

Decreasing incidence of knee arthroscopy in Sweden between 2002 and 2016: a nationwide register-based study

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Background and purpose — Several randomized trials have demonstrated the lack of effect of arthroscopic lavage as treatment for knee osteoarthritis (OA). These results have in turn resulted in a change in Swedish guidelines and reimbursement. We aimed to investigate the use of knee arthroscopies in Sweden between 2002 and 2016. Patient demographics, regional differences, and the magnitude of patients with knee OA undergoing knee arthroscopy were also analyzed.

Patients and methods — Trends in knee arthroscopy were investigated using the Swedish Hospital Discharge Register (SHDR) to conduct a nationwide register-based study including all adults (>18 years of age) undergoing any knee arthroscopy between 2002 and 2016.

Results — The total number of knee arthroscopies performed during the studied period was 241,055. The annual surgery rate declined in all age groups, for males and females as well as patients with knee OA. The incidence dropped from 247 to 155 per 10⁵ inhabitants. Over 50% of arthroscopies were performed in metropolitan regions.

Conclusion — We showed a dramatic decline in knee arthroscopy. There is variability in the surgery rate between males and females and among the regions of Sweden.

Several randomized controlled trials have shown that knee arthroscopy as a therapy for osteoarthritis (OA) did not yield better results than placebo in the form of sham surgery (1-4). This has caused a change in reimbursement regarding use of arthroscopic intervention of knee OA in many countries, including Sweden. The procedure was removed from Swedish National Guidelines in 2012 in accordance with the National Board of Health and Welfare (5).

After the publications by Moseley et al. and Kirkley et al. in 2002 and 2008, the number of arthroscopies undertaken for degenerative knee disease and traumatic meniscal tears in Finland and Sweden changed (1,3,6). In Sweden there was an initial increase during the first part of the 2000s with a peak in 2008 and a subsequent decline (6). Similar results can also be found in other countries (7,8), making it a global change.

Regarding cost and effect, the National Board of Health and Welfare in Sweden has estimated a cost reduction for avoiding arthroscopic lavage of OA knees to be approximately SEK 25 million per year (5). Although there have been continuous quality improvements in arthroscopic surgery and healthcare, surgical procedures, even though arthroscopic, are still not without risk of postoperative complications such as wound infection, hematoma, and deep vein thrombosis (10-13). Treatment of these types of diagnoses also contributes to indirect costs not included in the above-calculated cost reduction.

Our study investigated the incidence of knee arthroscopy in Sweden between 2002 and 2016 in the adult population, including patient demographics, diagnoses, and regional differences.

Patients and methods

This study is a nationwide population-based register study using data from the Swedish Hospital Discharge Register (SHDR). The register has been reviewed and validated (14). The Swedish National Board of Health and Welfare established the national register in 1964. The SHDR includes inpatient care since 1987 and outpatient appointments since 2001 with data on personal identification number, age, sex, domicile of the patient, length of hospital stay, primary and secondary diagnoses, and surgical procedures during the hospital stay (14). Annual population data between 2002 and 2016 was retrieved from Statistics Sweden (SCB) to calculate surgery rate (incidence per 10⁵ inhabitants). The incidence of knee arthroscopy was based on the entire adult population.

All adult patients from 18 years of age were included. The International Classification of Diseases, Tenth Revision (ICD-10) was used to identify surgical procedures. Patients with an ICD-10 procedure code indicative of any knee arthroscopy surgery between 2002 and 2016 were included in the study (Table 1).

To analyze the rate of knee arthroscopy among OA patients, ICD-10 diagnosis codes M17.0–9 were used to identify patients with an underlying primary and secondary OA disease of the knee followed by knee arthroscopy.

The data has been sorted to match the 21 regions in Sweden to simplify comparison. The annual surgery rate for each region was assessed.

To give an overview of the difference in densely populated areas versus less densely populated areas, the 3 regions with the highest population density (population per square kilometer, PD) were compared with the 3 regions with the lowest PD. According to SCB population data, the 3 most densely populated regions in 2017 were: Region Stockholm (PD 348), Region Skåne (PD 121), and Västra Götalandsregionen (PD 70). The 3 least densely populated regions in 2017 were: Region Västerbotten (PD 5), Region Jämtland Härjedalen (PD 3), and Region Norrbotten (PD 3). They were grouped into 2 groups for comparison: metropolitan regions and rural regions. Data on the number of arthroscopies performed and incidence were compared for each year in the study period.

Outcomes

Primary outcome was the number of knee arthroscopy performed, both during hospitalization and in an ambulatory care setting, in Sweden.

Secondary outcome was the number of knee arthroscopy performed in patients with ICD-10 coding for knee OA.

Statistics

Descriptive statistics for each year between 2002 and 2016 were produced using the statistical software SPSS 25.0 (IBM Corp, Armonk, NY, USA), Stata 17.0 (Stata Corp, College

Table 1. ICD operation codes included in the study

NGA11	Exploration of knee joint; arthroscopic
NGD01	Total excision of meniscus; arthroscopic
NGD10	Percutaneous or closed partial excision of meniscus
NGD11	Partial excision of meniscus; arthroscopic
NGD21	Reinsertion of meniscus; arthroscopic
NGD91	Other operation on meniscus; arthroscopic
NGE01	Incision or suture of joint capsule of knee; arthroscopic
NGE11	Transcision or excision of ligament of knee; arthroscopic
NGE21	Suture or replantation of ligament of knee; arthroscopic
NGE31	Transposition of ligament of knee; arthroscopic
NGE41	Reconstruction of ligament of knee without foreign object; arthroscopic
NGE51	Reconstruction of ligament of knee with foreign object; arthroscopic
NGE91	Other surgery on capsule or ligament of knee; arthroscopic
NGF01	Total synovectomy of knee; arthroscopic
NGF11	Partial synovectomy of knee; arthroscopic
NGF21	Fixation of fragment of surface of knee; arthroscopic
NGF31	Partial excision of joint cartilage of knee; arthroscopic
NGF91	Other operation on synovia or joint surface of knee; arthroscopic
NGH41	Extraction of foreign body or loose body of the knee; arthroscopic

Station, TX, USA), and SAS 9.4 level 1 M7 (SAS, Campus Drive, Cary, NC, USA). The frequency of knee arthroscopies performed in Sweden is presented, as well as the surgery incidence, calculated per 10⁵ inhabitants, sorted by region, sex, and the following age groups: 18–29, 30–39, 40–49, 50–59, 60–69, and ≥ 70. Separate analysis has been carried out for OA patients and presented in the same categories as for the general study population.

Ethics, data sharing, funding, and potential conflicts of interest

Ethical approval from the institutional review board was granted for the study (Ref nos 2013/581-31/5 and 2016/2251-32). Data sharing is possible through SHDR. The study was fully financed by research grants from Region Stockholm (ALF Re No 20170479, 20180462, and 20200305). The authors report no conflict of interest. Completed disclosure forms for this article following the ICMJE template are available on the article page doi: 10.2340/17453674.2023.7131

Results

The total number of knee arthroscopies in Sweden reported to SHDR between 2002 and 2016 was 241,055, comprising 218,082 performed in an ambulatory setting and 22,973 performed as in-hospital care (Table 2). The absolute number of yearly knee arthroscopies in Sweden decreased by 29% during the study period. The incidence also decreased, going from 247 to 155 knee arthroscopies per 10⁵ inhabitants during the study period. The mean age of the patients was 41 and remained steady during the study period (Table 2).

Table 2. The annual number of arthroscopies divided by sex, incidence per 10⁵ inhabitants, age and percentage performed in an outpatient clinic

Year	Male (n)	Female (n)	Total (n)	Incidence (per 10 ⁵)	Mean age	Out-patient clinic (%)
2002	10,912	6,329	17,241	247	41	85
2003	10,324	6,160	16,484	235	41	86
2004	9,976	5,923	15,899	225	41	87
2005	10,303	6,353	16,656	235	41	89
2006	9,738	6,222	15,960	223	42	87
2007	9,668	6,410	16,078	223	42	89
2008	11,125	7,551	18,676	256	42	92
2009	10,684	7,065	17,749	241	42	95
2010	9,911	6,401	16,312	219	40	93
2011	9,448	6,521	15,969	212	41	92
2012	9,713	6,492	16,205	213	41	92
2013	9,966	6,500	16,466	215	41	92
2014	9,253	6,384	15,637	202	40	94
2015	7,899	5,633	13,532	174	40	93
2016	6,905	5,286	12,191	155	39	94

Table 3. Incidence of knee arthroscopies per 10⁵ inhabitants divided into age groups

Year	18–29	30–39	40–49	50–59	60–69	≥ 70	Total
2002	340	292	307	279	178	45	246
2003	330	278	299	265	157	40	234
2004	309	259	284	266	160	40	225
2005	327	259	308	274	164	42	234
2006	313	234	272	274	169	46	222
2007	310	227	285	264	170	48	222
2008	348	251	325	318	201	56	255
2009	327	237	318	297	177	50	239
2010	325	217	291	258	145	36	218
2011	313	214	275	248	149	38	211
2012	302	207	290	266	144	39	212
2013	310	210	291	263	147	38	214
2014	311	201	273	245	123	31	201
2015	277	168	235	201	106	29	173
2016	264	150	201	175	89	24	154
Mean	313	227	283	259	151	40	217

Table 4. Comparison of metropolitan and rural regions. The annual number of arthroscopies and incidence per 10⁵

Year	Metropolitan regions		Rural regions		Incidence	
	metro.	rural	metro.	rural	metro.	rural
2002	10,005	610	222	96		
2003	9,566	703	211	110		
2004	9,700	562	213	88		
2005	9,582	1,019	209	160		
2006	8,361	1,192	180	187		
2007	8,422	1,039	179	164		
2008	10,452	1,089	220	172		
2009	9,587	1,214	199	191		
2010	8,601	954	176	150		
2011	8,288	779	168	123		
2012	8,355	700	167	110		
2013	8,828	768	175	121		
2014	8,838	687	173	107		
2015	7,934	586	153	91		
2016	7,183	505	136	78		
Total	133,702	12,407				
Mean			185	130		

More men (60%) than women (40%) underwent knee arthroscopy with the difference slightly decreasing towards the end of the study period (Figure 1). The age group 18–29 years underwent most knee arthroscopies and the age group > 70 the least (Table 3). The incidence per 10⁵ inhabitants decreased in all age groups. The biggest change was seen in the age groups 30–39 and 60–69, which both decreased by 50%. A peak was seen in all age groups in 2008 (Figure 2).

There was a big difference between the absolute number of knee arthroscopies in metropolitan regions and rural regions (Table 4). Over 50% of total knee arthroscopies were performed in a metropolitan region. The difference was at its peak during the beginning of the study period, 2002–2004, and was

Table 6. Annual number of knee arthroscopies of OA patients divided by sex, age groups, and incidence per 10⁵

Year	Male	Female	Total	Age groups						Incidence per 10 ⁵
				18–29	30–39	40–49	50–59	60–69	≥ 70	
2002	2,449	1,828	4,277	157	487	958	1,510	864	301	61
2003	2,471	1,773	4,244	159	474	1012	1,529	809	261	60
2004	2,325	1,697	4,022	129	418	897	1,472	838	268	57
2005	2,325	1,773	4,098	140	360	1,026	1,421	892	259	58
2006	2,270	1,775	4,045	111	346	914	1,402	951	321	57
2007	2,253	1,831	4,084	111	356	920	1,388	982	327	57
2008	2,764	2,352	5,116	166	421	1,159	1,740	1,254	376	71
2009	2,565	2,171	4,736	164	350	1,175	1,627	1,100	320	64
2010	2,177	1,782	3,959	128	298	1,022	1,326	958	227	53
2011	1,862	1,597	3,459	98	268	876	1,157	844	216	46
2012	1,883	1,612	3,495	114	237	888	1,212	803	241	46
2013	1,775	1,475	3,250	92	220	842	1,073	807	216	42
2014	1,594	1,340	2,934	104	214	734	1,057	639	186	38
2015	1,154	1,080	2,234	71	138	580	789	505	151	29
2016	1,064	906	1,970	82	109	477	719	442	141	25

less evident during 2006–2009, only to increase again towards the end of the period. In total, 4,048 knee arthroscopies were excluded from this analysis as specific hospital data was missing. The mean value for all regions was 157 arthroscopies per 10⁵ inhabitants. In the Capital Region of Stockholm, the mean incidence was 285. In general, there has been a decrease in all regions (Table 5, see Appendix).

The total number of knee arthroscopies performed on patients with knee OA has decreased since 2002 (Table 6). In 2002, 4,277 operations were done on OA indication and in 2016 the number had dropped to 1,970 operations. The maximum amount occurred in 2008 (n = 5,116). The incidence per 10⁵ inhabitants has also decreased in this patient group. In 2002 it was 61, in comparison with 25 in 2016. More male patients with knee OA were treated with knee arthroscopy

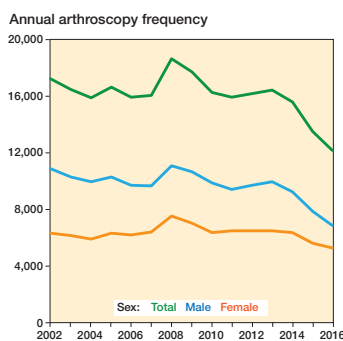


Figure 1. Annual surgery frequency by sex.

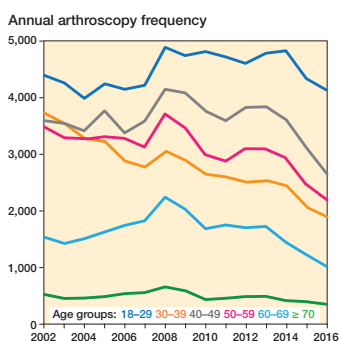


Figure 2. Annual surgery frequency by age groups.

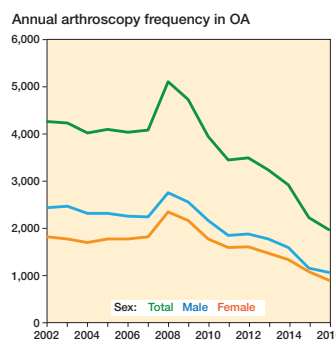


Figure 3. Annual surgery frequency in OA patients by sex.

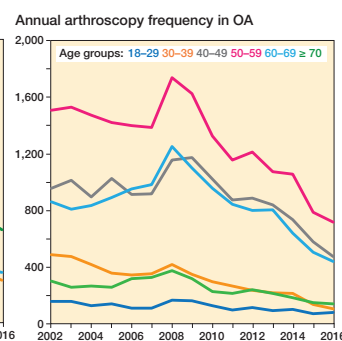


Figure 4. Annual surgery frequency in OA patients by age groups.

than females (Table 6). The difference decreased over time. The largest age group undergoing knee arthroscopy for OA diagnosis was 50–59 (Table 6).

Discussion

The main finding in this nationwide population-based register study is that the absolute number of knee arthroscopies performed each year in Sweden decreased between 2002 and 2016 even though the population as a whole increased. This includes all age groups, men and women, as well as patients with OA of the knee. The same change can also be seen in the incidence per 10^5 inhabitants. This does not mean that the total amount of knee surgeries in a broader sense has decreased. A study performed in Florida, USA, demonstrated that the rate of knee arthroscopies declined between 2002 and 2015 (15).

The Swedish National Guidelines for Musculoskeletal Diseases, published in 2012 (5), excluded arthroscopic lavage and debridement as treatment for OA, but the most cited studies on its ineffectiveness had already been published in 2002 and 2008 (1-4). Since then, there has been a consensus in Sweden that arthroscopic lavage and debridement should not be used for treating knee OA (16). The change of practice can be seen in the results, as patients in the older age groups are being operated on less frequently today. The arthroscopic surgery rate on patients with knee osteoarthritis decreased during the study period. Other studies have shown similar results up to 2012 (6) and it is noteworthy that there is a further decrease up to 2016. Evidence thus suggests that high-quality studies on the effectiveness of knee arthroscopy has, together with national guidelines, impacted healthcare on a global scale resulting in higher precision for the indication of knee arthroscopy, thus avoiding unnecessary complications. Taken together it is clear that change in practice requires time despite available evidence.

The mean age of patients undergoing knee arthroscopy has, in general, remained the same. Most of the patients are young, in the age group 18–29, and the change in incidence among

them is small compared with the other groups. The result could speculatively be explained by the fact that these patients are treated with knee arthroscopy because of injuries occurring during sports or physical activity, with specific symptoms of knee injury compared with degenerative knee disorders. Recommendations regarding arthroscopic knee surgery for younger patient groups have remained the same although studies suggest that, even without OA, degenerative meniscus injuries may not be a future indication for surgery (9).

There was a notable increase in the number of arthroscopies performed from 2006 to 2008, followed by a rapid decrease. This reduction occurred before the guidelines were changed (in 2012). Despite the publication of studies on the ineffectiveness of arthroscopy as general treatment for OA in 2002 and 2008, the magnitude of the reduction in surgeries was considerable (Table 6). The reason for this rapid change is not clear. A connection between health, healthcare services, and macroeconomic conditions might play a role regarding behavior. A study in the United States by the American Association of Hip and Knee Surgeons showed that the demand for joint reconstruction surgery and the visits to outpatient clinics decreased by around 30% following the 2008 economic crisis (17). It is possible that the 2008 financial crisis and the following recession also affected the availability and use of knee arthroscopy in Sweden. Even though some studies show higher utilization of healthcare in a recession, orthopedic surgery in general and knee arthroscopies in particular are not lifesaving and might follow a different pattern. Knee arthroscopies are usually done in ambulatory care. These clinics in Sweden, many of which are privately owned and operated, might have been affected in times of economic instability.

Furthermore, the arthroscopic surgery rate showed great variability between metropolitan and rural regions in Sweden. This reflection of inequality deserves to be pointed out as all regions share the same national reimbursement, healthcare policy, and legislation. The regional variations may reflect variations in surgeons' opinions and beliefs concerning clinical indications for surgery, which has also been demonstrated for knee arthroplasty (18). Large regional differences have previously also been shown regarding arthroscopic meniscal procedures

(19) and a recent publication demonstrated a large decrease in the incidence of arthroscopic meniscal procedures and other arthroscopic knee procedures from 2010 to 2018 (20).

Strengths and limitations

The size of the data set is one of the strengths of this nationwide population-based register study. Because our study is register-based, it is not possible to know how OA was diagnosed. There is a possibility that the coding was influenced by other factors, such as physician habits, insurance policies, patients' presentation, etc. As we included both minor and major surgical codes, we cannot rule out changes also in major procedures separate from minor procedures due to the emerging debate following several RCTs published in high-impact journals.

The division of metropolitan regions and rural regions was simplified, as we studied only regions and not specific cities. The 3 largest cities in Sweden are Stockholm, Gothenburg, and Malmö, and they are considered as metropolitan areas (regions). However, the regions they are included in also cover a large number of smaller cities and rural areas. The difference in arthroscopy rate between the regions is suspected to be even larger if a finer analysis were to be made.

Conclusion

The incidence of knee arthroscopy in Sweden has declined in all age groups, for both male and female patients as well as patients with knee OA. There were considerable regional variations in the incidence of knee arthroscopy. Living in a densely populated area seems to increase the possibility of being treated with a knee arthroscopy.

LB, LFT, and JA designed the study. CL and TQ were responsible for the collection of the data. CL and TQ performed the statistical analysis in collaboration with LB. LB, CL, JA, MP, and LFT participated in the interpretation of data. LB, CL, and LFT wrote the first draft of the manuscript. All authors contributed to reviewing, editing, and approving the final version of manuscript.

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Appendix

Table 5. Incidence per 10⁵ inhabitants per region, the mean of 2002–2016 and the mean for the whole of Sweden

Region	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Mean
Blekinge	205	193	240	174	163	135	154	140	105	107	104	94	74	62	52	133
Dalarna	210	176	172	148	166	165	188	176	155	150	129	117	110	104	94	151
Gävleborg	185	180	177	171	162	198	169	204	217	198	172	181	159	162	141	179
Gotland	274	240	115	30	30	239	231	252	164	164	183	212	168	178	137	174
Halland	149	141	128	162	125	105	88	113	112	96	106	130	55	44	128	112
Jämtland	108	128	117	172	188	151	154	60	29	23	17	28	20	21	8	82
Jönköping	95	94	160	226	209	197	199	244	179	154	132	141	127	114	102	158
Kalmar	113	162	228	307	526	391	565	549	260	510	420	366	301	200	121	335
Kronoberg	523	370	184	239	214	337	263	294	272	296	318	333	319	265	112	289
Norrbottn	152	146	119	95	171	174	141	161	141	105	91	109	85	84	89	124
Örebro	269	221	185	166	16	161	153	137	128	101	81	77	65	74	89	128
Östergötland	136	113	0	0	166	117	107	82	88	123	234	198	158	135	109	118
Skåne	186	147	136	145	132	141	125	144	139	113	119	130	117	130	115	134
Södermanland	193	165	138	136	119	137	156	172	150	138	124	91	91	75	71	130
Stockholm	335	339	332	316	268	261	359	318	274	255	271	245	254	236	214	285
Uppsala	205	175	176	173	155	146	149	140	187	174	222	212	199	189	160	178
Värmland	119	129	127	140	101	84	107	83	100	89	77	167	171	98	89	112
Västerbotten	33	67	44	218	203	159	210	285	218	189	174	177	172	132	103	159
Västernorrland	150	140	147	160	139	103	137	114	79	108	97	86	85	66	51	111
Västmanland	9	130	137	148	133	109	141	111	102	93	94	66	51	62	57	96
Västra Götaland	113	105	127	127	112	110	122	94	82	100	72	119	112	63	51	101
Sweden	179	170	152	164	167	172	186	185	152	156	154	156	138	119	100	157