinic at Karolinska Hospital. Anna Pappas works as the part-time administrator of the knee ligament registry. Dan Friberg administers questionnaires.

## 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 healthcare 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 healthcare 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. New regulations and remuneration will be introduced on 1 October 2021.

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 healthcare 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 Arthro Clinic.

In 2020, 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, Institute of Clinical Research and Education Söder Hospital, Karolinska Institutet, Stockholm

Magnus Forssblad, Associate Professor, Karolinska University Hospital and the Sports Trauma Research and Education Center, Karolinska Institutet, Stockholm, and Praktikertjänst Ortopedi Stockholm

Anne Fältström, MD, Linköping University and the Ryhov County Hospital, Jönköping

Erik Hamrin Senorski, Associate Professor, Sahlgrenska University Hospital, Gothenburg University, and Sportrehab, Gothenburg

Jüri Kartus, Professor, NU-sjukvården, Trollhättan/Uddevalla

Christina Mikkelsen, MD, Capiro Arthro Clinic and Sports Trauma Research and Education Center, Karolinska Institutet, Stockholm

Paul Neuman, MD, Skåne University Hospital

Kristian Samuelsson, Professor, Sahlgrenska University Hospital and Gothenburg University, Gothenburg

Anders Stålmán, MD, Capiro Arthro Clinic and Sports Trauma Research and Education Center, Karolinska Institutet, Stockholm

Anna Pappas, Capiro Arthro Clinic, has been co-opted to the steering committee as an administrator.

Dan Friberg, Praktikertjänst Ortopedi Stockholm, administers questionnaire dispatch.

Henrik Hedevis, 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, often 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 currently 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 2005-2020, 52,734 primary ACL reconstructions and 4,040 revisions were registered.

## Number of operations per clinic in 2005-2020

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

**TABLE 2**

*Primary reconstructions and revisions distributed by region and clinic 2005-2018, 2019 and 2020*

Region	Clinic	2020				2019				2005-2018			
		Primary		Revision		Primary		Revision		Primary		Revision	
		N	%	N	%	N	%	N	%	N	%	N	%
Greater Stockholm	ASTRID LINDGRENS BARNSJUKHUS	0	0	0	0	0	0	0	0	209	1	137	65
	ARTROCENTER	42	7	2	4	50	9	7	12	133	22	15	10
	CAPIO S:T GÖRANS SJUKHUS	0	0	0	0	0	0	0	0	102	5	2	2
	CITYAKUTEN PRIVATVÅRD	7	0	0	0	20	6	16	62	74	2	3	4
	DANDERYDS SJUKHUS	11	0	3	27	26	2	13	46	403	21	170	40
	LÖWETS SPECIALISTMOTTAGNING	0	0	0	0	0	0	0	0	247	0	217	88
	KAROLINSKA UNIVERSITETSSJUKHUSET / ORTOPEDKLINIKEN	2	0	0	0	12	1	0	0	679	43	382	53
	NACKA NÄRSJUKHUS	0	0	0	0	0	0	0	0	105	5	68	62
	ODENPLANS LÄKARHUS	0	0	0	0	0	0	0	0	201	14	21	10
	CAPIO ORTOPEDISKA HUSET	13	0	9	69	4	0	3	75	749	44	364	46
	PRAKTIKERTJÄNST ORTOPEDI STOCKHOLM	305	34	235	69	311	33	261	76	234	26	162	62
	ALERIS SPORTS MEDICINE & ORTOPEDI, SABBATSBERG	162	16	149	84	115	15	96	74	255	22	174	63
	SÖDERMALMS ORTOPEDI	12	0	2	17	9	0	1	11	108	4	44	39
	SÖDERTÄLJE SJUKHUS	0	0	0	0	0	0	0	0	91	0	10	11
	SÖDERSJUKHUSET	32	3	5	14	91	15	45	42	1548	127	876	52
	SOPHIAHEMMET	21	2	10	43	11	2	10	77	71	7	25	32
	GHP ORTHOCENTER STOCKHOLM	46	2	17	35	34	3	20	54	467	29	308	62
CAPIO ARTRO CLINIC	675	71	637	85	724	72	682	86	8524	808	8478	91	
<b>Total</b>	<b>1328</b>	<b>135</b>	<b>1069</b>	<b>73</b>	<b>1407</b>	<b>158</b>	<b>1154</b>	<b>74</b>	<b>14200</b>	<b>1180</b>	<b>11456</b>	<b>74</b>	
Svealand + Gotland	AKADEMISKA SJUKHUSET	75	11	12	14	49	11	6	10	270	16	15	5
	BOLLNÄS SJUKHUS	0	0	0	0	0	0	0	0	12	2	10	71
	LASARETTET I ENKÖPING	0	0	0	0	0	0	0	0	115	7	14	11
	ALERIS ELISABETHSJUKHUSET	95	12	68	64	78	14	58	63	944	100	667	64
	FALU LASARETT	17	1	5	28	43	2	16	36	618	35	265	41
	GÄVLE SJUKHUS	11	0	2	18	18	0	10	56	437	10	299	67
	HUDIKSVALLS SJUKHUS	6	0	2	33	8	1	6	67	323	20	288	84
	KARLSTAD CENTRALSJUKHUS	37	4	11	27	50	6	12	21	927	87	191	19
	KARLSKOGA LASARETT	0	0	0	0	0	0	0	0	11	0	11	100
	CAPIO LÄKARGRUPPEN I ÖREBRO AB	13	0	13	100	9	2	10	91	590	66	643	98
	MÄLARSJUKHUSET ESKILSTUNA	10	0	0	0	7	1	0	0	395	19	307	74
	NORRTÄLJE SJUKHUS	26	0	0	0	32	2	0	0	169	6	85	49
	NYKÖPINGS LASARETT	1	0	0	0	3	0	1	33	144	2	17	12
	ORTOPEDISKA KLINIKEN REGION ÖREBRO LÄN	42	0	36	86	61	4	61	94	510	28	229	43
SAMARITERHEMMETS SJUKHUS	0	0	0	0	0	0	0	0	221	17	87	37	

TABLE 2 continues on the next page

Continuation of TABLE 2.

*Primary reconstructions and revisions distributed by region and clinic 2005-2018, 2019 and 2020*

Region	Clinic	2020				2019				2005-2018			
		Primary	Revision	Answered KOOS pre-op	%	Primary	Revision	KOOS pre-op	%	Primary	Revision	Answered KOOS pre-op	%
		N	N	N	%	N	N	N	%	N	N	N	%
	SPECIALISTCENTER SCANDINAVIA	60	3	38	60	57	2	37	63	82	2	23	27
	VÄSTERÅS CENTRALLASARETTET	43	2	25	56	50	0	27	54	370	18	153	39
	VISBY LASARETT	11	1	2	17	7	0	0	0	114	5	86	72
	VÄSTERÅS ORTOPEDPRAKTIK	0	0	0	0	0	0	0	0	187	11	113	57
	DBI VÄSTERÅS ORTOPEDI	15	1	5	31	0	0	0	0	0	0	0	0
	<b>Total</b>	<b>462</b>	<b>35</b>	<b>219</b>	<b>44</b>	<b>472</b>	<b>45</b>	<b>244</b>	<b>47</b>	<b>6439</b>	<b>451</b>	<b>3503</b>	<b>51</b>
Skåne	ALERIS ORTOPEDI ÄNGELHOLM	40	3	21	49	14	1	8	53	647	46	548	79
	HÄSSLEHOLMS SJUKHUS	59	2	52	85	75	6	72	89	930	39	880	91
	HELSINGBORGS SJUKHUS	51	6	31	54	85	2	54	62	736	37	669	87
	LUNDS UNIVERSITET	0	0	0	0	0	0	0	0	412	21	265	61
	MALMÖ ALLMÄNNA SJUKHUS	0	0	0	0	0	0	0	0	788	66	754	88
	ORTHOCENTER I SKÅNE	121	7	90	70	53	4	43	75	178	16	144	74
	SKÅNES UNIVERSITETSSJUKHUS	142	8	94	63	195	29	144	64	1937	164	1613	77
	<b>Total</b>	<b>413</b>	<b>26</b>	<b>288</b>	<b>66</b>	<b>422</b>	<b>42</b>	<b>321</b>	<b>69</b>	<b>5628</b>	<b>389</b>	<b>4873</b>	<b>81</b>
Halland	HALLANDS SJUKHUS HALMSTAD	0	0	0	0	0	0	0	0	68	6	37	50
	KUNGSBACKA SJUKHUS	140	10	106	71	137	13	82	55	961	74	625	60
	CAPIO MOVEMENT	124	5	68	53	78	13	66	73	1227	108	912	68
	ORTOPEDSPECIALISTERNA	41	2	26	60	56	5	35	57	123	4	90	71
	<b>Total</b>	<b>305</b>	<b>17</b>	<b>200</b>	<b>62</b>	<b>271</b>	<b>31</b>	<b>183</b>	<b>61</b>	<b>2379</b>	<b>192</b>	<b>1664</b>	<b>65</b>
Småland + Blekinge	ART CLINIC JÖNKÖPING	16	0	14	88	16	1	15	88	72	4	63	83
	HÖGLANDSSJUKHUSET	24	2	17	65	43	1	40	91	513	17	244	46
	KALMAR SJUKHUS	18	4	15	68	27	5	18	56	711	46	462	61
	BLEKINGESJUKHUSET	17	0	11	65	20	0	10	50	148	1	57	38
	LJUNGBY LASARETT	1	0	0	0	6	0	0	0	243	9	84	33
	OSKARSHAMNS SJUKHUS	12	0	4	33	31	0	26	84	374	5	269	71
	LÄNSSJUKHUSET RYHOV	9	2	7	64	30	3	10	30	403	27	188	44
	CENTRALLASARETTET VÄXJÖ	25	3	22	79	41	1	35	83	640	38	541	80
	VÄRNAMO SJUKHUS/ORTOPEDKLINIKEN	9	0	4	44	27	0	12	44	75	1	62	82
	VÄSTERVIKS SJUKHUS	10	0	4	40	11	0	7	64	174	4	51	29
	<b>Total</b>	<b>141</b>	<b>11</b>	<b>98</b>	<b>64</b>	<b>252</b>	<b>11</b>	<b>173</b>	<b>66</b>	<b>3353</b>	<b>152</b>	<b>2021</b>	<b>58</b>
Västra Götaland	ALINGSÅS LASARETT	0	0	0	0	5	0	3	60	344	31	306	82
	ART CLINIC GÖTEBORG	9	2	8	73	18	1	6	32	57	6	15	24
	SÖDRA ÄLVSBOGS SJUKHUS	15	0	2	13	33	2	8	23	216	1	115	53
	CARLANDERSKA ORTOPEDI	0	0	0	0	3	3	1	17	48	0	20	42
	DROTTNING SILVIAS BARN- OCH UNGDOMSSJUKHUS	0	0	0	0	0	0	0	0	72	1	4	5
	FRÖLUNDAORTOPEDEN	12	1	4	31	17	2	5	26	23	0	11	48
	FRÖLUNDA SPECIALISTSJUKHUS	33	5	10	26	33	1	8	24	301	32	279	84
	ORTHOCENTER/IFK-KLINIKEN	325	49	320	86	253	37	242	83	1609	179	1315	74
	KUNGÄLVS SJUKHUS	9	0	4	44	27	0	18	67	193	1	139	72
	CAPIO LUNDBY NÄRSJUKHUS	117	6	52	42	98	7	62	59	644	27	406	61
	LIDKÖPINGS SJUKHUS	0	0	0	0	0	0	0	0	226	8	31	13
	NU-SJUKVÅRDEN	52	3	33	60	66	10	46	61	1282	142	1112	78
	PERAGO ORTOPEDKLINIK	0	0	0	0	0	0	0	0	124	14	50	36
	KÄRNSJUKHUSET I SKÖVDE	16	0	13	81	33	1	16	47	136	3	47	34
	SPORTSMED	30	0	21	70	41	3	19	43	120	7	61	48
	SAHLGRENSKA UNIVERSITETSSJUKHUSET	85	11	45	47	154	21	128	73	1958	204	1300	60
	VARBERGS SJUKHUS	0	0	0	0	0	0	0	0	279	4	189	67
	ANGERED NÄRSJUKHUS	7	0	0	0	0	0	0	0	0	0	0	0
	<b>Total</b>	<b>710</b>	<b>77</b>	<b>512</b>	<b>65</b>	<b>781</b>	<b>88</b>	<b>562</b>	<b>65</b>	<b>7632</b>	<b>660</b>	<b>5400</b>	<b>65</b>

TABLE 2 continues on the next page

Continuation of TABLE 2.

*Primary reconstructions and revisions distributed by region and clinic 2005-2018, 2019 and 2020*

Region	Clinic	2020				2019				2005-2018			
		Primary		Revision		KOOS pre-op		KOOS pre-op		Primary		Revision	
		N	%	N	%	N	%	N	%	N	%	N	%
Östergötland	LINKÖPINGS HEALTH CARE	0	0	0	0	0	0	0	0	1	0	1	100
	LINKÖPINGS UNIVERSITETSKLINIK	31	0	19	61	63	3	37	56	879	53	665	71
	VRINNEVISJUKHUSET	37	3	25	63	56	3	35	59	1017	55	705	66
	Total	68	3	44	62	119	6	72	58	1897	108	1371	68
Norrländ	ALFREDSON TENDON CLINIC	0	0	0	0	0	0	0	0	2	1	0	0
	GÄLLIVARE SJUKHUS	12	0	2	17	8	1	4	44	65	1	36	55
	LÄKARHUSET HERMELINEN	6	0	5	83	8	0	5	63	85	0	37	44
	MEDICIN DIREKT	0	0	0	0	0	0	0	0	470	35	344	68
	ÖRNSKÖLDSVIKS SJUKHUS	18	0	17	94	24	0	24	100	182	8	184	97
	ÖSTERSUNDS SJUKHUS	37	3	4	10	77	6	42	51	199	12	110	52
	PITEÅ ÄLVDAL SJUKHUS	0	0	0	0	0	0	0	0	71	0	52	73
	SKELLEFTEÅ SJUKHUS	14	1	0	0	11	0	2	18	48	0	35	73
	SPORTS MEDICINE UMEÅ	14	3	8	47	30	2	23	72	451	42	346	70
	SOLLEFTEÅ SJUKHUS	0	0	0	0	0	0	0	0	60	1	42	69
	SUNDERBY SJUKHUS	53	0	13	25	82	1	34	41	679	22	551	79
	LÄNSSJUKHUSET SUNDSVALL	5	0	3	60	0	0	0	0	77	0	44	57
	NORRLANDS UNIVERSITETSSJUKHUS, UMEÅ	68	8	15	20	56	6	12	19	1186	72	735	58
Total	227	15	67	28	296	16	146	47	3575	194	2516	67	

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 primary ACL surgery in 2020 was 28 for both women and men. This age has not changed 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.

In 2020, the average age at revision surgery was 25 for women and 28 for men.

The percentage of women registered in the registry is approximately 45%.

We do not know why the average percentage of women in the registry has increased from 40% to 45% and this question needs to be studied in more detail. Women who are younger and are involved in sports such as soccer and handball run a higher risk of suffering an ACL injury than men. Taken as a whole, far more men participate in these contact sports, so it is difficult to say whether women undergo ACL surgery to a greater or lesser degree than men. 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 3A***Average age at primry reconstruction distributed by gender and year of surgery 2005-2020*

Year	Women				Men				Total			
	N	Info missing	MV	SD	N	Info missing	MV	SD	N	Info missing	MV	SD
2020	1654	0	28	12	1996	4	28	10	3650	4	28	11
2019	1847	1	28	12	2169	3	29	10	4016	4	28	11
2018	1699	1	28	12	2070	4	28	10	3769	5	28	11
2017	1732	0	28	12	2120	14	29	10	3852	14	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	1940	1	28	10	3420	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	826	0	26	10	1163	0	28	9	1989	0	27	10
Total	22927	3	27	11	29807	40	28	10	52734	43	27	10

*MV, mean value; SD, standard deviation***TABLE 3B***Primary reconstructions distributed by age interval at surgery and year of surgery 2005-2020*

Year	Age interval 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	%
2020	283	8	804	22	720	20	573	16	391	11	295	8	584	16	3650	100
2019	296	7	931	23	747	19	658	16	372	9	275	7	737	18	4016	100
2018	279	7	892	24	721	19	632	17	348	9	284	8	613	16	3769	100
2017	264	7	853	22	803	21	581	15	375	10	313	8	663	17	3852	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	494	14	322	9	256	7	526	15	3420	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	393	20	297	15	253	13	201	10	229	12	1989	100
Total	3546	7	13416	25	10655	20	7858	15	5177	10	4484	9	7598	14	52734	100

**TABLE 4A***Average age at revision distributed by gender and year of surgery 2005-2020*

Year	Women				Men				Total			
	N	Info missing	MV	SD	N	Info missing	MV	SD	N	Info missing	MV	SD
2020	141	0	25	9	177	1	28	8	318	1	27	9
2019	172	0	28	11	225	0	28	8	397	0	28	9
2018	170	0	27	9	184	0	28	9	354	0	27	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	164	0	28	9	300	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	1788	0	26	9	2252	2	28	8	4040	2	27	9

*MV, mean value; SD, standard deviation***TABLE 4B***Revisions distributed by age interval at surgery and year of surgery 2005-2020*

Year	Age interval 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	%
2020	1	0	68	21	97	31	79	25	26	8	18	6	29	9	318	100
2019	6	2	80	20	98	25	97	24	43	11	21	5	52	13	397	100
2018	5	1	85	24	97	27	68	19	29	8	33	9	37	10	354	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	31	10	300	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	38	1	997	25	1102	27	741	18	430	11	306	8	426	11	4040	100

**TABLE 5***Primary reconstructions and revisions distributed by gender and year of surgery 2005-2020*

Year	Primary reconstructions				Revisions				Total			
	Women		Men		Women		Men		Women		Men	
	N	%	N	%	N	%	N	%	N	%	N	%
2020	1654	45	2000	55	141	44	178	56	1795	45	2178	55
2019	1848	46	2172	54	172	43	225	57	2020	46	2397	54
2018	1700	45	2074	55	170	48	184	52	1870	45	2258	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	164	55	1613	43	2171	57
2014	1480	43	1941	57	122	43	159	57	1602	43	2100	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	826	42	1163	58	47	44	59	56	873	42	1222	58
Total	22930	43	29847	57	1788	44	2254	56	24718	44	32101	56

## 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 2020, soccer was the cause of ACL injuries in 29% of women and 49% of men. The second most common activity in connection with injury was downhill skiing for both women (21%) and men (10%).

As soccer is the leading cause of ACL injuries, it is interesting that projects including preventive 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 at time of injury for primary reconstructions distributed by gender 2019 and 2020*

Activity	2020						2019					
	Women			Men			Women			Men		
	N	K%	R%	N	K%	R%	N	K%	R%	N	K%	R%
SOCCER	479	29	33	977	49	67	492	27	31	1076	50	69
ALPINE/TELEMARK	351	21	64	195	10	36	493	27	69	224	10	31
FLOORBALL	130	8	42	179	9	58	118	6	41	173	8	59
HANDBALL	130	8	71	54	3	29	144	8	68	67	3	32
OTHER LEISURE SPORT	65	4	67	32	2	33	58	3	55	48	2	45
BASKETBALL	43	3	50	43	2	50	39	2	49	41	2	51
MARTIAL ARTS	40	2	43	53	3	57	41	2	45	51	2	55
EQUESTRIAN SPORT	33	2	97	1	0	3	27	1	96	1	0	4
RACKET SPORT	31	2	43	41	2	57	21	1	48	23	1	52
GYMNASTICS	31	2	78	9	0	23	54	3	89	7	0	11
CYCLING	24	1	52	22	1	48	21	1	43	28	1	57
EXERCISE	24	1	55	20	1	45	30	2	55	25	1	45
DANCING	20	1	83	4	0	17	30	2	75	10	0	25
OUTDOOR LIFE	19	1	56	15	1	44	15	1	58	11	1	42
TRAMPOLINE	16	1	73	6	0	27	19	1	76	6	0	24
WORK	16	1	30	38	2	70	17	1	30	40	2	70
AMERICAN FOOTBALL/RUGBY	14	1	34	27	1	66	18	1	40	27	1	60
TRAFFIC	14	1	29	35	2	71	26	1	42	36	2	58
SNOWBOARDING	12	1	52	11	1	48	6	0	32	13	1	68
VOLLEYBALL	11	1	61	7	0	39	16	1	55	13	1	45
ENDURO/MOTORCROSS	5	0	10	43	2	90	7	0	15	39	2	85
ICE HOCKEY/BANDY	4	0	17	19	1	83	3	0	8	33	2	92
WRESTLING	4	0	22	14	1	78	6	0	35	11	1	65
SKATEBOARDING	4	0	17	19	1	83	2	0	17	10	0	83
CROSS-COUNTRY SKIING	2	0	50	2	0	50	2	0	40	3	0	60
WAKEBOARDING/SURFING	2	0	25	6	0	75	4	0	67	2	0	33
OTHER	130	8	50	128	6	50	139	8	47	154	7	53
Total	1654	100	45	2000	100	55	1848	100	46	2172	100	54

*K%, column percent within 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, 76% performed fewer than 30 operations in 2020.

The average duration of surgery for a primary ACL reconstruction is 70 minutes for a primary operation and just over 93 minutes for a revision.

**TABLE 7A***Total number of reconstructions and primary reconstructions by surgeon distributed by year of surgery 2005-2020*

Year	Reconstructions by surgeon and year						Primary reconstructions by surgeon and year					
	< 30		≥ 30		Total		< 30		≥ 30		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
2020	122	75	41	25	163	100	123	75	40	25	163	100
2019	116	69	51	31	167	100	119	71	48	29	167	100
2018	118	71	49	29	167	100	123	74	44	26	167	100
2017	113	68	54	32	167	100	117	70	50	30	167	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	104	74	37	26	141	100	108	77	33	23	141	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	1686	70	730	30	2416	100	1741	72	675	28	2416	100

**TABLE 7B***Reconstructions by surgeon distributed by year of surgery 2005-2020*

Year		Reconstructions by surgeon and year					
		N	%	MV	SD	OP	OP %
2020	0-10 ops	69	42	4	3	307	8
	11-29 ops	53	33	18	6	940	24
	≥ 30 ops	41	25	66	33	2726	69
	Total	163	100	24	30	3973	100
2019	0-10 ops	60	36	5	3	286	6
	11-29 ops	56	34	20	6	1120	25
	≥ 30 ops	51	31	59	27	3011	68
	Total	167	100	26	27	4417	100
2005-2018	0-10 ops	758	36	5	3	3613	7
	11-29 ops	690	33	19	6	13095	27
	≥ 30 ops	638	31	50	17	31674	65
	Total	2086	100	23	21	48382	100
Total	0-10 ops	887	37	5	3	4206	7
	11-29 ops	799	33	19	6	15155	27
	≥ 30 ops	730	30	51	19	37411	66
	Total	2416	100	23	22	56772	100

*MV, mean value; SD, standard deviation OP, operations*

TABLE 7B continues on the next page.

Continuation of TABLE 7B.

*Primary reconstructions by surgeon and year 2005-2020*

Year		Primära rekonstruktioner per operatör och år					
		N	%	MV	SD	OP	OP %
2020	0-10 ops	73	45	5	3	331	9
	11-29 op	50	31	17	6	873	24
	≥30 op	40	25	61	30	2450	67
	Total	163	100	22	27	3654	100
2019	0-10 op	62	37	5	3	287	7
	11-29 ops	57	34	19	5	1104	27
	≥ 30 ops	48	29	55	24	2629	65
	Total	167	100	24	25	4020	100
2005-2018	0-10 ops	799	38	5	3	3869	9
	11-29 op	700	34	19	6	13442	30
	≥30 op	587	28	47	15	27748	62
	Total	2086	100	22	19	45059	100
Total	0-10 op	934	39	5	3	4487	9
	11-29 ops	807	33	19	6	15419	29
	≥ 30 ops	675	28	49	17	32827	62
	Total	2416	100	22	20	52733	100

*MV, mean value; SD, standard deviation OP, operations***TABLE 8***Operating time (min) for primary reconstructions and revisions distributed by year of surgery 2005-2020*

Year	Primary reconstructions					Revisions				
	N	Info missing	MV	SD	MD	N	Info missing	MV	SD	MD
2020	3490	164	70	28	65	308	11	93	35	90
2019	3786	234	74	29	69	370	27	92	32	90
2018	3620	154	73	29	68	323	31	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	283	17	95	38	90
2014	3263	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	1779	210	76	27	70	93	13	90	36	80
Total	49884	2893	74	28	70	3780	262	93	35	90

*MV, mean value; SD, standard deviation; MD, median*

## Time between injury and surgery

Since 2019, the time between injury and surgery has increased, probably due to the Covid-19 pandemic. Nor are there any obvious differences between private and public caregivers. What can be seen is that Norrland (north of Sweden) has the longest time between injury and surgery, 1,020 days, twice the number compared with other regions.

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 the extremely high 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 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 surgery for primary reconstruction distributed by region (clinic) 2005-2020*

Region	Year	Days between injury and surgery						
		N	Info missing	MV	SD	MD	K1	K3
Greater Stockholm	2020	1265	63	405	932	137	77	285
	2019	1318	89	366	757	156	86	292
	2005-2018	13919	281	525	1050	197	104	423
Svealand + Gotland	2020	447	15	627	896	309	152	681
	2019	441	31	657	1145	280	163	561
	2005-2018	6282	157	688	1067	320	178	683
Skåne	2020	403	10	778	1448	285	145	644
	2019	408	14	599	955	279	163	548
	2005-2018	5497	131	694	1162	289	160	668
Halland	2020	288	17	578	1179	199	109	442
	2019	259	12	515	1048	170	96	453
	2005-2018	2298	81	569	843	268	147	607
Småland + Blekinge	2020	135	6	561	849	276	138	520
	2019	232	20	469	665	236	141	481
	2005-2018	3236	117	481	783	229	134	473
Västra Götaland	2020	664	46	402	778	183	97	370
	2019	736	45	426	847	177	93	342
	2005-2018	7438	194	556	975	246	130	508
Östergötland	2020	67	1	737	1125	338	204	864
	2019	119	0	461	520	251	144	508
	2005-2018	1859	38	556	775	280	172	571
Norrland	2020	218	9	1030	1650	366	201	864
	2019	282	14	859	1513	310	160	658
	2005-2018	3475	100	766	1240	329	166	769
Total	2020	3487	167	542	1070	203	98	438
	2019	3795	225	493	942	204	104	410
	2005-2018	44004	1099	594	1038	251	134	550

*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 90% of the total number of operations, both primary and revisions. In 2005, the corresponding figure was 50%.

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 for primary reconstructions and revisions distributed by year of surgery 2005-2020*

Year	Primary reconstructions				Revisions				Total			
	Day surgery				Day surgery				Day surgery			
	Yes		No		Yes		No		Yes		No	
	N	%	N	%	N	%	N	%	N	%	N	%
2020	3335	91	319	9	280	88	39	12	3615	91	358	9
2019	3643	91	377	9	336	85	61	15	3979	90	438	10
2018	3373	89	401	11	277	78	77	22	3650	88	478	12
2017	3379	87	487	13	254	76	80	24	3633	87	567	14
2016	3187	89	409	11	233	76	72	24	3420	88	481	12
2015	3012	86	472	14	241	80	59	20	3253	86	531	14
2014	2916	85	505	15	221	79	60	21	3137	85	565	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	50	985	50	54	51	52	49	1058	51	1037	49
Total	42852	81	9925	19	3048	75	994	25	45900	81	10919	19

**TABLE 11***Day surgery for primary reconstructions and revisions distributed by region 2005-2020*

Region	Year	Primary reconstructions				Revisions				Total			
		Day surgery				Day surgery				Day surgery			
		Yes		No		Yes		No		Yes		No	
		N	%	N	%	N	%	N	%	N	%	N	%
Greater Stockholm	2020	1280	96	48	4	122	90	13	10	1402	96	61	4
	2019	1319	94	88	6	136	86	22	14	1455	93	110	7
	2005-2018	10546	74	3654	26	759	64	421	36	11305	74	4075	26
Svealand + Gotland	2020	335	73	127	27	21	60	14	40	356	72	141	28
	2019	362	77	110	23	31	69	14	31	393	76	124	24
	2005-2018	4664	72	1775	28	291	65	160	35	4955	72	1935	28
Skåne	2020	398	96	15	4	24	92	2	8	422	96	17	4
	2019	403	95	19	5	40	95	2	5	443	95	21	5
	2005-2018	5164	92	464	8	344	88	45	12	5508	92	509	8
Halland	2020	264	87	41	13	14	82	3	18	278	86	44	14
	2019	242	89	29	11	23	74	8	26	265	88	37	12
	2005-2018	1697	71	682	29	101	53	91	47	1798	70	773	30
Småland + Blekinge	2020	121	86	20	14	11	100	0	0	132	87	20	13
	2019	221	88	31	12	9	82	2	18	230	87	33	13
	2005-2018	2315	69	1038	31	121	80	31	20	2436	70	1069	30
Västra Götaland	2020	658	93	52	7	70	91	7	9	728	93	59	7
	2019	712	91	69	9	76	86	12	14	788	91	81	9
	2005-2018	6732	88	900	12	551	83	109	17	7283	88	1009	12
Östergötland	2020	64	94	4	6	3	100	0	0	67	94	4	6
	2019	115	97	4	3	6	100	0	0	121	97	4	3
	2005-2018	1790	94	107	6	101	94	7	6	1891	94	114	6
Norrland	2020	215	95	12	5	15	100	0	0	230	95	12	5
	2019	269	91	27	9	15	94	1	6	284	91	28	9
	2005-2018	2966	83	609	17	164	85	30	15	3130	83	639	17
Total	2020	3335	91	319	9	280	88	39	12	3615	91	358	9
	2019	3643	91	377	9	336	85	61	15	3979	90	438	10
	2005-2018	35874	80	9229	20	2432	73	894	27	38306	79	10123	21

## 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 conjunction 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.

As different from the total number of operations, the number of children under 15 years of age undergoing surgery has not changed compared with 2019.

TABLE 12

Primary reconstructions on children under 15 distributed by gender, region and clinic 2005-2020

Region	Clinic	Children under 15							
		2020		2019		2005-2018		Total	
		Girl	Boy	Girl	Boy	Girl	Boy	Girl	Boy
		N	N	N	N	N	N	N	N
Greater Stockholm	ASTRID LINDGRENS BARNSJUKHUS	0	0	0	0	97	89	97	89
	ARTROCENTER	1	0	1	1	3	0	5	1
	ODENPLANS LÄKARHUS	0	0	0	0	1	3	1	3
	CAPIO ORTOPEDISKA Huset	0	0	0	0	2	1	2	1
	PRAKTIKERTJÄNST ORTOPEDI STOCKHOLM	9	4	7	4	4	5	20	13
	ALERIS SPORTS MEDICINE & ORTOPEDI, SABBATSBERG	11	4	6	3	4	0	21	7
	SÖDERSJUKHUSET	0	0	0	0	3	1	3	1
	GHP ORTHOCENTER STOCKHOLM	0	0	2	0	7	7	9	7
	CAPIO ARTRO CLINIC	18	19	26	12	216	150	260	181
Total	39	27	42	20	337	256	418	303	
Svealand + Gotland	ALERIS ELISABETHSJUKHUSET	0	0	0	0	12	0	12	0
	FALU LASARETT	0	0	0	0	17	4	17	4
	GÄVLE SJUKHUS	0	0	0	0	5	2	5	2
	HUDIKSVALLS SJUKHUS	0	0	0	0	2	1	2	1
	KARLSTAD CENTRALSJUKHUS	1	1	1	0	13	5	15	6
	CAPIO LÄKARGRUPPEN I ÖREBRO AB	0	0	2	0	9	1	11	1
	MÄLARSJUKHUSET ESKILSTUNA	0	0	0	0	2	2	2	2
	NORRTÄLJE SJUKHUS	0	0	0	1	1	0	1	1
	NYKÖPINGS LASARETT	0	0	0	0	1	1	1	1
	ORTOPEDISKA KLINIKEN REGION ÖREBRO LÄN	0	2	2	2	17	3	19	7
	SPECIALISTCENTER SCANDINAVIA	1	2	2	0	1	0	4	2
	VÄSTERÅS CENTRALLASARETTET	2	0	1	1	3	3	6	4
	VISBY LASARETT	0	0	0	0	0	1	0	1
	VÄSTERÅS ORTOPEDPRAKTIK	0	0	0	0	4	2	4	2
DBI VÄSTERÅS ORTOPEDI	1	0	0	0	0	0	1	0	
Total	5	5	8	4	87	25	100	34	
Skåne	ALERIS ORTOPEDI ÄNGELHOLM	0	0	0	0	7	1	7	1
	HÄSSLEHOLMS SJUKHUS	1	0	1	0	7	1	9	1
	HELSINGBORGS SJUKHUS	2	3	2	1	11	1	15	5
	LUNDS UNIVERSITET	0	0	0	0	12	1	12	1
	MALMÖ ALLMÄNNA SJUKHUS	0	0	0	0	11	9	11	9
	ORTHOCENTER I SKÅNE	2	0	0	0	0	1	2	1
	SKÅNES UNIVERSITETSSJUKHUS	8	1	3	1	37	13	48	15
	Total	13	4	6	2	85	27	104	33
Halland	HALLANDS SJUKHUS HALMSTAD	0	0	0	0	1	1	1	1
	KUNGSBACKA SJUKHUS	6	0	3	4	10	3	19	7
	CAPIO MOVEMENT	0	0	0	0	6	1	6	1
	Total	6	0	3	4	17	5	26	9
Småland + Blekinge	ART CLINIC JÖNKÖPING	0	0	0	0	1	0	1	0
	HÖGLANDSSJUKHUSET	2	0	3	0	10	8	15	8
	KALMAR SJUKHUS	0	1	2	1	15	4	17	6
	BLEKINGESJUKHUSET	1	0	0	0	2	0	3	0
	LJUNGBY LASARETT	0	0	0	0	5	0	5	0
	OSKARSHAMNS SJUKHUS	0	0	1	0	11	3	12	3
	LÄNSSJUKHUSET RYHOV	0	0	2	0	7	5	9	5
	CENTRALLASARETTET VÄXJÖ	1	0	1	2	20	6	22	8
	VÄRNAMO SJUKHUS / ORTOPEDKLINIKEN	0	0	1	0	0	1	1	1
	VÄSTERVIKS SJUKHUS	0	0	0	0	5	0	5	0
Total	4	1	10	3	76	27	90	31	

TABLE 12 continues on the next page.

		Children under 15							
		2020		2019		2005-2018		Total	
Region	Clinic	Girl	Boy	Girl	Boy	Girl	Boy	Girl	Boy
		N	N	N	N	N	N	N	N
Västra Götaland	ALINGSÅS LASARETT	0	0	0	0	7	0	7	0
	ART CLINIC GÖTEBORG	0	0	1	1	0	0	1	1
	SÖDRA ÄLVSBORGS SJUKHUS	0	0	0	0	2	0	2	0
	DROTTNING SILVIAS BARN- OCH UNGDOMSSJUKHUS	0	0	0	0	29	8	29	8
	ORTHOCENTER / IFK-KLINIKEN	4	4	2	2	31	6	37	12
	KUNGÄLVS SJUKHUS	0	0	0	0	2	0	2	0
	CAPIO LUNDBY NÄRSJUKHUS	3	0	2	1	13	0	18	1
	NU-SJUKVÅRDEN	4	1	0	1	28	13	32	15
	PERAGO ORTOPEDKLINIK	0	0	0	0	4	0	4	0
	KÄRNSJUKHUSET I SKÖVDE	0	0	4	0	4	2	8	2
	SAHLGRENSKA UNIVERSITETSSJUKHUSET	6	1	5	0	25	12	36	13
	VARBERGS SJUKHUS	0	0	0	0	5	2	5	2
	<b>Total</b>	<b>17</b>	<b>6</b>	<b>14</b>	<b>5</b>	<b>150</b>	<b>43</b>	<b>181</b>	<b>54</b>
Östergötland	LINKÖPINGS UNIVERSITETSKLINIK	2	0	1	0	16	1	19	1
	VRINNEVISJUKHUSET	2	0	0	1	7	1	9	2
	<b>Total</b>	<b>4</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>23</b>	<b>2</b>	<b>28</b>	<b>3</b>
Norrland	GÄLLIVARE SJUKHUS	0	0	0	0	1	0	1	0
	LÄKARHUSET HERMELINEN	0	0	0	0	3	0	3	0
	MEDICIN DIREKT	0	0	0	0	10	0	10	0
	ÖRNSKÖLDSVIKS SJUKHUS	0	0	2	1	6	0	8	1
	ÖSTERSUNDS SJUKHUS	1	0	3	0	3	0	7	0
	PITEÅ ÄLVDAL SJUKHUS	0	0	0	0	2	0	2	0
	SKELLEFTEÅ SJUKHUS	0	0	1	1	1	0	2	1
	SPORTS MEDICINE UMEÅ	1	0	1	0	7	4	9	4
	SOLLEFTEÅ SJUKHUS	0	0	0	0	2	0	2	0
	SUNDERBY SJUKHUS	0	0	1	0	28	3	29	3
<b>Total</b>	<b>6</b>	<b>0</b>	<b>9</b>	<b>2</b>	<b>82</b>	<b>14</b>	<b>97</b>	<b>16</b>	
<b>Total</b>	<b>94</b>	<b>43</b>	<b>93</b>	<b>41</b>	<b>857</b>	<b>399</b>	<b>1044</b>	<b>483</b>	

## Surgical variables

### Graft selection - type of ligament

The use of hamstring grafts has recently declined from almost 98% to 85% in 2019. Instead, the percentage of patellar grafts and, first and foremost, quadriceps grafts, has increased. This matches international trends. However, no change in quadriceps grafts could be seen in 2020. By far the most common graft selection is still 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 grafts 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 a patellar graft 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 graft 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, however, declined in favor of the patellar graft and, to some degree, also the quadriceps, even if the absolute figures are still low.

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 graft probably results in less anterior knee pain than the patellar graft. There is speculation about whether the patellar graft and the quadriceps graft should be considered more frequently as a graft alternative in patient groups in which a greater risk of graft rupture can be anticipated. This has taken place in Norway where patellar grafts are currently being used in approximately 70% of operations.

A recent prospective, randomized study comparing the quadriceps graft with the hamstring graft reveals no differences in terms of the risk of reoperation, knee stability or subjective function at a two-year follow-up (Lind et al., Br J Sports Med 2020). More studies are needed and there are plans to study the results after surgery involving quadriceps grafts in the Swedish registry when sufficient two-year data for this group are available.

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 30,000 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, patellar grafts are being used increasingly in revision surgery. Allografts and quadriceps grafts are also frequently used in revision surgery.

**TABLE 13****ACL graft in primary reconstructions distributed by region and year of surgery 2005-2020**

Region	Graft	2020		2019		2005-2018		Total	
		N	%	N	%	N	%	N	%
Greater Stockholm	Patellar graft	54	4	78	6	829	6	961	6
	Hamstring graft	1086	82	1136	81	12458	90	14680	89
	Quadriceps graft	171	13	171	12	407	3	749	5
	Other*	9	1	14	1	109	1	132	1
	Total	1320	100	1399	100	13803	100	16522	100
Svealand + Gotland	Patellar graft	7	2	13	3	344	5	364	5
	Hamstring graft	447	97	454	97	5989	94	6890	94
	Quadriceps graft	6	1	3	1	25	0	34	0
	Other*	1	0	0	0	23	0	24	0
	Total	461	100	470	100	6381	100	7312	100
Skåne	Patellar graft	15	4	15	4	395	7	425	7
	Hamstring graft	367	90	365	87	5039	90	5771	90
	Quadriceps graft	15	4	31	7	27	0	73	1
	Other*	12	3	8	2	125	2	145	2
	Total	409	100	419	100	5586	100	6414	100
Halland	Patellar graft	12	4	17	6	172	7	201	7
	Hamstring graft	293	96	254	94	2148	92	2695	93
	Quadriceps graft	0	0	0	0	1	0	1	0
	Other*	0	0	0	0	3	0	3	0
	Total	305	100	271	100	2324	100	2900	100
Småland + Blekinge	Patellar graft	10	7	12	5	240	7	262	7
	Hamstring graft	129	91	237	94	3089	92	3455	93
	Quadriceps graft	2	1	1	0	2	0	5	0
	Other*	0	0	1	0	10	0	11	0
	Total	141	100	251	100	3341	100	3733	100
Västra Götaland	Patellar graft	178	26	150	19	389	5	717	8
	Hamstring graft	510	73	594	77	7047	93	8151	90
	Quadriceps graft	9	1	17	2	37	0	63	1
	Other*	0	0	12	2	91	1	103	1
	Total	697	100	773	100	7564	100	9034	100
Östergötland	Patellar graft	6	9	5	4	27	1	38	2
	Hamstring graft	62	91	112	96	1856	98	2030	98
	Quadriceps graft	0	0	0	0	0	0	0	0
	Other*	0	0	0	0	7	0	7	0
	Total	68	100	117	100	1890	100	2075	100
Norrland	Patellar graft	13	6	9	3	129	4	151	4
	Hamstring graft	207	92	270	92	3291	92	3768	92
	Quadriceps graft	3	1	13	4	136	4	152	4
	Other*	3	1	2	1	5	0	10	0
	Total	226	100	294	100	3561	100	4081	100
Total	Patellar graft	295	8	299	7	2525	6	3119	6
	Hamstring graft	3101	85	3422	86	40917	92	47440	91
	Quadriceps graft	206	6	236	6	635	1	1077	2
	Other*	25	1	37	1	373	1	435	1
	Total	3627	100	3994	100	44450	100	52071	100

\* Allograft or other graft

**TABLE 14****ACL grafts in revisions distributed by region in year of surgery 2005-2020**

Region	Graft	2020		2019		2005-2018		Total	
		N	%	N	%	N	%	N	%
Greater Stockholm	Patellar graft	61	46	60	38	616	53	737	51
	Hamstring graft	16	12	41	26	351	30	408	28
	Quadriceps graft	46	34	43	27	122	11	211	15
	Other*	11	8	13	8	66	6	90	6
	Total	134	100	157	100	1155	100	1446	100
Svealand + Gotland	Patellar graft	19	56	26	58	230	52	275	53
	Hamstring graft	13	38	17	38	204	46	234	45
	Quadriceps graft	2	6	1	2	8	2	11	2
	Other*	0	0	1	2	2	0	3	1
	Total	34	100	45	100	444	100	523	100
Skåne	Patellar graft	9	35	5	12	150	39	164	36
	Hamstring graft	6	23	6	15	119	31	131	29
	Quadriceps graft	9	35	27	66	25	6	61	13
	Other*	2	8	3	7	95	24	100	22
	Total	26	100	41	100	389	100	456	100
Halland	Patellar graft	15	88	25	81	121	63	161	67
	Hamstring graft	2	12	6	19	58	30	66	28
	Quadriceps graft	0	0	0	0	2	1	2	1
	Other*	0	0	0	0	10	5	10	4
	Total	17	100	31	100	191	100	239	100
Småland + Blekinge	Patellar graft	6	55	7	64	74	49	87	51
	Hamstring graft	5	45	3	27	72	48	80	47
	Quadriceps graft	0	0	1	9	3	2	4	2
	Other*	0	0	0	0	1	1	1	1
	Total	11	100	11	100	150	100	172	100
Västra Götaland	Patellar graft	64	84	70	80	317	49	451	56
	Hamstring graft	1	1	7	8	202	31	210	26
	Quadriceps graft	8	11	8	9	41	6	57	7
	Other*	3	4	3	3	86	13	92	11
	Total	76	100	88	100	646	100	810	100
Östergötland	Patellar graft	2	67	3	50	69	64	74	63
	Hamstring graft	1	33	3	50	35	32	39	33
	Quadriceps graft	0	0	0	0	4	4	4	3
	Other*	0	0	0	0	0	0	0	0
	Total	3	100	6	100	108	100	117	100
Norrland	Patellar graft	0	0	4	25	51	26	55	24
	Hamstring graft	11	73	6	38	94	48	111	49
	Quadriceps graft	2	13	4	25	44	23	50	22
	Other*	2	13	2	13	5	3	9	4
	Total	15	100	16	100	194	100	225	100
Total	Patellar graft	176	56	200	51	1628	50	2004	50
	Hamstring graft	55	17	89	23	1135	35	1279	32
	Quadriceps graft	67	21	84	21	249	8	400	10
	Other*	18	6	22	6	265	8	305	8
	Total	316	100	395	100	3277	100	3988	100

\* Allograft or other graft

## Tibial fixation

The most common form of tibial fixation at the present time is the cortical button, which was used in 63% of operations in 2020. Screws were used in the other cases. The use of resorbable screws increased sharply between 2008 and 2013, but it has since declined steadily in recent years. The use of metal screws experienced a declining trend in 2005-2013, but it has since stabilized at just under 20% during the past five years.

**TABLE 15**

*Tibial fixation in primary reconstructions distributed by year of surgery 2005-2020 (%)*

Tibial fixation		Year of surgery										Total
		2020	2019	2018	2017	2016	2015	2014	2013	2012	2011-2005	
Cortical	Cobra		<1%					<1%			<1%	<1%
	Staple	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
	Endobutton	<1%	<1%	<1%	<1%	<1%	1%	<1%	<1%	<1%	<1%	<1%
	AO screw	20%	23%	24%	22%	21%	21%	21%	16%	18%	14%	18%
	Tightrope	29%	28%	28%	28%	27%	24%	20%	7%	1%	<1%	14%
	Suture washer	10%	7%	4%	3%	3%	<1%					2%
	Infinity button	4%	<1%									<1%
	Total	63%	59%	57%	53%	51%	48%	41%	24%	19%	15%	35%
Intrafix / Rigidfix	Intrafix			<1%	<1%	1%	2%	3%	7%	8%	17%	8%
	Rigidfix		<1%	<1%	<1%		<1%	<1%	<1%	<1%	5%	2%
	Total		<1%	<1%	<1%	1%	2%	3%	7%	9%	21%	10%
Close to joint	Metal screw	16%	19%	17%	19%	18%	16%	17%	23%	24%	35%	25%
	Metal screw/staple	<1%	<1%	2%	2%	3%	4%	4%	6%	7%	11%	6%
	Retroscrew	<1%	<1%	<1%	<1%		<1%	<1%	<1%	<1%	3%	1%
	Retrobutton	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
	Resorbable screw	18%	18%	19%	21%	21%	23%	28%	33%	34%	12%	20%
	Metal screw/osteosuture	<1%	1%	1%	1%	2%	2%	3%	3%	3%	1%	2%
	Resorbable/post	<1%	2%	2%	2%	3%	2%	3%	4%	3%	<1%	2%
	Total	37%	40%	42%	46%	47%	48%	56%	68%	71%	62%	55%
Other	Mitek anchor	<1%	<1%								<1%	<1%
	Other	<1%	<1%	1%	<1%	<1%	2%	<1%	1%	<1%	<1%	<1%
	Total	<1%	<1%	1%	<1%	<1%	2%	<1%	1%	<1%	<1%	<1%
Total N		3654	4020	3774	3857	3556	3439	3388	3427	3486	19791	52392

## Femoral fixation

The most common form of femoral fixation at the present time is the cortical button, which is used in 85% of all femoral fixations. The use of the TightRope has risen sharply in the past few years and has overtaken the Endobutton. At the same time, the Ultrabutton, which is similar to the TightRope and the Endobutton, is used in just under 10% of cases. 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 85% in 2020. 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. Metal 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 15%.

**TABLE 16**

*Femoral fixation in primary reconstructions distribute by year of surgery*

Femoral fixation		Year of surgery										Total
		2020	2019	2018	2017	2016	2015	2014	2013	2012	2011-2005	
Cortical	Endobutton	19%	23%	24%	23%	38%	44%	49%	57%	59%	37%	37%
	Staple				<1%			<1%		<1%	<1%	<1%
	AO screw	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
	Toggleloc	<1%	<1%	<1%	<1%	<1%	1%	1%	1%	1%	<1%	<1%
	Tightrope	52%	54%	58%	62%	50%	42%	38%	30%	22%	2%	29%
	Interference screw					<1%					<1%	<1%
	Graftmax		<1%	<1%	<1%	<1%						<1%
	Ultrabutton	9%	9%	7%	5%							2%
	XO button	<1%	<1%	<1%								<1%
	Infinity button	5%	<1%									<1%
	Total	85%	88%	90%	91%	89%	88%	89%	88%	82%	39%	70%
Rigidfix /	Rigidfix		<1%		<1%	<1%	<1%	<1%	2%	4%	26%	10%
Transfix	Transfix				<1%		<1%	<1%	<1%	1%	12%	5%
	Total		<1%		<1%	<1%	<1%	<1%	3%	5%	37%	15%
Close to joint	Metal screw	13%	11%	9%	7%	7%	9%	10%	8%	11%	20%	13%
	Retrobutton		<1%		<1%	<1%	<1%		<1%	<1%	3%	1%
	Retroscrew	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
	Ezloc										<1%	<1%
	Metal screw/Endopearl		<1%		<1%		<1%	<1%	<1%		<1%	<1%
	Resorbable screw	<1%										<1%
Total	13%	12%	9%	8%	7%	9%	10%	8%	12%	23%	15%	
Annan	Other	1%	<1%	1%	2%	2%	2%	<1%	<1%	<1%	<1%	<1%
	Total	1%	<1%	1%	2%	2%	2%	<1%	<1%	<1%	<1%	<1%
Total N		3654	4020	3774	3860	3558	3454	3396	3430	3492	19845	52483

## Revisions and surgery on the contralateral side

A total of 4,040 revisions were registered in the knee ligament registry in 2005-2020. 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 both registered, the figure for revisions is reduced to 2,341.

The total revision frequency is 2.3% within two years and 4.5% within five years. The risk of revision or a new ACL injury on the contralateral knee is 4.0% and 8.2% respectively. Taken as a whole, patellar grafts run a slightly lower risk of revision, but the difference is between 0.5% and 1%. Among sports, handball has the highest revision frequency and this also applies generally to young people under the age of 20.

In half (50%) of revisions, a patellar graft is used, whereas quadriceps grafts are used in 25%. 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 hamstring graft has a slightly higher revision frequency compared with the patellar graft at two years (2.4% compared with 1.8%), but, as far more patients are given hamstring grafts, it is difficult to draw any conclusions about the impact of graft selection on the risk of revision. A quadriceps graft has been revised in 2.2% of cases, but this is a far more recent technique.

The following table presents the number of revisions on the same knee within two years and per clinic. The clinics that are presented are the clinics 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. We should also point out that we are presenting the percentage of revision surgeries – but we do not know anything about the number of reruptures (the number of operations on ACLs that have ruptured in connection with a new injury). Nor does a high percentage of revisions indicate poor quality; different clinics may have different indications for revisions and/or more patients who return to elite sports and/or may have differences in age and gender.

**TABLE 17**

*ACL index leading to revision within two years distributed by ACL index graft and tibial fixation  
ACL index during surgery period 1 January 2005 to 31 December 2018*

Graft	Tibial fixation	Revision within two years					Revision				
		Yes		No		ACL index	Yes		No		ACL index
		N	%	N	%		N	%	N	%	
Patellar graft	Cortical	2	1,4	140	98,6	142	5	3,5	137	96,5	142
	Intrafix/Rigidfix	0	0,0	14	100,0	14	2	14,3	12	85,7	14
	Close to joint	40	1,8	2140	98,2	2180	108	5,0	2072	95,0	2180
	Other	0	0,0	7	100,0	7	0	0,0	7	100,0	7
	Total	42	1,8	2301	98,2	2343	115	4,9	2228	95,1	2343
Hamstring graft	Cortical	349	2,9	11869	97,1	12218	711	5,8	11507	94,2	12218
	Intrafix/Rigidfix	74	1,5	4779	98,5	4853	237	4,9	4616	95,1	4853
	Close to joint	495	2,3	21070	97,7	21565	1212	5,6	20353	94,4	21565
	Other	9	2,4	360	97,6	369	25	6,8	344	93,2	369
	Total	927	2,4	38078	97,6	39005	2185	5,6	36820	94,4	39005
Quadriceps graft	Cortical	9	5,0	170	95,0	179	14	7,8	165	92,2	179
	Intrafix/Rigidfix	0	0,0	1	100,0	1	0	0,0	1	100,0	1
	Close to joint	4	1,0	407	99,0	411	10	2,4	401	97,6	411
	Other	0	0,0	1	100,0	1	0	0,0	1	100,0	1
	Total	13	2,2	579	97,8	592	24	4,1	568	95,9	592
Allograft	Cortical	1	3,3	29	96,7	30	2	6,7	28	93,3	30
	Intrafix/Rigidfix	0	0,0	0	0,0	0	0	0,0	0	0,0	0
	Close to joint	3	1,5	195	98,5	198	9	4,5	189	95,5	198
	Other	0	0,0	4	100,0	4	0	0,0	4	100,0	4
	Total	4	1,7	228	98,3	232	11	4,7	221	95,3	232
Other	Cortical	0	0,0	28	100,0	28	1	3,6	27	96,4	28
	Intrafix/Rigidfix	0	0,0	7	100,0	7	0	0,0	7	100,0	7
	Close to joint	2	3,1	63	96,9	65	4	6,2	61	93,8	65
	Other	1	14,3	6	85,7	7	1	14,3	6	85,7	7
	Total	3	2,8	104	97,2	107	6	5,6	101	94,4	107
Total	Cortical	361	2,9	12236	97,1	12597	733	5,8	11864	94,2	12597
	Intrafix/Rigidfix	74	1,5	4801	98,5	4875	239	4,9	4636	95,1	4875
	Close to joint	544	2,2	23875	97,8	24419	1343	5,5	23076	94,5	24419
	Other	10	2,6	378	97,4	388	26	6,7	362	93,3	388
	Total	989	2,3	41290	97,7	42279	2341	5,5	39938	94,5	42279

**TABLE 18**

*ACL index leading to revision within two years distributed by ACL index graft and femoral fixation  
ACL index during surgery period 1 January 2005 to 31 December 2018*

Graft	Femoral fixation	Revision within two years					Revision				
		Yes		No		ACL index	Yes		No		ACL index
		N	%	N	%		N	%	N	%	
Patellar graft	Cortical	9	2,0	433	98,0	442	19	4,3	423	95,7	442
	Rigidfix/Transfix	0	0,0	7	100,0	7	0	0,0	7	100,0	7
	Close to joint	32	1,7	1856	98,3	1888	95	5,0	1793	95,0	1888
	Other	1	11,1	8	88,9	9	2	22,2	7	77,8	9
	Total	42	1,8	2304	98,2	2346	116	4,9	2230	95,1	2346
Hamstring graft	Cortical	679	2,5	26113	97,5	26792	1515	5,7	25277	94,3	26792
	Rigidfix/Transfix	102	1,4	7453	98,6	7555	346	4,6	7209	95,4	7555
	Close to joint	137	3,1	4296	96,9	4433	308	6,9	4125	93,1	4433
	Other	9	2,9	300	97,1	309	17	5,5	292	94,5	309
	Total	927	2,4	38162	97,6	39089	2186	5,6	36903	94,4	39089
Quadriceps graft	Cortical	12	2,2	535	97,8	547	20	3,7	527	96,3	547
	Rigidfix/Transfix	0	0,0	0	0,0	0	0	0,0	0	0,0	0
	Close to joint	1	2,1	46	97,9	47	4	8,5	43	91,5	47
	Other	0	0,0	3	100,0	3	0	0,0	3	100,0	3
	Total	13	2,2	584	97,8	597	24	4,0	573	96,0	597
Allograft	Cortical	4	2,2	181	97,8	185	11	5,9	174	94,1	185
	Rigidfix/Transfix	0	0,0	10	100,0	10	0	0,0	10	100,0	10
	Close to joint	0	0,0	35	100,0	35	0	0,0	35	100,0	35
	Other	0	0,0	2	100,0	2	0	0,0	2	100,0	2
	Total	4	1,7	228	98,3	232	11	4,7	221	95,3	232
Other	Kortikal	1	1,4	69	98,6	70	4	5,7	66	94,3	70
	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	2,8	104	97,2	107	6	5,6	101	94,4	107
Total	Cortical	705	2,5	27331	97,5	28036	1569	5,6	26467	94,4	28036
	Rigidfix/Transfix	102	1,3	7474	98,7	7576	346	4,6	7230	95,4	7576
	Close to joint	171	2,7	6254	97,3	6425	408	6,4	6017	93,6	6425
	Other	11	3,3	323	96,7	334	20	6,0	314	94,0	334
	Total	989	2,3	41382	97,7	42371	2343	5,5	40028	94,5	42371

**TABLE 19**

*ACL index leading to revision within two years distributed by region and clinic where ACL index was performed*

*ACL index during surgery period 1 January 2005 to 31 December 2018*

Region	Clinic	Revision within two years					Revision					
		Yes		No		ACL index	Yes		No		ACL index	
		N	%	N	%		N	%	N	%		
Greater Stockholm	ASTRID LINDGRENS BARNSJUKHUS	3	1,5	203	98,5	206	11	5,3	195	94,7	206	
	ARTROCENTER	6	4,9	116	95,1	122	7	5,7	115	94,3	122	
	CAPIO S:T GÖRANS SJUKHUS	3	3,0	97	97,0	100	6	6,0	94	94,0	100	
	CITYAKUTEN PRIVATVÅRD	0	0,0	73	100,0	73	0	0,0	73	100,0	73	
	DANDERYDS SJUKHUS	9	2,3	389	97,7	398	22	5,5	376	94,5	398	
	LÖWETS SPECIALISTMOTTAGNING	5	2,1	238	97,9	243	18	7,4	225	92,6	243	
	KAROLINSKA UNIVERSITETSSJUKHUSET / ORTOPEDKLINIKEN	19	2,9	634	97,1	653	41	6,3	612	93,7	653	
	NACKA NÄRSJUKHUS	2	1,9	102	98,1	104	7	6,7	97	93,3	104	
	ODENPLANS LÄKARHUS	4	2,2	180	97,8	184	14	7,6	170	92,4	184	
	CAPIO ORTOPEDISKA HUSET	14	1,9	718	98,1	732	29	4,0	703	96,0	732	
	PRAKTIKERTJÄNST ORTOPEDI STOCKHOLM	7	3,2	210	96,8	217	10	4,6	207	95,4	217	
	ALERIS SPORTS MEDICINE & ORTOPEDI, SABBATSBERG	11	4,5	232	95,5	243	14	5,8	229	94,2	243	
	SÖDERMALMS ORTOPEDI	1	1,0	104	99,0	105	2	1,9	103	98,1	105	
	SÖDERTÄLJE SJUKHUS	3	3,4	85	96,6	88	8	9,1	80	90,9	88	
	SÖDERSJUKHUSET	35	2,3	1462	97,7	1497	87	5,8	1410	94,2	1497	
	SOPHIAHEMMET	0	0,0	69	100,0	69	0	0,0	69	100,0	69	
	GHP ORTHOCENTER STOCKHOLM	11	2,5	437	97,5	448	25	5,6	423	94,4	448	
	CAPIO ARTRO CLINIC	200	2,5	7882	97,5	8082	482	6,0	7600	94,0	8082	
	<b>Total</b>		<b>333</b>	<b>2,5</b>	<b>13231</b>	<b>97,5</b>	<b>13564</b>	<b>783</b>	<b>5,8</b>	<b>12781</b>	<b>94,2</b>	<b>13564</b>
	Svealand + Gotland	AKADEMISKA SJUKHUSET	8	3,1	248	96,9	256	18	7,0	238	93,0	256
BOLLNÄS SJUKHUS		0	0,0	12	100,0	12	1	8,3	11	91,7	12	
LASARETTET I ENKÖPING		2	1,8	112	98,2	114	5	4,4	109	95,6	114	
ALERIS ELISABETHSJUKHUSET		27	3,0	873	97,0	900	70	7,8	830	92,2	900	
FALU LASARETT		9	1,5	591	98,5	600	27	4,5	573	95,5	600	
GÄVLE SJUKHUS		4	0,9	422	99,1	426	18	4,2	408	95,8	426	
HUDIKSVALLS SJUKHUS		8	2,6	302	97,4	310	14	4,5	296	95,5	310	
KARLSTAD CENTRALSJUKHUS		16	1,8	889	98,2	905	49	5,4	856	94,6	905	
KARLSKOGA LASARETT		0	0,0	11	100,0	11	3	27,3	8	72,7	11	
CAPIO LÄKARGRUPPEN I ÖREBRO AB		23	4,0	545	96,0	568	45	7,9	523	92,1	568	
MÄLARSJUKHUSET ESKILSTUNA		6	1,6	381	98,4	387	12	3,1	375	96,9	387	
NORRTÄLJE SJUKHUS		3	1,8	162	98,2	165	7	4,2	158	95,8	165	
NYKÖPINGS LASARETT		2	1,4	137	98,6	139	9	6,5	130	93,5	139	
ORTOPEDISKA KLINIKEN REGION ÖREBRO LÄN		11	2,2	480	97,8	491	23	4,7	468	95,3	491	
SAMARITERHEMMETS SJUKHUS		1	0,5	217	99,5	218	9	4,1	209	95,9	218	
SPECIALISTCENTER SCANDINAVIA		2	2,5	77	97,5	79	3	3,8	76	96,2	79	
VÄSTERÅS CENTRALLASARETTET		2	0,6	361	99,4	363	8	2,2	355	97,8	363	
VISBY LASARETT		3	2,7	107	97,3	110	7	6,4	103	93,6	110	
VÄSTERÅS ORTOPEDPRAKTIK		4	2,2	176	97,8	180	7	3,9	173	96,1	180	
<b>Total</b>			<b>131</b>	<b>2,1</b>	<b>6103</b>	<b>97,9</b>	<b>6234</b>	<b>335</b>	<b>5,4</b>	<b>5899</b>	<b>94,6</b>	<b>6234</b>
Skåne	ALERIS ORTOPEDI ÄNGELHOLM	11	1,7	620	98,3	631	28	4,4	603	95,6	631	
	HÄSSLEHOLMS SJUKHUS	16	1,8	888	98,2	904	49	5,4	855	94,6	904	
	HELSINGBORGS SJUKHUS	15	2,1	686	97,9	701	28	4,0	673	96,0	701	
	LUNDS UNIVERSITET	6	1,5	397	98,5	403	26	6,5	377	93,5	403	
	MALMÖ ALLMÄNNA SJUKHUS	17	2,2	745	97,8	762	51	6,7	711	93,3	762	
	ORTHOCENTER I SKÅNE	5	3,1	157	96,9	162	10	6,2	152	93,8	162	
	SKÅNES UNIVERSITETSSJUKHUS	32	1,7	1811	98,3	1843	90	4,9	1753	95,1	1843	
<b>Total</b>		<b>102</b>	<b>1,9</b>	<b>5304</b>	<b>98,1</b>	<b>5406</b>	<b>282</b>	<b>5,2</b>	<b>5124</b>	<b>94,8</b>	<b>5406</b>	

TABLE 19 continues on the next page.

Continuation of TABLE 19.

Region	Clinic	Revision within two years					Revision				
		Yes		No		ACL index	Yes		No		ACL index
		N	%	N	%		N	%	N	%	
Halland	HALLANDS SJUKHUS HALMSTAD	3	4,6	62	95,4	65	8	12,3	57	87,7	65
	KUNGSBACKA SJUKHUS	23	2,5	892	97,5	915	49	5,4	866	94,6	915
	CAPIO MOVEMENT	43	3,7	1131	96,3	1174	88	7,5	1086	92,5	1174
	ORTOPEDSPECIALISTERNA	4	3,4	113	96,6	117	7	6,0	110	94,0	117
	Total	73	3,2	2198	96,8	2271	152	6,7	2119	93,3	2271
Småland + Blekinge	ART CLINIC JÖNKÖPING	1	1,5	66	98,5	67	2	3,0	65	97,0	67
	HÖGLANDSSJUKHUSET	8	1,6	485	98,4	493	20	4,1	473	95,9	493
	KALMAR SJUKHUS	17	2,5	658	97,5	675	38	5,6	637	94,4	675
	BLEKINGESJUKHUSET	0	0,0	143	100,0	143	5	3,5	138	96,5	143
	LJUNGBY LASARETT	5	2,1	229	97,9	234	9	3,8	225	96,2	234
	OSKARSHAMNS SJUKHUS	0	0,0	361	100,0	361	7	1,9	354	98,1	361
	LÄNSSJUKHUSET RYHOV	9	2,3	382	97,7	391	18	4,6	373	95,4	391
	CENTRALLASARETTET VÄXJÖ	7	1,2	597	98,8	604	28	4,6	576	95,4	604
	VÄRNAMO SJUKHUS / ORTOPEDKLINIKEN	1	1,3	74	98,7	75	4	5,3	71	94,7	75
	VÄSTERVIKS SJUKHUS	1	0,6	164	99,4	165	4	2,4	161	97,6	165
	Total	49	1,5	3159	98,5	3208	135	4,2	3073	95,8	3208
Västra Götaland	ALINGSÅS LASARETT	12	3,6	322	96,4	334	29	8,7	305	91,3	334
	ART CLINIC GÖTEBORG	2	3,7	52	96,3	54	4	7,4	50	92,6	54
	SÖDRA ÄLVSBORGS SJUKHUS	5	2,4	206	97,6	211	9	4,3	202	95,7	211
	CARLANDERSKA ORTOPEDI	2	4,3	44	95,7	46	2	4,3	44	95,7	46
	DROTTNING SILVIAS BARN- OCH UNGDOMSSJUKHUS	3	4,2	69	95,8	72	8	11,1	64	88,9	72
	FRÖLUNDAORTOPEDEN	0	0,0	23	100,0	23	0	0,0	23	100,0	23
	FRÖLUNDA SPECIALISTSJUKHUS	11	3,8	280	96,2	291	20	6,9	271	93,1	291
	ORTHOCENTER / IFK-KLINIKEN	89	5,9	1420	94,1	1509	146	9,7	1363	90,3	1509
	KUNGÄLVS SJUKHUS	4	2,1	188	97,9	192	10	5,2	182	94,8	192
	CAPIO LUNDBY NÄRSJUKHUS	18	2,9	597	97,1	615	32	5,2	583	94,8	615
	LIDKÖPINGS SJUKHUS	3	1,4	215	98,6	218	7	3,2	211	96,8	218
	NU-SJUKVÅRDEN	45	3,7	1182	96,3	1227	96	7,8	1131	92,2	1227
	PERAGO ORTOPEDKLINIK	6	5,0	113	95,0	119	7	5,9	112	94,1	119
	KÄRNSJUKHUSET I SKÖVDE	3	2,4	124	97,6	127	6	4,7	121	95,3	127
	SPORTSMED	0	0,0	118	100,0	118	1	0,8	117	99,2	118
	SAHLGRENSKA UNIVERSITETSSJUKHUSET	49	2,6	1837	97,4	1886	99	5,2	1787	94,8	1886
	VARBERGS SJUKHUS	4	1,5	270	98,5	274	13	4,7	261	95,3	274
	Total	256	3,5	7060	96,5	7316	489	6,7	6827	93,3	7316
Östergötland	LINKÖPINGS HEALTH CARE	0	0,0	1	100,0	1	0	0,0	1	100,0	1
	LINKÖPINGS UNIVERSITETSKLINIK	8	0,9	839	99,1	847	37	4,4	810	95,6	847
	VRINNEVISJUKHUSET	9	0,9	963	99,1	972	36	3,7	936	96,3	972
	Total	17	0,9	1803	99,1	1820	73	4,0	1747	96,0	1820
Norrland	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	2,4	80	97,6	82	5	6,1	77	93,9	82
	MEDICIN DIREKT	9	2,1	430	97,9	439	36	8,2	403	91,8	439
	ÖRNSKÖLDSVIKS SJUKHUS	2	1,1	177	98,9	179	9	5,0	170	95,0	179
	ÖSTERSUNDS SJUKHUS	4	2,2	181	97,8	185	10	5,4	175	94,6	185
	PITEÅ ÄLVDAL SJUKHUS	0	0,0	68	100,0	68	2	2,9	66	97,1	68
	SKELLEFTEÅ SJUKHUS	0	0,0	48	100,0	48	3	6,3	45	93,8	48
	SPORTS MEDICINE UMEÅ	13	3,0	417	97,0	430	26	6,0	404	94,0	430
	SOLLEFTEÅ SJUKHUS	0	0,0	58	100,0	58	0	0,0	58	100,0	58
	SUNDERBY SJUKHUS	8	1,2	653	98,8	661	20	3,0	641	97,0	661
	LÄNSSJUKHUSET SUNDSVALL	1	1,3	74	98,7	75	3	4,0	72	96,0	75
	NORRLANDS UNIVERSITETSSJUKHUS, UMEÅ	12	1,1	1125	98,9	1137	46	4,0	1091	96,0	1137
	Total	51	1,5	3377	98,5	3428	160	4,7	3268	95,3	3428
Total	1012	2,3	42235	97,7	43247	2409	5,6	40838	94,4	43247	

## 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 a rating of under 44 points 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 postoperatively and the percentage who have given a rating of under 44 points, 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 surgery period 1 January 2005 to 31 December 2018*

Region	Clinic	KOOS knee-related quality of life two years postop								ACL Index
		QoL < 44		QoL ≥ 44		Response frequency		No response because of new		
		N	%	N	%	N	%	N	%	
Greater Stockholm	ASTRID LINDGRENS BARNSJUKHUS	18	14,2	109	85,8	127	61,7	6	2,9	206
	ARTROCENTER	10	19,2	42	80,8	52	42,6	10	8,2	122
	CAPIO S:T GÖRANS SJUKHUS	12	19,7	49	80,3	61	61,0	2	2,0	100
	CITYAKUTEN PRIVATVÅRD	10	30,3	23	69,7	33	45,2	0	0,0	73
	DANDERYDS SJUKHUS	62	37,3	104	62,7	166	41,7	10	2,5	398
	LÖWETS SPECIALISTMOTTAGNING	28	20,1	111	79,9	139	57,2	11	4,5	243
	KAROLINSKA UNIVERSITETSSJUKHUSET / ORTOPEDKLINIKEN	84	29,6	200	70,4	284	43,5	26	4,0	653
	NACKA NÄRSJUKHUS	17	34,0	33	66,0	50	48,1	1	1,0	104
	ODENPLANS LÄKARHUS	14	17,5	66	82,5	80	43,5	8	4,3	184
	CAPIO ORTOPEDISKA HUSET	82	23,2	272	76,8	354	48,4	17	2,3	732
	PRAKTIKERTJÄNST ORTOPEDI STOCKHOLM	13	14,8	75	85,2	90	41,5	8	3,7	217
	ALERIS SPORTS MEDICINE & ORTOPEDI, SABBATSBERG	32	33,3	64	66,7	96	39,5	13	5,3	243
	SÖDERMALMS ORTOPEDI	5	9,4	48	90,6	54	51,4	1	1,0	105
	SÖDERTÄLJE SJUKHUS	18	51,4	17	48,6	35	39,8	1	1,1	88
	SÖDERSJUKHUSET	198	30,6	449	69,4	647	43,2	34	2,3	1497
	SOPHIAHEMMET	5	15,6	27	84,4	32	46,4	1	1,4	69
GHP ORTHOCENTER STOCKHOLM	63	28,6	157	71,4	220	49,2	14	3,1	447	
CAPIO ARTRO CLINIC	924	21,8	3322	78,2	4249	52,6	246	3,0	8082	
	Total	1595	23,6	5168	76,4	6769	49,9	409	3,0	13563
Svealand + Gotland	AKADEMISKA SJUKHUSET	19	24,7	58	75,3	78	30,5	11	4,3	256
	BOLLNÄS SJUKHUS	2	40,0	3	60,0	5	41,7	0	0,0	12
	LASARETTET I ENKÖPING	13	29,5	31	70,5	44	38,6	1	0,9	114
	ALERIS ELISABETHSJUKHUSET	101	27,0	273	73,0	374	41,6	28	3,1	900
	FALU LASARETT	95	36,1	168	63,9	264	44,0	13	2,2	600
	GÄVLE SJUKHUS	76	39,2	118	60,8	194	45,5	8	1,9	426
	HUDIKSVALLS SJUKHUS	43	32,1	91	67,9	134	43,2	9	2,9	310
	KARLSTAD CENTRALSJUKHUS	151	34,6	285	65,4	437	48,3	21	2,3	905
	KARLSKOGA LASARETT	4	66,7	2	33,3	6	54,5	0	0,0	11
	CAPIO LÄKARGRUPPEN I ÖREBRO AB	111	35,5	202	64,5	313	55,1	24	4,2	568
	MÄLARSJUKHUSET ESKILSTUNA	74	38,3	119	61,7	193	49,9	4	1,0	387
	NORRTÄLJE SJUKHUS	15	26,3	42	73,7	57	34,5	2	1,2	165
	NYKÖPINGS LASARETT	24	40,0	36	60,0	60	43,2	5	3,6	139
	ORTOPEDISKA KLINIKEN REGION ÖREBRO LÄN	80	37,7	132	62,3	212	43,2	12	2,4	491
	SAMARITERHEMETS SJUKHUS	33	30,6	75	69,4	108	49,5	2	0,9	218
	SPECIALISTCENTER SCANDINAVIA	16	43,2	21	56,8	37	46,8	2	2,5	79
VÄSTERÅS CENTRALLASARETTET	72	44,7	89	55,3	161	44,4	7	1,9	363	
VISBY LASARETT	22	39,3	34	60,7	56	50,9	2	1,8	110	
VÄSTERÅS ORTOPEDPRAKTIK	25	37,9	41	62,1	66	36,7	4	2,2	180	
	Total	976	34,9	1820	65,1	2799	44,9	155	2,5	6234
Skåne	ALERIS ORTOPEDI ÄNGELHOLM	78	27,7	204	72,3	282	44,7	15	2,4	631
	HÄSSLEHOLMS SJUKHUS	140	30,7	316	69,3	456	50,4	10	1,1	904
	HELSINGBORGS SJUKHUS	110	36,1	195	63,9	305	43,5	16	2,3	701

TABLE 20 continues on the next page.

		KOOS knee-related quality of life two years postop								
Region	Clinic	QoL < 44				QoL ≥ 44				ACL Index
		Response frequency		No response because of new		Response frequency		No response because of new		
		N	%	N	%	N	%	N	%	
	LUNDS UNIVERSITET	61	28,0	157	72,0	218	54,1	10	2,5	403
	MALMÖ ALLMÄNNA SJUKHUS	147	39,7	223	60,3	370	48,6	24	3,1	762
	ORTHOCENTER I SKÅNE	20	24,4	62	75,6	82	50,6	4	2,5	162
	SKÅNES UNIVERSITETSSJUKHUS	315	36,0	559	64,0	875	47,5	41	2,2	1843
	Total	871	33,7	1716	66,3	2588	47,9	120	2,2	5406
Halland	HALLANDS SJUKHUS HALMSTAD	12	31,6	26	68,4	38	58,5	3	4,6	65
	KUNGSBACKA SJUKHUS	132	30,5	301	69,5	434	47,4	27	3,0	915
	CAPIO MOVEMENT	195	33,0	396	67,0	591	50,3	52	4,4	1174
	ORTOPEDSPECIALISTERNA	14	25,9	40	74,1	54	46,2	4	3,4	117
	Total	353	31,6	763	68,4	1117	49,2	86	3,8	2271
Småland + Blekinge	ART CLINIC JÖNKÖPING	4	12,9	27	87,1	31	46,3	1	1,5	67
	HÖGLANDSSJUKHUSET	79	30,2	183	69,8	262	53,1	12	2,4	493
	KALMAR SJUKHUS	92	30,0	215	70,0	307	45,5	21	3,1	675
	BLEKINGESJUKHUSET	23	35,9	41	64,1	64	44,8	1	0,7	143
	LJUNGBY LASARETT	30	26,8	82	73,2	112	47,9	7	3,0	234
	OSKARSHAMNS SJUKHUS	64	32,8	131	67,2	196	54,3	1	0,3	361
	LÄNSSJUKHUSET RYHOV	54	28,7	134	71,3	188	48,1	11	2,8	391
	CENTRALLASARETTET VÄXJÖ	81	27,3	216	72,7	297	49,2	9	1,5	604
	VÄRNAMO SJUKHUS / ORTOPEDKLINIKEN	10	35,7	18	64,3	28	37,3	1	1,3	75
	VÄSTERVIKS SJUKHUS	26	32,9	53	67,1	79	47,9	2	1,2	165
	Total	463	29,6	1100	70,4	1564	48,8	66	2,1	3208
Västra Götaland	ALINGSÅS LASARETT	52	34,7	98	65,3	150	44,9	15	4,5	334
	ART CLINIC GÖTEBORG	8	34,8	15	65,2	23	42,6	2	3,7	54
	SÖDRA ÄLVSBOGERS SJUKHUS	50	49,0	52	51,0	102	48,3	4	1,9	211
	CARLANDERSKA ORTOPEDI	6	31,6	13	68,4	19	41,3	1	2,2	46
	DROTTNING SILVIAS BARN- OCH UNGDOMSSJUKHUS	8	23,5	26	76,5	34	47,2	4	5,6	72
	FRÖLUNDAORTOPEDEN	1	9,1	10	90,9	11	47,8	0	0,0	23
	FRÖLUNDA SPECIALISTSJUKHUS	45	29,8	106	70,2	151	51,9	10	3,4	291
	ORTHOCENTER / IFK-KLINIKEN	202	25,6	587	74,4	789	52,3	94	6,2	1509
	KUNGÄLVS SJUKHUS	40	37,0	68	63,0	108	56,3	6	3,1	192
	CAPIO LUNDBY NÄRSJUKHUS	80	27,0	216	73,0	296	48,1	23	3,7	615
	LIDKÖPINGS SJUKHUS	49	43,4	64	56,6	113	51,8	4	1,8	218
	NU-SJUKVÅRDEN	216	31,9	461	68,1	677	55,2	54	4,4	1227
	PERAGO ORTOPEDKLINIK	15	25,9	43	74,1	58	48,7	5	4,2	119
	KÄRNSJUKHUSET I SKÖVDE	12	19,4	50	80,6	62	48,8	5	3,9	127
	SPORTSMED	17	25,4	50	74,6	67	56,8	0	0,0	118
	SAHLGRENSKA UNIVERSITETSSJUKHUSET	324	35,4	590	64,6	914	48,5	56	3,0	1886
	VARBERGS SJUKHUS	52	32,9	106	67,1	158	57,7	3	1,1	274
	Total	1177	31,5	2555	68,5	3732	51,0	286	3,9	7316
Östergötland	LINKÖPINGS HEALTH CARE	0	0,0	1	100,0	1	100,0	0	0,0	1
	LINKÖPINGS UNIVERSITETSKLINIK	145	36,3	255	63,8	400	47,2	13	1,5	847
	VRINNEVISJUKHUSET	152	33,4	303	66,6	455	46,8	17	1,7	972
	Total	297	34,7	559	65,3	856	47,0	30	1,6	1820
Norrland	ALFREDSON TENDON CLINIC	0	0,0	1	100,0	1	50,0	0	0,0	2
	GÄLLIVARE SJUKHUS	10	23,3	33	76,7	43	67,2	1	1,6	64
	LÄKARHUSET HERMELINEN	8	17,8	37	82,2	45	54,9	2	2,4	82
	MEDICIN DIREKT	66	29,9	155	70,1	221	50,3	9	2,1	439
	ÖRNSKÖLDSVIKS SJUKHUS	47	46,1	55	53,9	102	57,0	2	1,1	179
	ÖSTERSUNDS SJUKHUS	21	26,9	57	73,1	78	42,2	6	3,2	185
	PITEÅ ÄLVDAL SJUKHUS	13	35,1	24	64,9	37	54,4	0	0,0	68
	SKELLEFTEÅ SJUKHUS	7	30,4	16	69,6	23	47,9	0	0,0	48
	SPORTS MEDICINE UMEÅ	65	31,4	142	68,6	207	48,1	14	3,3	430
	SOLLEFTEÅ SJUKHUS	13	56,5	10	43,5	23	39,7	0	0,0	58
	SUNDERBY SJUKHUS	99	31,5	215	68,5	315	47,7	15	2,3	661
	LÄNSSJUKHUSET SUNDSVALL	10	35,7	18	64,3	28	37,3	2	2,7	75
	NORRLANDS UNIVERSITETSSJUKHUS, UMEÅ	182	33,7	358	66,3	541	47,6	22	1,9	1137
	Total	541	32,6	1121	67,4	1664	48,5	73	2,1	3428
Total		6273	29,8	14802	70,2	21089	48,8	1225	2,8	43246

## 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, 83 multiligament injuries were registered in 2020. By far the most common combination was the reconstruction of the ACL with an injury to the medial cruciate ligament (MCL), where 37 operations were performed. Fourteen operations involved different combinations of the ACL and collateral ligament (LCL). On 16 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 2005-2020*

ACL	Graft				2020		2019		2005-2018		Total	
	PCL	MCL	LCL	PLC	N	%	N	%	N	%	N	%
ACL*	---	---	---	---	3571	97,7	3912	97,3	44106	97,8	51589	97,7
ACL*	---	MCL	---	---	37	1,0	49	1,2	417	0,9	503	1,0
ACL*	PCL	---	---	---	16	0,4	23	0,6	194	0,4	233	0,4
ACL*	---	---	LCL	---	14	0,4	12	0,3	117	0,3	143	0,3
ACL*	PCL	MCL	---	---	6	0,2	6	0,1	74	0,2	86	0,2
ACL*	---	---	LCL	PLC	4	0,1	6	0,1	75	0,2	85	0,2
ACL*	PCL	---	LCL	PLC	4	0,1	4	0,1	36	0,1	44	0,1
ACL*	---	---	---	PLC	2	0,1	3	0,1	20	0,0	25	0,0
ACL*	PCL	---	LCL	---	0	0,0	2	0,0	24	0,1	26	0,0
ACL*	PCL	---	---	PLC	0	0,0	2	0,0	15	0,0	17	0,0
ACL*	PCL	MCL	LCL	PLC	0	0,0	1	0,0	10	0,0	11	0,0
ACL*	---	MCL	LCL	PLC	0	0,0	0	0,0	6	0,0	6	0,0
ACL*	---	MCL	LCL	---	0	0,0	0	0,0	6	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
Total					3654	100	4020	100	45103	100	52777	100

\*Also include the ACLs without information on grafts

## Meniscal sutures

The registry data from 2005 to 2020 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 20% 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 2020.

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 focus on following this up in the future.

## Portals

Some 91% of operations are performed using the medial portal technique, while the transtibial technique is used in 7%. In 2020, only three operations were performed using the double-tunnel technique. 2008 was a record year for this technique when it was used in 203 operations.

## New ligaments

In recent years, there has been a lively discussion relating to the role played by anterolateral structures in knee stability and in cartilage surgery. The anterolateral ligament (ALL) is a structure within the anterolateral complex (ALC), primarily comprising the tractus iliotibialis (ITB), superficial and deep part, plus the capsule and the ALL. The ALL is probably not a morphologic ligament but is more likely a structure within the capsule anterolaterally. This structure is thought to run from the lateral femoral condyle posteriorly and proximally of the lateral collateral ligament (LCL) to the proximal tibia between Gerdy's tubercle and the caput fibula. The structure that is primarily of the greatest significance for anterior translation and inward rotation in connection with extension is, however, the anterior cruciate ligament (ACL), while other stabilizers are the ITB, the lateral meniscus and the ALL/anterolateral capsule. Methods for lateral tenodesis with a view to resembling the ALL have been presented. The most common method at the present time is a so-called modified LeMaire in which a one-centimeter "strip" of the ITB is loosened and passed under the LCL, after which it is fixed dorsally and proximally of the LCL in the lateral femoral epicondyle. The importance of lateral tenodesis in ACL surgery cannot currently be regarded as complete. There are studies reporting a sharp decrease in the risk of graft rupture, 21.7% compared with 3.3% in patients with excess mobility, if an ACL reconstruction is performed with the addition of lateral tenodesis (Helito et al. *Arthroscopy* 2019). They include a multicenter prospective study randomizing patients under 25 years of age with two of the following three criteria: (1) grade 2 pivot shift or more, (2) the desire to return to pivoting sport and (3) general joint laxity. This study comprised 618 patients with an average age of 18.9 years. At the two-year follow-up, 11% graft rupture in connection with ACL reconstruction and 4% in connection with ACL + lateral tenodesis (relative risk reduction 0.67 95% CI 0.36-0.83) were found. Fourteen patients required surgery with ACL + lateral tenodesis to prevent a graft rupture (Getgood et al. *Am J Sports Med* 2020). The indications for adding this as a reinforcement in ACL reconstruction usually include extreme pivoting, especially among young patients planning to return to pivoting sports, excess mobility or possibly revision surgery. In connection with a lateral tenodesis, it is important not to create too much tension and to fix the tibia in a neutral to outwardly rotated position, as the question of whether a lateral tenodesis may create increased pressure and load in the lateral compartment, especially in the event of a meniscal injury, has been raised. At the present time, there is still insufficient knowledge in this area. Since 2018, it has been possible to register a lateral tenodesis in conjunction with an ACL reconstruction. So far, this has not made a breakthrough in Sweden and is only performed at just a few clinics. In 2020, the number of operations increased to 82 from 52, despite a reduction in the total number of surgeries. The majority were performed using a so-called modified LeMaire.

## Antibiotic prophylaxis

Antibiotics are basically administered in connection with all surgery. Infection is an unusual yet feared complication. In a recently published study of Swedish material, with the ACL Registry as the basis, an infection rate of 1.1% was noted in Sweden. The risk factors for infection were male gender, a hamstring graft and a long surgery time, > 70 minutes. The study also noted that clindamycin as pre-op prophylaxis was less effective than cloxacillin. It should also be noted that there was a large difference

in the occurrence of infection between different clinics, with > 2% at most and 0.2% at the least. Local guidelines and infection-prevention measures are probably of great importance.

A number of studies, describing a reduced risk of infection if the graft is prepared preoperatively with vancomycin, have recently been published. 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. The use of a vancomycin bath is increasing in Sweden, from 19% in 2018, to 24% in 2019 and 30% in 2020. Preoperative intravenous prophylaxis was also administered. The number of clinics performing this procedure is fairly stable: 2018 – 19 clinics, 2019–18 clinics and 2020 – 19 clinics. In 2020, 69 clinics performed ACL surgery and were registered in the registry. 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 currently 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 based on the Swedish ACL registry and a comparison with national patient data is ongoing and the results are expected to be complete in 2022.

## 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 -0.594 ("worse than being dead") 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 2020 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-

**TABLE 22**

*KOOS pain, symptoms and ADL (mean value), as well as function and knee-related quality of life (mean value) two years postop distributed by region and clinic*

*Primary hamstring graft during surgery period 2007-2018 for the 20-30 year age range*

Region	Clinic	KOOS two years postop									Primary ACL
		Pain, Symptoms & ADL			Function & Quality of life			Response frequency		Loss*	
		N	MV	SD	N	MV	SD	N	%		
Greater Stockholm	ARTROCENTER	14	90,9	11,6	14	73,5	23,7	14	35,0	3	43
	CITYAKUTEN PRIVATVÅRD	11	82,9	17,6	11	65,4	19,8	11	47,8	0	23
	DANDERYDS SJUKHUS	53	75,2	19,5	53	49,4	28,7	53	38,1	4	143
	LÖWETS SPECIALISTMOTTAGNING	47	86,3	15,3	47	68,5	25,5	47	55,3	2	87
	KAROLINSKA UNIVERSITETSSJUKHUSET / ORTOPEDKLINIKEN	88	84,6	14,0	88	60,5	26,2	88	43,1	6	210
	NACKA NÄRSJUKHUS	13	85,2	9,4	13	68,5	22,3	13	38,2	1	35
	ODENPLANS LÄKARHUS	27	84,9	14,3	27	64,7	23,1	27	36,0	6	81
	CAPIO ORTOPEDISKA HUSET	84	87,0	11,9	84	67,2	23,2	84	36,7	6	235
	PRAKTIKERTJÄNST ORTOPEDI STOCKHOLM	15	88,5	8,6	15	67,9	17,7	15	26,8	5	61
	ALERIS SPORTS MEDICINE & ORTOPEDI, SABBATSBERG	19	81,0	15,2	19	55,1	25,3	19	33,9	1	57
	SÖDERMALMS ORTOPEDI	4	79,8	11,4	4	55,2	11,1	4	57,1	0	7
	SÖDERTÄLJE SJUKHUS	9	78,1	11,6	9	47,4	23,3	9	28,1	0	32
	SÖDERSJUKHUSET	211	83,7	15,0	211	61,5	24,5	211	40,8	13	530
	SOPHIAHEMMET	3	69,5	10,0	3	45,6	10,7	3	25,0	1	13
	GHP ORTHOCENTER STOCKHOLM	58	82,2	13,9	58	59,6	23,7	58	44,3	6	137
	CAPIO ARTRO CLINIC	999	86,8	12,5	999	66,8	22,5	999	47,5	68	2170
	Total	1655	85,6	13,6	1655	64,8	23,6	1655	44,2	122	3864
Svealand + Gotland	AKADEMISKA SJUKHUSET	29	84,7	12,1	28	64,1	22,3	29	25,2	3	118
	BOLLNÄS SJUKHUS	1	62,4		1	21,9		1	20,0	0	5
	LASARETTET I ENKÖPING	12	78,8	16,3	12	56,1	28,4	12	24,0	0	50
	ALERIS ELISABETHSJUKHUSET	157	87,1	11,3	157	66,9	19,4	157	39,1	15	417
	FALU LASARETT	77	81,3	14,9	77	59,6	23,5	77	39,1	6	203
	GÄVLE SJUKHUS	63	79,9	17,9	63	56,3	26,0	63	46,0	2	139
	HUDIKSVALLS SJUKHUS	57	79,5	14,4	57	57,3	23,1	57	39,3	2	147
	KARLSTAD CENTRALSJUKHUS	127	80,2	16,4	126	58,1	25,1	127	47,9	4	269
	CAPIO LÄKARGRUPPEN I ÖREBRO AB	101	81,7	14,8	101	59,1	25,1	101	50,5	6	206
	MÄLARSJUKHUSET ESKILSTUNA	51	85,9	11,9	51	63,9	22,8	51	40,8	0	125
	NORRTÄLJE SJUKHUS	24	83,2	16,0	24	61,4	25,8	24	30,4	0	79
	NYKÖPINGS LASARETT	19	80,1	18,7	19	56,1	23,1	19	39,6	1	49
	ORTOPEDISKA KLINIKEN REGION ÖREBRO LÄN	66	82,7	14,8	66	61,3	25,9	66	35,3	4	191
	SAMARITERHEMETS SJUKHUS	18	82,0	15,2	18	63,7	21,2	18	39,1	0	46
	SPECIALISTCENTER SCANDINAVIA	11	81,5	18,7	11	60,4	23,7	11	42,3	1	27
	VÄSTERÅS CENTRALLASARETTET	48	79,1	17,9	48	56,0	24,2	48	36,9	2	132
	VISBY LASARETT	20	86,6	11,2	20	63,1	25,5	20	42,6	0	47
	VÄSTERÅS ORTOPEDPRAKTIK	25	80,3	18,0	25	56,9	26,2	25	32,9	2	78
	Total	906	82,4	15,0	904	60,5	23,9	906	39,7	48	2328
Skåne	ALERIS ORTOPEDI ÄNGELHOLM	59	83,9	12,1	59	58,1	23,6	59	42,4	4	143
	HÄSSLEHOLMS SJUKHUS	191	82,8	15,9	191	60,9	23,9	191	50,5	3	381
	HELSINGBORGS SJUKHUS	85	77,7	18,1	85	54,5	26,8	85	36,0	6	242
	LUNDS UNIVERSITET	55	85,3	12,3	55	63,8	21,7	55	56,7	1	98
	MALMÖ ALLMÄNNA SJUKHUS	86	81,4	16,4	86	56,9	26,3	86	48,6	6	183
	ORTHOCENTER I SKÅNE	31	84,3	15,0	31	67,7	25,9	31	56,4	0	55
	SKÅNES UNIVERSITETSSJUKHUS	315	81,2	16,1	315	56,2	25,0	315	41,8	13	767
	Total	822	81,8	15,8	822	58,3	24,9	822	44,8	33	1869
Halland	HALLANDS SJUKHUS HALMSTAD	8	73,2	11,0	8	44,0	19,3	8	34,8	3	26
	KUNGSBACKA SJUKHUS	155	83,1	14,9	155	60,6	24,3	155	44,3	18	368
	CAPIO MOVEMENT	206	83,5	14,5	206	62,1	24,0	206	46,9	19	458
	ORTOPEDSPECIALISTERNA	25	89,1	7,7	25	67,4	23,2	25	47,2	3	56
	Total	394	83,5	14,4	394	61,5	24,1	394	45,5	43	908

TABLE 22 continues on the next page.

Continuation of TABLE 22.

Region	Clinic	KOOS two years postop									
		Pain, Symptoms & ADL			Function & Quality of life			Response frequency		Loss*	Primary ACL
		N	MV	SD	N	MV	SD	N	%		
Småland + Blekinge	ART CLINIC JÖNKÖPING	10	91,3	5,8	10	74,0	14,1	10	38,5	1	27
	HÖGLANDSSJUKHUSET	75	84,6	14,7	75	64,9	26,6	75	47,5	3	161
	KALMAR SJUKHUS	118	81,8	16,8	118	57,7	25,0	118	45,0	7	269
	BLEKINGESJUKHUSET	25	78,5	16,3	25	50,0	21,5	25	37,3	0	67
	LJUNGBY LASARETT	49	83,1	14,7	49	63,2	22,9	49	45,8	3	110
	OSKARSHAMNS SJUKHUS	67	83,5	11,5	66	58,6	21,9	67	50,4	0	133
	LÄNSSJUKHUSET RYHOV	64	86,2	12,2	64	65,4	21,9	64	41,8	5	158
	CENTRALLASARETTET VÄXJÖ	87	85,2	12,6	87	65,2	22,8	87	41,2	5	216
	VÄRNAMO SJUKHUS / ORTOPEDKLINIKEN	11	78,7	14,0	11	50,1	22,5	11	34,4	1	33
	VÄSTERVIKS SJUKHUS	30	76,0	18,6	30	53,0	22,6	30	37,5	1	81
	Total	536	83,2	14,6	535	61,0	23,8	536	43,6	26	1255
Västra Götaland	ALINGSÅS LASARETT	41	82,7	14,7	41	54,6	25,2	41	40,6	3	104
	ART CLINIC GÖTEBORG	10	87,0	15,1	10	68,2	23,6	10	32,3	0	31
	SÖDRA ÄLVSBOGERS SJUKHUS	45	79,9	18,4	45	53,7	25,1	45	48,9	2	94
	CARLANDERSKA ORTOPEDI	6	83,2	18,8	6	55,6	35,0	6	33,3	1	19
	FRÖLUNDAORTOPEDEN	3	85,4	9,6	3	71,7	14,5	3	50,0	0	6
	FRÖLUNDA SPECIALISTSJUKHUS	54	82,4	14,8	54	59,1	25,4	54	47,4	5	119
	ORTHOCENTER / IFK-KLINIKEN	228	85,9	13,3	228	66,3	24,3	228	47,6	29	508
	KUNGÄLVS SJUKHUS	29	83,6	12,5	29	59,9	25,9	29	50,0	2	60
	CAPIO LUNDBY NÄRSJUKHUS	137	88,3	12,1	137	67,6	21,9	137	47,6	10	298
	LIDKÖPINGS SJUKHUS	46	77,6	18,7	46	50,1	23,3	46	51,1	2	92
	NU-SJUKVÅRDEN	170	82,0	15,9	170	59,1	24,9	170	49,6	11	354
	PERAGO ORTOPEDKLINIK	17	82,2	13,5	17	59,9	24,4	17	34,0	3	53
	KÄRNSJUKHUSET I SKÖVDE	25	84,4	13,2	25	64,9	20,7	25	41,7	1	61
	SPORTSMED	17	84,6	18,9	17	62,8	27,8	17	53,1	0	32
	SAHLGRENSKA UNIVERSITETSSJUKHUSET	286	83,9	15,3	286	61,3	24,6	286	44,1	21	669
VARBERGS SJUKHUS	29	82,2	14,1	29	56,2	28,8	29	53,7	0	54	
	Total	1143	84,0	14,9	1143	61,6	24,7	1143	46,4	90	2554
Östergötland	LINKÖPINGS UNIVERSITETSKLINIK	144	82,2	15,9	144	58,0	24,4	144	44,7	1	323
	VRINNEVISJUKHUSET	174	81,3	15,4	174	59,6	24,3	174	42,4	4	414
	Total	318	81,7	15,6	318	58,9	24,3	318	43,4	5	737
Norrland	LÄKARHUSET HERMELINEN	16	85,5	11,0	16	64,1	19,3	16	69,6	0	23
	MEDICIN DIREKT	55	85,5	11,6	55	64,9	18,4	55	41,7	3	135
	ÖRNSKÖLDSVIKS SJUKHUS	24	75,6	15,5	24	45,1	23,6	24	45,3	0	53
	ÖSTERSUNDS SJUKHUS	20	85,5	9,9	20	60,1	19,6	20	47,6	2	44
	PITEÅ ÄLVDAL SJUKHUS	10	82,2	21,0	10	60,4	25,0	10	55,6	0	18
	SKELLEFTEÅ SJUKHUS	3	97,7	2,0	3	81,5	9,6	3	30,0	0	10
	SPORTS MEDICINE UMEÅ	83	83,9	14,1	83	61,7	23,2	83	45,4	2	185
	SOLLEFTEÅ SJUKHUS	11	74,6	11,9	11	48,4	24,0	11	36,7	0	30
	SUNDERBY SJUKHUS	86	83,9	15,0	86	63,0	23,0	86	40,0	6	221
	LÄNSSJUKHUSET SUNDSVALL	8	82,3	15,2	8	58,8	18,1	8	28,6	2	30
	NORRLANDS UNIVERSITETSSJUKHUS, UMEÅ	181	84,3	13,5	181	59,9	23,8	181	42,5	6	432
	Total	497	83,8	13,9	497	60,6	22,9	497	42,8	21	1181
	Total	6271	83,7	14,7	6268	61,6	24,1	6271	43,8	388	14696

\*Anticipated loss due to new operation; MV, mean value; SD, standard deviation

2018. The table presents two constructed average values within the KOOS; the first comprises the three dimensions of 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.

## 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 to 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 progress.

## What has been learned

Two systematic review articles comprising all the studies from the registries were published in 2018 and turned the spotlight on factors which 1) increase the risk of a new ACL injury and 2) influence patient-reported knee function following an ACL injury and reconstruction. The main findings from these review articles are summarized below.

### Risk factors identified from the Scandinavian knee ligament registries

<b>Patient factors</b>	Younger patients report better knee function and run an increased risk of revision.
	There are no gender differences in terms of the risk of revision.
	Women run an increased risk of contralateral ACL reconstruction.
<b>Surgical factors</b>	More than 90% of all ACL reconstructions in Sweden and more than 80% in Denmark are performed with hamstring grafts. In Norway, the majority of ACL reconstructions in 2018 were performed with patellar grafts.
	Hamstring tendon grafts are associated with slightly better knee function in the short term compared with patellar grafts.
	There is a slightly increased risk of revision with hamstring tendon grafts compared with patellar grafts.
	The risk of revision is reduced by 14% for every 0.5 mm increase in diameter in conjunction with a hamstring tendon graft.
<b>Injury factors</b>	Associated knee injuries produce poorer patient-reported knee function.
	Associated cartilage injuries are associated with a lower risk of revision.

## Limitations

The three most commonly used outcome measurements in the Scandinavian knee ligament registries have been: 1) revision, 2) quality of life (EQ-5D) and 3) patient-reported knee function (KOOS). Even though revision 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 revision. The percentage of patients who choose not to have a revision 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 injury. 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 ACL registries enables analyses of large cohorts and extremely generalizable results, together with the opportunity to study the effect of 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 stages. 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.

## Short presentations of publications in 2020

Age, gender, quadriceps strength and hop test performance are the most important factors affecting the achievement of a patient-acceptable symptom state after ACL reconstruction

**Aim:** To evaluate the percentage of patients who experience acceptable knee function (PASS) two years after ACLR and to identify the factors that influence its achievement

**Methods:** Data from the Capio Artro Clinic database 2005-2015. Patients with a two-year KOOS were included. The study outcome was the achievement of a PASS on every KOOS subscale. Logistic regression analysis to evaluate whether age, gender, time from injury to ACLR, pre-injury Tegner, graft, cartilage injury, MM or LM resection or repair, six-month LSI quadriceps and hamstring strength test and the one-leg-hop test correlated to the achievement of a PASS for every KOOS subscale.

**Result:** A total of 2,335 patients were included. More than 60% achieved a PASS on four KOOS subscales.

- *Age  $\geq 30$  years:* increased the odds for all subscales
- *Six-month LSI of  $\geq 90\%$  for quadriceps:* increased the odds for all subscales
- *Female gender:* reduced the odds for the Pain, ADL and Sport/Rec subscales
- *MM repair:* reduced the odds for the Pain subscale
- *HT over BPTB autograft:* increased the odds for the Sport/Rec subscale
- *Cartilage injury:* reduced the odds for the Sport/Rec subscale
- *Six-month LSI of  $\geq 90\%$  for the one-leg-hop test:* increased the odds for the ADL, Sport/Rec and QoL subscales

**Conclusion:** More than 60% obtained a PASS on four KOOS subscales two years after ACLR. Age  $\geq 30$  years and female gender were the two most important, unmodifiable factors that increased and decreased the individual PASS achievement. Symmetric six-month quadriceps strength and the one-leg-hop tests were the two most important, modifiable factors that increased the potential for PASS achievement two years after ACLR.

Cristiani R, Mikkelsen C, Edman G, Forssblad M, Engström B, Stålmán A. Age, gender, quadriceps strength and hop test performance are the most important factors affecting the achievement of a patient-acceptable symptom state after ACL reconstruction. *Knee Surg Sports Traumatol Arthrosc.* 2020 Feb;28(2):369-380.

## Delayed anterior cruciate ligament reconstruction increases the risk of abnormal pre-reconstruction laxity, cartilage injuries and medial meniscus injuries

**Aim:** To study the connection between time from injury to ACLR, age, gender, BMI and cartilage damage, meniscal injury, meniscal repair and abnormal preoperative laxity

**Methods:** Data from the Capio Artro Clinic database. Primary ACLRs January 2005-March 2017 were included. Logistic regression analysis to evaluate whether the time from injury to ACLR, age, gender and BMI were risk factors for cartilage injury, meniscal injury, meniscal repair and abnormal (KT-1000 side-to-side difference > 5 mm) preoperative laxity.

**Result:** A total of 3,976 patients were included (average age  $28.6 \pm 10.6$  years).

### *Cartilage injury*

The risk increased with: the time from injury to ACLR > 12 months and age  $\geq 30$  years.

### *Medial meniscus injury*

The risk increased with: the time from injury to ACLR > 12 months, male gender and age  $\geq 30$  years.

### *Lateral meniscus injury*

The risk decreased with: the time from injury to ACLR > 3 months and age  $\geq 30$  years.

The risk increased with male gender.

### *Medial meniscus repair (against medial meniscus injury)*

The potential decreased with: the time from injury to ACLR > 6 months and age  $\geq 30$  years.

### *Lateral meniscus repair (against lateral meniscus injury)*

The potential decreased with: age  $\geq 30$  years.

### *Abnormal preoperative laxity (KT-1000 STS > 5 mm)*

The risk increased with: the time from injury to ACLR > 6 months and a medial meniscus injury.

The risk decreased with: BMI  $\geq 25$ .

**Conclusion:** A period from injury to ACLR of > 12 months increased the risk of cartilage injury and medial meniscus injuries, while a period from injury to ACLR of > 6 months increased the risk of abnormal preoperative laxity and reduced the potential for a medial meniscus repair.

To reduce meniscal loss and the risk of poorer laxity, ACLR should be performed within six months of the injury.

Cristiani R, Janarv PM, Engström B, Edman G, Forssblad M, Stålmán A. Delayed Anterior Cruciate Ligament Reconstruction Increases the Risk of Abnormal Pre-Reconstruction Laxity, Cartilage and Medial Meniscus Injuries. *Arthroscopy*. 2021 Apr;37(4):1214–1220.

## There is no general use of thromboprophylaxis and prolonged antibiotic prophylaxis in anterior cruciate ligament reconstruction: a nationwide survey of ACL surgeons in Sweden

**Aim:** The use of prophylaxis for thromboembolism and infection in connection with the reconstruction of the anterior cruciate ligament (ACL) is not well documented and no general guidelines have been established. The aim of this study was to evaluate ACL surgeons' individual strategies for thromboprophylaxis and the use of antibiotic prophylaxis. The degree to which surgery was performed in bloodless fields was also analyzed.

**Methods:** Questionnaires were distributed to all the Swedish ACL surgeons registered in the Swedish knee ligament registry (SKLR), with questions on thromboprophylaxis, antibiotic prophylaxis, the use of vancomycin applied locally and the use of bloodless fields during surgery. The answers were compared for agreement with the data reported to the registry.

**Result:** 115 (75%) ACL surgeons replied to the questionnaire. 81.7% only prescribed thromboprophylaxis in the event of risk factors, such as a history of previous thromboembolic disease and the use of oral preventive medicine. The respondents were generally restrictive when it came to using prolonged antibiotic prophylaxis in addition to preoperative antibiotics. Vancomycin-soaked transplants were used by only nine (8%) surgeons who represented 406 (13%) surgeries; data to 2017.

**Conclusion:** Swedish ACL surgeons are generally restrictive with thromboprophylaxis and it is only used when risk factors are present. Consensus is, however, lacking on how to weigh up the different risk factors and this is not wholly in agreement with the available literature. High age was given a low classification as a risk factor, but it is the leading risk factor according to the available literature. Prolonged antibiotic prophylaxis is rarely used and the use of vancomycin-soaked transplants is extremely limited and they are only used by a small number of surgeons. The use of bloodless fields is common, 50%. There is a need for ACL-specific guidelines when it comes to the use of thromboprophylaxis.

Ekdahl V, Stålman A, Forssblad M, Samuelsson K, Edman G, Kraus Schmitz J. There is no general use of thromboprophylaxis and prolonged antibiotic prophylaxis in anterior cruciate ligament reconstruction: a nationwide survey of ACL surgeons in Sweden. *Knee Surg Sports Traumatol Arthrosc.* 2020 Aug;28(8):2535–2542.

One sixth of primary anterior cruciate ligament reconstructions may undergo reoperation due to complications or new injuries within two years

**Aim:** To analyze the incidence, cause and risk factors of reoperations within two years after a primary anterior cruciate ligament reconstruction (ACLR)

**Methods:** Local clinical registries and the Swedish ACL Registry were used to identify primary ACLRs performed in 2005 to 2015 and reoperations performed on the ipsilateral knee within two years. Reoperations were identified using procedural codes and a review of medical notes. A logistic regression analysis was used to evaluate the risk factors for reoperation.

**Result:** A total of 6,030 primary ACLRs were included. A total of 1,112 (18.4%) reoperations performed on 1,018 (16.9%) primary ACLRs were identified. The most common reoperations were screw removal (n = 282, 4.7%), meniscal procedures (n = 238, 3.9%), removal of cyclops lesions/notchplasty (n = 222, 3.7%) and reoperations with a diagnosis of graft insufficiency (n = 146, 2.4%), including revision ACLR. Age < 30 years (OR 1.57; 95% KI 1.37-1.80; P <0.001), female gender (OR 1.33; 95% KI 1.17-1.51; P <0.001), medial meniscus repair (OR 1.55; 95% KI 1.23-1.97; P <0.001), lateral meniscus resection (OR 1.26; 95% KI 1.07-1.49; P = 0.005) and lateral meniscus repair (OR 1.38; 95% KI 1.03-1.85; P = 0.02) in connection with a primary ACLR were found to be risk factors for reoperation.

**Conclusion:** One sixth of all primary ACLRs underwent a reoperation due to complications or new injuries within two years. The most common reoperations were the extraction of osteosynthesis material, meniscal procedures, the removal of cyclops lesions/notchplasty and reoperations due to graft insufficiency, including revisions of ACLRs. Low age (<30 year), female gender, medial meniscus repair and lateral meniscus resection were associated with an increased risk of reoperation. This study provides clinically important data to inform patients about the most common reoperations and the risk factors for reoperation after primary ACLR.

Lord L, Cristiani R, Edman G, Forssblad M, Stålmán A. One sixth of primary anterior cruciate ligament reconstructions may undergo reoperation due to complications or new injuries within 2 years. *Knee Surg Sports Traumatol Arthrosc.* 2020 Aug;28(8):2478–2485.

## Meniscus repair does not result in an inferior short-term outcome compared with meniscus resection: an analysis of 5,378 patients with primary anterior cruciate ligament reconstruction

**Aim:** To compare preoperative, one- and two-year KOOS between an isolated ACLR and an ACLR + medial meniscus (MM) and/or lateral meniscus (LM) resection or repair

**Methods:** Data from the Capio Artro Clinic database. A total of 5,378 patients (January 2005-December 2015) were included. Patients with an isolated ACLR were compared with patients with an ACLR + MM resection, MM repair, LM resection, LM repair, MM + LM resection and MM + LM repair. A comparison of the preoperative situation at one and two years using ANCOVA with age, gender and cartilage damage as the covariates.

**Result:** Postoperatively, at both one and two years, non-significant differences were found between the groups on all five KOOS subscales. Preoperatively, a significant difference was found on the KOOS Symptoms, Pain, ADL and Sport/Rec subscales. The lowest values were found for the ACLR + MM + LM repair group.

**Conclusion:** Patients with an isolated ACLR and those with ACLR + MM and/or LM resection or repair obtained the same result for the KOOS at one and two years. Differences between the groups were only found preoperatively, as patients with ACLR + MM + LM repair reported the lowest values on the KOOS Symptoms, Pain, ADL and Sport/Rec subscales.

Cristiani R, Parling A, Forssblad M, Edman G, Engström B, Stålmán A. Meniscus Repair Does Not Result in an Inferior Short-term Outcome Compared with Meniscus Resection: An Analysis of 5,378 Patients with Primary Anterior Cruciate Ligament Reconstruction. *Arthroscopy*. 2020 Apr;36(4):1145-1153.

There is no connection between the tuck-jump test and the one-leg-hop test, the fall-hop test or patient-reported outcome measurements

**Background:** The tuck jump (jumping with the knees pulled up for 10 seconds) was developed in order to identify athletes who risked suffering an anterior cruciate ligament injury or to evaluate improvements during rehabilitation for cruciate ligament injury. The tuck jump was graded on a scale from 0-10, where zero represents an excellent performance and ten represents technical failures in ten established areas. Six or more technical failures have been given as the cut-off (deviation) to identify a patient/player with a high-risk pattern and an increased risk of incurring an anterior cruciate ligament injury.

**Aim:** The aim was to determine whether there was a connection between the tuck-jump score (total and cut-off), functional tests, such as the one-leg hop and the fall-hop test, the so-called drop vertical jump (DVJ), and patient-reported outcome measurements in female soccer players undergoing surgery on an anterior cruciate ligament injury and players with healthy knees. The hypothesis was that a higher tuck-jump score would be associated with poorer results on the one-leg-hop test, a more valgus movement pattern in the knees in conjunction with DVJ and a lower score in patient-reported outcome measurements.

**Method:** This is a cross-sectional study comprising 334 female soccer players (117 of whom have undergone surgery on a knee with an anterior cruciate ligament injury and 117 whose knees are healthy). The players who underwent surgery for an anterior cruciate ligament injury were identified via the Swedish ACL Registry. They performed the tuck jump, one-leg hop and the DVJ and were asked to complete the International Knee Documentation Committee 2000 Subjective Knee Form (IKDC-SKF) and the Knee injury Osteoarthritis Outcome Score (KOOS). All the players were categorized based on cut-off values for the tuck-jump score. Spearman's rank correlation was used to analyze whether there was a connection between the total tuck-jump score and a deviating tuck-jump score and the Limb Symmetry Index on the one-leg hop, a valgus pattern of movement in the knee joint in connection with the DVJ and patient-reported outcome measurements.

**Result:** Eighty-seven (37%) of the 234 players (50 of the players who had undergone surgery on a knee with an anterior cruciate ligament injury and 37 with healthy knees,  $P=0.08$ ) were classified as having a deviating tuck-jump score. There was no statistically significant connection between the total tuck-jump score or a deviating tuck-jump score and the result for the one-leg-hop test and the DVJ. Nor was there any connection between the tuck-jump score and the scores on the IKDC-SKF and the KOOS among players who had undergone surgery on a knee with an anterior cruciate ligament injury.

**Conclusion:** This study indicates that the tuck-jump score and a deviating tuck-jump score have no connection with functional or patient-reported results and the hypothesis was not proved. Clinics may need to be careful about their interpretation of the tuck-jump score, as additional validation is needed. The tuck jump can be used to identify specific areas with a deficit in hop technique rather than using total scores or categorizing players as having a normal or deviating tuck-jump score.

Arundale A, Kvist J, Hägglund M, Fältström A. Tuck jump score is not related to hopping performance or patient-reported outcome measures in female soccer players. *Int J Sports Phys Ther.* 2020 May; 15(3): 395–406.

## Can talented youth soccer players who have undergone surgery on an injured anterior cruciate ligament become elite players as adults?

ACL injuries are common in soccer and a large number of patients undergoing surgery are teenagers who are perhaps dreaming of playing at the very highest level as senior players. The purpose of this study was to determine how an anterior cruciate ligament operation in teenage impacted a soccer player's chances of playing at elite level as an adult. To achieve this, all the players who had participated in the Swedish FA's elite camp for 15 year olds between 2005 and 2011 (players born in 1990-1996) were followed. The elite camp is an annual camp to which each district in Sweden sends a group of the 16 players that have made the most progress in their development. This study followed a total of 5,285 talented soccer players, 2,631 boys and 2,654 girls.

The Swedish ACL Registry was used to identify the players that had undergone surgery on an ACL injury and, using the Swedish FA's administrative IT system, FOGIS, information relating to whether the youngsters were still playing soccer at the age of 21 and, if so, at which level was collected. Players who had undergone surgery at the age of 15 to 19 were compared with those that had not undergone surgery to see how ACL surgery impacted the chance of playing at elite level or of being active as senior players. In this study, active was defined as participating in at least one match during the season and elite level encompassed the Swedish First Division and the Swedish Championship for men and the Elite First Division for women

A total of 524 (10%) of the players who had participated at the elite camp were included in the ACL Registry and had undergone an ACL reconstruction. The girls (351, 13.3%) had approximately twice as many ACL injuries as the boys (173, 6.6%). The risk of incurring a new ACL injury was high and 23.3% underwent a second ACL operation. Of the players participating at the elite camp, 292 (5.5%) underwent surgery when they were 15 to 19 years old and, in this age group, these injuries were almost three times more common than they were among the girls, 217 (8.2%) and 75 (2.9%) respectively.

During the season in which the players were 21 years old, a total of 570 (10.8%) were playing at elite level. An ACL reconstruction at the age of 15 to 19 does not affect the chance of playing soccer at elite level at the age of 21. If the injury was incurred at an early stage or late in teenage, this did not affect the opportunity to be an elite player at the age of 21. Nor was any difference seen in the number of players who were still active at the age of 21. A difference was, however, found between the sexes, where 82% of the boys were still active at the age of 21 compared with 63% of the girls.

To summarize, an ACL reconstruction gives talented soccer players the opportunity to become elite players at senior level and to continue playing soccer to the same degree as players who have not been injured. The risk of incurring an ACL injury was high. Of the players who participated in the elite camp, 10% had undergone a reconstruction and about one in four had undergone a second ACL reconstruction.

Can Talented Youth Soccer Players Who Have Undergone Anterior Cruciate Ligament Reconstruction Reach the Elite Level?

Alexander Sandon, Tor Söderström, Andreas Stenling and Magnus Forssblad  
The American Journal of Sports Medicine 2021;49(2):384-390.

## Ten-year follow-up of soccer players in the Swedish ACL Registry who have undergone an ACL operation

The Swedish ACL Registry was established in 2005, which means that it is now possible to conduct long-term follow-ups of the outcome after ACL reconstruction. Soccer is the most common cause of an ACL injury in the registry and one of the indications for an ACL reconstruction is to enable a return to soccer. Ten years after surgery, 1,661 soccer players were asked to answer a questionnaire with questions relating to whether or not they had returned to soccer and what had influenced their decision, together with questions on any new knee injuries. The aim of the study was to determine how many of the players returned to soccer, what influenced their decision and how a return to soccer impacted the risk of suffering a new ACL injury. In addition to the information obtained from the questionnaire, data were also obtained from the ACL Registry in the form of gender, age, surgery-related data, associated injuries and new operations. The results are based on the 684 soccer players who chose to participate in the study.

After the ACL reconstruction, 51% of the players returned to soccer. For two in three of those that did not return, the primary reason was their knee. The most common knee-related reasons for not returning to soccer were pain and/or instability (50%) and fear of a new injury (32%). For the one third who did not return to soccer, the primary reason was not related to their knees and can be summarized as family undertakings, a change in life-related priorities and the desire to focus on their careers. Those that returned to soccer played for an average of five years after surgery and 20% were still playing at the 10-year follow-up. Younger soccer players returned to soccer to a greater degree, but there were no significant differences related to gender or the type of ligament. This study comprised players at all levels from the Swedish First Division to the inter-company soccer league.

All the players at the highest level reported that they returned to soccer and the return frequency then diminished at every level.

The players who returned to soccer ran a significantly higher risk of incurring another ACL injury. Of the players who returned to soccer, 28.7% (odds ratio (OR) 2.3,  $P < .001$ ) incurred a new ACL injury, 9.7% (OR 2.9,  $P < .001$ ) suffered a re-rupture and 20.6% (OR 2.1,  $P < .001$ ) injured the ACL in the contralateral knee compared with a total of 14.6% new injuries, 3.6% re-ruptures and 11% contralateral ACL injuries among those that did not return to soccer.

High Risk of Further Anterior Cruciate Ligament Injury in a 10-Year Follow-up Study of Anterior Cruciate Ligament-Reconstructed Soccer Players in the Swedish National Knee Ligament Registry. Sandon A, Engström B, Forssblad M. *Arthroscopy*. 2020 Jan;36(1):189-195.

## Comparison of the incidence of associated injuries and patient-reported knee function in patients who have undergone both primary and revision operations after an ACL injury

Revision surgery, i.e. a re-operation, after a second ACL injury has previously been shown to be associated with a poorer outcome compared with a primary ACL reconstruction. There are only a few previous cohort studies that have examined differences in patient-reported knee function between revision surgery and a primary ACL reconstruction or an ACL injury. The aim of this study was to examine differences in both knee function and the incidence of associated injuries between primary and revision surgery after an ACL injury in a cohort of patients in the Swedish ACL Registry that had undergone both operations. The aim was also to identify possible predictors of patient-reported knee function after revision surgery on an ACL injury. The hypothesis was that an ACL revision would be associated with both poorer patient-reported knee function and a higher incidence of associated injuries compared with a primary ACL reconstruction.

Patients aged between 13 and 49 who had undergone a primary ACL reconstruction with a hamstring graft as the transplant for surgery and had data from the Knee injury and Osteoarthritis Outcome Score (KOOS) questionnaire were included. A total of 1,014 patients were included in the study. There was a higher incidence of cartilage injuries in connection with revision surgery ( $p < 0.001$ ), where 23% of the patients had a cartilage injury, compared with the incidence in a primary ACL reconstruction. The difference was greatest on the subscale of function in sport and recreation ( $5.2 \pm 32.2$  points,  $p = 0.002$ ). An associated posterolateral capsule injury in connection with revision surgery was a negative predictor for KOOS, with the greatest negative effect on knee function in sport and recreation ( $\beta = -29.20$  [95% CI - 50.71; - 6.69],  $p = 0.011$ ). The use of an allograft in revision surgery was a predictor of a poorer outcome ( $\beta = -12.69$  [95% CI - 21.84; - 3.55],  $p = 0.0066$ ).

As a result, the conclusion of this study was that revision surgery following an ACL injury results in poorer perceived knee function compared with a primary ACL reconstruction. ACL revisions were also linked with a higher frequency of concomitant cartilage injury. An injury to the posterolateral capsule, together with the use of an allograft in ACL revision, were shown to be predictors of a poorer clinical outcome.

Svantesson E, Hamrin Senorski E, Kristiansson F, Alentorn-Geli E, Westin O, Samuelsson K. Comparison of concomitant injuries and patient-reported outcome in patients that have undergone both primary and revision ACL reconstruction-a national registry study. *Orthop Surg Res.* 2020 Jan 10;15(1):9.

## A combined ACL injury and medial collateral ligament injury - how does the graft type affect the risk of revision surgery on the ACL?

Combined injuries to the ACL and the medial collateral ligament are common. The medial collateral ligament has the potential to heal without surgical treatment, so a treatment strategy in which the patient undergoes an ACL and receives non-surgical treatment for the medial collateral ligament is therefore not uncommon. However, the medial collateral ligament performs an important stabilizing function for the inside of the knee, like that performed by the inner hamstring musculature. A previous study from the Swedish ACL Registry revealed that there was a greater risk of revision surgery on the ACL in patients who received non-surgical treatment on a concomitant medial collateral ligament injury compared with patients who underwent surgical treatment on the medial collateral ligament (Svantesson et al. 2019). One hypothesis when it comes to this result is that non-surgical treatment of the medial collateral ligament may lead to remaining instability on the inside of the knee, exerting more force on the ligament and increasing the risk of another re-rupture.

This study therefore aimed to compare the risk of revision surgery between hamstring and patellar grafts in patients who underwent an ACL reconstruction and concomitant non-surgical treatment for a medial collateral ligament injury. The hypothesis was that patients who received a hamstring graft would run a higher risk of revision, as these patients experience an additional effect on the inner stability of the knee in addition to their medial collateral ligament injury, compared with those patients who received a patellar graft. A total of 622 patients from the Swedish ACL Registry were included and three groups were created, depending on the choice of graft; 1) Semitendinosus (ST)  $n = 174$ , 2) Semitendinosus and gracilis (ST-G)  $n = 32$  and 3) Patellar graft (PT)  $n = 125$ . Their average age was 29.7 years and 42.4% were women. There was no difference in the risk of revision of the ACL surgery between the ST and ST-G groups (HR 1.354; 95% CI [KI] 0.678-2.702) or between the PT and ST-G groups (HR 0.837; 95% CI 0.334-2.100). Nor could any difference be seen when the ST and ST-G groups were combined to create one group (hamstring graft) and compared with the PT group in relation to the risk of revision surgery (HR 0.745; 95% CI 0.312-1.783). A total of 39 patients (6.3%) from the entire study population underwent revision surgery during the study period – 14 patients in the ST group (8.0%), 19 patients in the ST-G group (5.9%) and six patients in the PT group (4.8%). The conclusion of this study was therefore that the risk of revision of an ACL reconstruction did not differ between hamstring and patellar grafts in patients who also received concomitant non-surgical treatment for a medial collateral ligament injury.

Svantesson E, Hamrin Senorski E, Östergaard M, Grassi A, Krupic F, Westin O, Samuelsson K. Graft Choice for Anterior Cruciate Ligament Reconstruction with a Concomitant Non-surgically Treated Medial Collateral Ligament Injury Does Not Influence the Risk of Revision. *Arthroscopy*. 2020 Jan;36(1):199-211.

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