

Hip arthroplasty in Norway 1989–2008

Summary

Background: Since information on regional variation in the frequency of primary total hip arthroplasty in Norway is scarce, we studied differences by county and regional health authority throughout the last 20 years.

Material and methods: We included 112,514 primary total hip arthroplasties reported to the Norwegian Arthroplasty Register in the years 1989–2008. Annual gender and age standardized frequencies were calculated, and Poisson regression was used for group comparisons (RR = rate ratio).

Results: We observed an increase in hip arthroplasty frequency from 109 operations per 100,000 inhabitants in the years 1991–1995 to 140 in 2006–2008 (RR=1.28), and more so for operations performed due to coxarthrosis (RR=1.46). An increased frequency over time was evident in all five regions and 19 counties. Differences between counties and regions had decreased throughout the study period. In the years 2006–2008, Helse Midt (152 operations) had a statistically significant higher frequency than the other regions except for Helse Sør. The lowest frequencies at county level were found for Finnmark (116 operations) and the highest for Aust-Agder (172).

Interpretation: While regional differences have decreased since the early 1990s, existing differences may in part be due to differing access to surgery, varying indications for surgery, or possibly also genetic or cultural differences.

Birgitte Espehaug

birgitte.espehaug@helse-bergen.no
The Norwegian Arthroplasty Register
Department of Orthopaedic Surgery
Haukeland University Hospital
and
Bergen University College

Ove Furnes

Lars Birger Engesaeter

Leif Ivar Havelin

The Norwegian Arthroplasty Register
Haukeland University Hospital
and
Department of Surgical Sciences
University of Bergen

In cost-benefit analyses, hip arthroplasty is ranked as one of the most successful medical and surgical treatments available (1, 2). Hip arthroplasty has been shown to give arthritis patients a considerable reduction of pain as well as improved functional capability, at a lower cost than other forms of treatment (3). Nevertheless, the frequency of primary total hip arthroplasties varies significantly in different countries (4). These can be difficult to compare, however, since they often date from different periods of time and have been estimated without taking demographic differences into account. Previous reports have indicated that the number of hip arthroplasties caused by rheumatic disorders is declining (5–8), which may be due to improved drugs. On the whole, however, there is a clearly increasing frequency of hip arthroplasty in the Western countries. This has been documented for all the Nordic countries (9), Australia (10), Canada (11, 12) and the US (13). Within some countries, considerable regional differences in age-standardized rates have been documented (12, 14–17). In Norway, the prevalence of primary hip arthroplasty within different regions is unknown. Hence, the purpose of this study was to investigate whether the prevalence of primary total hip arthroplasty varied according to place of residence. We therefore compared the frequency of hip arthroplasties in the population according to place of residence, distributed among the regional health enterprises and county of residence in the years 1989–2008. We also wished to focus on changes in the prevalence over time.

Material and methods

In September 1987, the Norwegian Arthroplasty Register (18) started to record infor-

mation on primary and revision hip arthroplasties (19, 20). This information is submitted to the register on paper (not electronically) by orthopaedic surgeons in all hospitals in Norway that perform this type of surgery. Compared to the number of operations reported to the Norwegian Patient Register, a total of 97 per cent of all primary hip arthroplasties were reported to the register in the period 1999–2002 (21). Prior to 1989, the registration procedure did not comprise all hospitals. In this study we therefore included primary hip arthroplasties performed in the period from January 1989 to December 2008, with the exception of operations performed on patients with no known place of residence ($n = 37$). The study was based on information on hip arthroplasties reported to the arthroplasty register. Information on the patients' last known address as of 31 December 2008 was collected from the National Population Register, and demographic data were supplied by Statistics Norway (22).

Analyses

The annual unadjusted rate of primary total hip arthroplasties for the years 1989–2008 and for the periods 1989–90, 1991–95, 1996–2000, 2001–05 and 2006–08 was estimated as the number of operations divided by the population mean (average of the population at the beginning and at the end of the year) in Norway. Subdivisions have to the largest extent possible been undertaken in five-year intervals in order to allow for a comparison with other studies. The annual age and gender standardized rate was estimated by way of direct standardization (23), using the gender and age distribution (0–39, 40–49, 50–59, 60–69, 70–79, 80+ years) in Norway as the standard population. The

Main message

- The frequency of primary hip arthroplasties has increased since 1989.
- In 2006–08, the annual frequency constituted 140 per 100,000 inhabitants: 99 for men and 173 for women.
- Today, the differences between regions and counties are far smaller than before.
- Some counties still stand out in terms of an especially high or low frequency.

annual rate for each period of time was also estimated for various diagnoses that may lead to arthroplasty, for each of the regional health enterprises and counties, as well as for sub-groups defined by gender and age for the primary operation. Even though different countries may have widely differing age distributions, the choice of a common standard population may still provide comparable figures for prevalence. An annual age-standardized rate was therefore also established on the basis on an estimated European standard population (24). Rate ratio (RR) values for the changes in prevalence over time and between geographical areas were estimated using Poisson regression, with the period 1991–95 as reference. These analyses were adjusted for gender and age, which were grouped as described above. P values less than 0.05 were assumed to be statistically significant. Analyses were undertaken with the aid of the software package SPSS 16.0 (SPSS Inc., Chicago, IL).

Results

During the period of study, a total of 112,514 hip arthroplasties were performed in Nor-

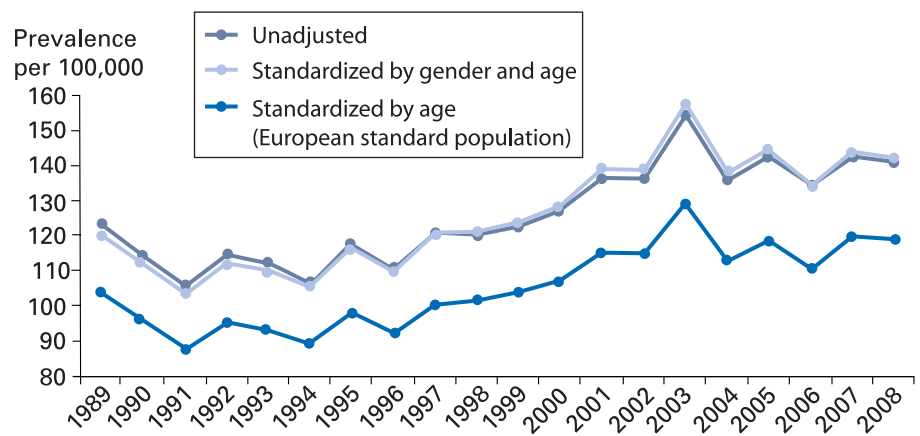


Figure 1 Frequency of primary total hip arthroplasties per 100,000 inhabitants, by year of operation. Frequencies are unadjusted, standardized according to the gender and age distribution in Norway 1989–2008, and standardized according to the European age distribution [European standard population, ESP].

way. We observed an increase over time in the annual age and gender standardized frequencies of primary total hip arthroplasties (fig 1), from 109 operations per 100,000 inhabitants in 1991–95 to 140 in 2006–08 (RR = 1.28; 95% confidence interval 1.25–

1.30) (e-tab 1). This increase was at its strongest during the second half of the 1990s, and since then, only minor changes have been observed (fig. 1). The highest frequency was observed in 2003, with 157 operations for each 100,000 of the population.

Table 2 Gender and age standardized frequency 1 for primary total hip arthroplasties per 100,000 inhabitants, by place of residence and period of time

Regional health enterprise County	No. of prostheses	1989–1990	1991–1995	1996–2000	2001–2005	2006–2008	RR ² [95% CI] 2006–08 vs. 1991–95
Helse Øst ³	39,125	111	104	120	137	134	1.28 (1.24–1.32)
Østfold	6,433	113	111	111	131	136	1.23 (1.13–1.32)
Akershus	10,220	107	105	127	140	133	1.24 (1.17–1.32)
Oslo	10,463	81	88	107	120	120	1.34 (1.26–1.43)
Hedmark	6,355	144	120	138	158	162	1.36 (1.25–1.47)
Oppland	5,654	154	117	130	152	135	1.16 (1.06–1.27)
Helse Sør ³	24,678	129	120	132	155	147	1.23 (1.18–1.28)
Buskerud	6,612	132	115	127	155	148	1.26 (1.17–1.37)
Vestfold	5,770	114	11	132	142	145	1.30 (1.20–1.42)
Telemark	5,153	128	127	133	164	144	1.13 (1.03–1.24)
Aust-Agder	2,992	132	133	140	164	172	1.29 (1.15–1.44)
Vest-Agder	4,151	146	119	136	158	140	1.18 (1.07–1.31)
Helse Vest	21,795	120	115	121	144	141	1.22 (1.17–1.28)
Rogaland	8,175	126	118	122	144	135	1.13 (1.05–1.21)
Hordaland	10,444	108	110	119	142	140	1.27 (1.20–1.35)
Sogn og Fjordane	3,176	148	127	127	156	164	1.31 (1.17–1.46)
Helse Midt-Norge	16,824	117	116	118	149	152	1.31 (1.25–1.37)
Møre og Romsdal	6,315	115	111	110	147	143	1.29 (1.19–1.39)
Sør-Trøndelag	6,561	116	109	116	141	154	1.40 (1.30–1.51)
Nord-Trøndelag	3,948	122	139	135	169	165	1.19 (1.08–1.31)
Helse Nord	10,092	101	86	104	134	129	1.49 (1.40–1.59)
Nordland	5,213	93	71	95	135	132	1.86 (1.70–2.04)
Troms	3,488	112	112	123	140	128	1.15 (1.03–1.28)
Finnmark	1,391	112	91	94	119	116	1.28 (1.08–1.52)

¹ Gender and age distribution in Norway 1989–2008 as standard

² Rate ratio (RR) adjusted for gender and age, Poisson regression

³ Helse Sør and Helse Øst are considered as two separate health enterprises even after their merger on 1 June 2007.

The differences between the standardized and the unadjusted rate remained minor during the entire period of study (fig 1).

The age-adjusted frequency of hip arthroplasties was lower for men than for women, totalling 99 per 100,000 men and 173 for each 100,000 women. The frequency of hip arthroplasties increased over time for all age groups over 40 years, but was least marked in the age group 60–69 years. The increase in frequency was stronger for hip prosthetics implanted because of idiopathic coxarthrosis (RR = 1.46) than what was observed for the total material (e-tab 1).

County of residence and regional health enterprises

An increase in frequency was evident in all the regional health enterprises and counties (tab 2). In our comparison of prevalence in 1991–95 and 2006–08, we found the greatest increase among inhabitants of the Helse Nord health region (RR = 1.49; 95% CI: 1.40–1.59). On the other hand, Helse Nord has had the lowest frequency throughout the entire period of study (fig 2). At the county level, we found the smallest increases among inhabitants of Rogaland (RR = 1.13; 1.05–1.21) and Telemark counties (RR = 1.13; 1.03–1.24), and the largest increase in Nordland county (RR = 1.86; 1.70–2.04) (tab 2).

Even though the differences between the regional health enterprises (fig 2) and the counties (tab 2) have decreased considerably over time, some variations remain. In the period 2006–08, the Helse Midt health region stood out, with 152 operations for every 100,000 inhabitants (tab 2). This represented a statistically significant higher frequency than in all other regional health enterprises, with the exception of Helse Sør. With regard to counties, there were still some major differences during the final period, even between counties within the same regional health enterprise (tab 2).

Discussion

The information on hip arthroplasties is based on data reported to the Norwegian Arthroplasty register. Data are reported directly by the surgeon, who usually fills in the form submitted to the register immediately after the operation. Even though this reporting of operations to the register is voluntary, we have reason to believe that the register is near-complete. Comparisons with information submitted to the Norwegian Patient Register (NPR) show that the number of primary hip arthroplasties reported to the Norwegian Arthroplasty Register constituted 97% of the number of prosthetics reported to the patient register (21). This completeness of reporting has also been confirmed at the patient level in several hospitals (25–27). The validity of the reported information has also been investigated in one hospital and showed very satisfactory re-

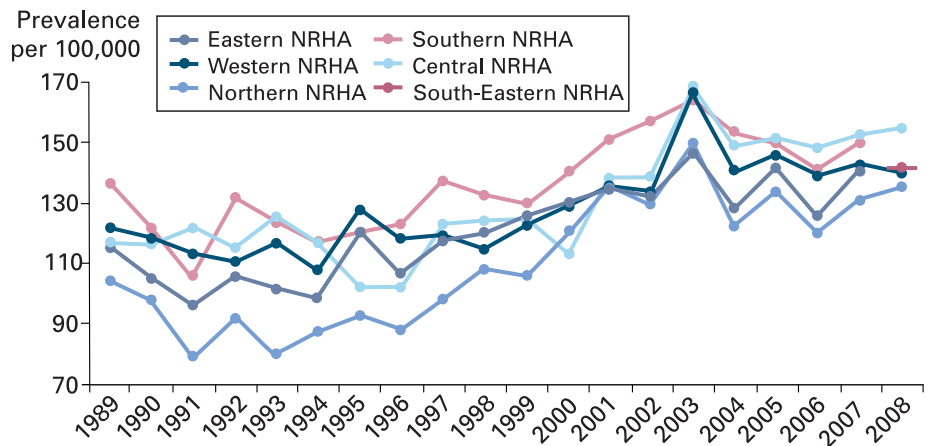


Figure 2 Frequency of primary total hip arthroplasties per 100,000 inhabitants, by place of residence in a regional health enterprise and year of operation standardized according to the gender and age distribution in Norway 1989–2008.

sults with regard to the variables reviewed: side (left, right), type of operation (primary, revision) and the date of operation (25).

The fact that the patient's reported place of residence was the current place of residence rather than the place of residence at the time of the operation could represent a weakness of the study design. However, in light of the age group in question, there is little reason to assume that many of the patients have moved to other counties or regional health enterprises (28).

The frequency of primary hip arthroplasties caused by idiopathic coxarthrosis has increased more than for the material as a whole. This could be due to improved access to surgery, but also to a change in indications for operation. It has been shown that if the operation is postponed and the patient's condition deteriorates, then the outcome of the operation will be poorer (29, 30). This could probably to some extent explain why a higher number of operations than before are performed on young people with less assumed pain and better functional capability. Nevertheless, we found that the increase was most marked among the oldest patients. The increasing number of elderly people with good general health who are able to undergo hip arthroplasty, better anaesthetics and a general consensus of not using age as a contraindication for an operation, are factors that can explain this increase. It is crucial to investigate whether this change in indication for operation may change the results of hip arthroplasty surgery.

In recent years, we have seen that the frequency of primary hip arthroplasty has remained relatively constant, and one may ask whether existing surgical capacity is sufficient to cover demand for this type of surgery. A study published in 1999 showed that hip arthroplasty capacity in England fell six per cent short of demand (31). Comparable frequencies of primary hip arthroplasty have been reported for Norway and England (32),

and if we assume that the prevalence of hip disorders that require implantation of a prosthesis also is similar, it is reasonable to claim that too few, rather than too many, are offered this type of surgery in Norway. Many studies estimate an increasing need for hip arthroplasty in the years to come, in light of an increasing proportion of elderly people in the population and also because an increasing number of young people (33) and elderly people undergo surgery (6, 33, 34). Further studies ought to be undertaken to clarify the need for future surgical capacity, with regard to Norway as well.

It has been shown that the frequency of primary total hip arthroplasties varies significantly in different countries (4). However, a study based on national registry data for the years 1996–2000 showed that the annual frequencies of arthroplasties caused by primary coxarthrosis were fairly similar in the Nordic countries (9). Differences could nevertheless be observed for groups of individuals. In concurrence with our study, Lohmann et al. (9) observed that the proportion with hip arthroplasty was twice as high among Norwegian women as among men, while this proportion was lower in the other Nordic countries, at 1.1–1.3.

Similar to the results of our study, considerable regional differences in the frequencies of primary total hip arthroplasties have been found in other countries as well (14–16). In a Danish study, differences related to diagnoses could not explain the regional variations (15). Investigating this issue in Norway is difficult, since generally little is known about the frequency of various diagnoses according to area of residence. Differences in the prevalence of coxarthrosis among various groups of the population have been demonstrated (35, 36), and it is conceivable that this can partly explain the low frequency of arthroplasty operations in some counties. For example, as of 1 January 2009, a total of 22 per cent of the population

of Oslo had a non-Western background, compared to 8 per cent in the country as a whole (37). Another possible explanation includes the differences in attitudes to this type of operation among various groups of the population, reflected in surveys (38). For example, it has been shown that non-European patients have a higher level of discomfort before they undergo surgery, and that they assess this operation as dangerous to a higher extent than patients from a European ethnic background (39). Furthermore, studies have revealed a lower frequency of hip arthroplasty in large cities in countries such as England, Denmark, Sweden and Finland (14, 15, 17, 40). Attempted explanations refer to how the infrastructure and working conditions are better there than in rural areas, so that it is possible to cope without an artificial joint (14). A study from the US showed that low population density was correlated with a high frequency of hip arthroplasty (41), while other studies, on the other hand, show that regional differences cannot be explained by population density, or by factors such as density of orthopaedic surgeons, hospital costs and regional gross domestic product (14, 15, 17). In our study, we have not adjusted for factors such as differences in the extent of hospital coverage and surgical capacity, and further research should also investigate the effects of such factors in the Norwegian context. Geographical differences in the indication for an operation could also be a possible explanatory factor for the variations in frequency according to place of residence (14).

Birgitte Espehaug (b. 1962)

is a dr. philos. She is a statistician at the Norwegian Arthroplasty Register, Haukeland University Hospital, and Assistant Professor at Bergen University College.

Stated conflicts of interest: Has given lectures that have generated fees to the Norwegian Arthroplasty Register from the enterprise Stryker.

Ove Furnes (b. 1960)

is a Doctor of Medicine and a specialist in orthopaedic surgery. He is Chief Consultant at the Orthopaedic Clinic and the Norwegian Arthroplasty Register, and Professor at the University of Bergen. He has been involved in the operations and research activities of the Norwegian Arthroplasty Register since 1992, including as a director, and he is President of the International Society of Arthroplasty Registries.

Stated conflicts of interest: Has given lectures that have generated fees to the Norwegian Arthroplasty Register from the enterprise Link, and has received fees for lectures from OrtoMedic. Haukeland University Hospital has received a research grant to a project that he has directed, with joint funding by Helse Vest and the enterprises OrtoMedic and Smith & Nephew.

Lars Birger Engsaeter (b. 1948)

is a specialist of general surgery and orthopaedic surgery. He is a Professor at the University of Bergen and Head of Section in the Orthopaedic Department, Haukeland University Hospital.

Stated conflicts of interest: None

Leiv Ivar Havelin (b. 1949)

is a Doctor of Medicine and a specialist in orthopaedic surgery. He is Chief Consultant at the Department of Orthopaedic Surgery and the Norwegian Arthroplasty Register, Haukeland University Hospital, and Professor at the University of Bergen. He has been involved in the operations and research activities of the Norwegian Arthroplasty Register since 1987 and is Chairman of the steering group for the Centre of Excellence of joint replacements.

Stated conflicts of interest: Has given lectures that have generated fees to the Norwegian Arthroplasty Register from the enterprises Stryker and Link.

References

- Garellick G, Malchau H, Herberts P et al. Life expectancy and cost utility after total hip replacement. *Clin Orthop Relat Res* 1998; nr. 346: 141–51.
- Laupacis A, Bourne R, Rorabeck C et al. Costs of elective total hip arthroplasty during the first year. Cemented versus noncemented. *J Arthroplasty* 1994; 9: 481–7.
- Hawker GA, Badley EM, Croxford R et al. A population-based nested case-control study of the costs of hip and knee replacement surgery. *Med Care* 2009; 47: 732–41.
- Merx H, Dreinhöfer K, Schröder P et al. International variation in hip replacement rates. *Ann Rheum Dis* 2003; 62: 222–6.
- Fevang BT, Lie SA, Havelin LI et al. Reduction in orthopedic surgery among patients with chronic inflammatory joint disease in Norway, 1994–2004. *Arthritis Rheum* 2007; 57: 529–32.
- Pedersen AB, Johnsen SP, Overgaard S et al. Total hip arthroplasty in Denmark: incidence of primary operations and revisions during 1996–2002 and estimated future demands. *Acta Orthop* 2005; 76: 182–9.
- Weiss RJ, Stark A, Wick MC et al. Orthopaedic surgery of the lower limbs in 49,802 rheumatoid arthritis patients: results from the Swedish National Inpatient Registry during 1987 to 2001. *Ann Rheum Dis* 2006; 65: 335–41.
- da Silva E, Doran MF, Crowson CS et al. Declining use of orthopedic surgery in patients with rheumatoid arthritis? Results of a long-term, population-based assessment. *Arthritis Rheum* 2003; 49: 216–20.
- Lohmander LS, Engesaeter LB, Herberts P et al. Standardized incidence rates of total hip replacement for primary hip osteoarthritis in the 5 Nordic countries: similarities and differences. *Acta Orthop* 2006; 77: 733–40.
- Graves SE, Davidson D, Ingerson L et al. The Australian Orthopaedic Association National Joint Replacement Registry. *Med J Aust* 2004; 180 (suppl 5): S31–4.
- Bourne RB, Maloney WJ, Wright JG. An AOA critical issue. The outcome of the outcomes movement. *J Bone Joint Surg Am* 2004; 86-A: 633–40.
- Hip and knee replacements in Canada. Canadian Joint Replacement Registry (CJRR) 2008–2009 Annual report. Ottawa: Canadian Institute for Health Information, 2009.
- Mahomed NN, Barrett JA, Katz JN et al. Rates and outcomes of primary and revision total hip replacement in the United States medicare population. *J Bone Joint Surg Am* 2003; 85-A: 27–32.
- Mäkelä KT, Peltola M, Häkkinen U et al. Geographical variation in incidence of primary total hip arthroplasty: a population-based analysis of 34,642 replacements. *Arch Orthop Trauma Surg* 2010; 130: 633–9.
- Pedersen AB, Johnsen SP, Overgaard S et al. Regional variation in incidence of primary total hip arthroplasties and revisions in Denmark, 1996–2002. *Acta Orthop* 2005; 76: 815–22.
- Wells VM, Hearn TC, McCaul KA et al. Changing incidence of primary total hip arthroplasty and total knee arthroplasty for primary osteoarthritis. *J Arthroplasty* 2002; 17: 267–73.
- Dixon T, Shaw ME, Dieppe PA. Analysis of regional variation in hip and knee joint replacement rates in England using Hospital Episodes Statistics. *Public Health* 2006; 120: 83–90.
- Nasjonalt Register for Leddproteser. www.haukeland.no/nrv/ (6.7.2010).
- Havelin LI, Engesaeter LB, Espehaug B et al. The Norwegian Arthroplasty Register: 11 years and 73,000 arthroplasties. *Acta Orthop Scand* 2000; 71: 337–53.
- Furnes O, Havelin LI, Espehaug B et al. Det norske leddproteseregisteret – 15 nyttige år for pasientene og for helsevesenet. *Tidsskr Nor Lægeforen* 2003; 123: 1367–9.
- Espehaug B, Furnes O, Havelin LI et al. Registration completeness in the Norwegian Arthroplasty Register. *Acta Orthop* 2006; 77: 49–56.
- Statistisk sentralbyrå. www.ssb.no/ (6.7.2010).
- Woodward M. Epidemiology. Study design and data analysis. Boca Raton, FL: Chapman & Hall/CRC, 1999.
- National Cancer Institute. Standard populations (millions) for age-adjustment. <http://seer.cancer.gov/stdpopulations/> (6.7.2010).
- Arthursson AJ, Furnes O, Espehaug B et al. Validation of data in the Norwegian Arthroplasty Register and the Norwegian Patient Register: 5,134 primary total hip arthroplasties and revisions operated at a single hospital between 1987 and 2003. *Acta Orthop* 2005; 76: 823–8.
- Hulleberg G, Aamodt A, Espehaug B et al. A clinical and radiological 13-year follow-up study of 138 Charnley hip arthroplasties in patients 50–70 years old. Comparison of university hospital data and registry data. *Acta Orthop* 2008; nr. 5: 79.
- Frøen JF, Lund-Larsen F. Ti år med Lubinus Interplanta hofteproteser. *Tidsskr Nor Lægeforen* 1998; 118: 2767–71.
- Statistisk sentralbyrå. Flest flytter innenfor egen kommune. Samfunnspeilet nr. 5/2005. www.ssb.no/samfunnspeilet/utg/200505/05/index.html (6.7.2010).
- Espehaug B, Havelin LI, Engesaeter LB et al. Patient satisfaction and function after primary and revision total hip replacement. *Clin Orthop Relat Res* 1998; nr. 351: 135–48.
- Hajat S, Fitzpatrick R, Morris R et al. Does waiting for total hip replacement matter? Prospective cohort study. *J Health Serv Res Policy* 2002; 7: 19–25.
- Frankel S, Eachus J, Pearson N et al. Population requirement for primary hip-replacement surgery: a cross-sectional study. *Lancet* 1999; 353: 1304–9.
- Flugsrud GB, Nordstletten L, Espehaug B et al. Risk factors for total hip replacement due to primary osteoarthritis: a cohort study in 50,034 persons. *Arthritis Rheum* 2002; 46: 675–82.
- Kurtz SM, Lau E, Ong K et al. Future young patient demand for primary and revision joint replacement: national projections from 2010 to 2030. *Clin Orthop Relat Res* 2009; 467: 2606–12.
- Kurtz S, Ong K, Lau E et al. Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. *J Bone Joint Surg Am* 2007; 89: 780–5.
- Allen KD. Racial and ethnic disparities in osteoarthritis phenotypes. *Curr Opin Rheumatol* 2010; 22:528–32.
- Nevitt MC, Xu L, Zhang Y et al. Very low prevalence of hip osteoarthritis among Chinese elderly in Beijing, China, compared with whites in the United States: the Beijing osteoarthritis study. *Arthritis Rheum* 2002; 46: 1773–9.
- Statistisk sentralbyrå. Innvandrer og norskfødte med innvandrereforeldre, etter landbakgrunn. Fylke. 1 januar 2009. www.ssb.no/emner/02/01/10/innvbeif/arkiv/tab-2009-04-30-09.html (6.7.2010).
- Hausmann LR, Mor M, Hanusa BH et al. The effect of patient race on total joint replacement recommendations and utilization in the orthopedic setting. *J Gen Intern Med* 2010; 25: 982–8.

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39. Gandhi R, Razak F, Davey JR et al. Ethnicity and patient's perception of risk in joint replacement surgery. *J Rheumatol* 2008; 35: 1664-7.
40. Söderman P. On the validity of the results from the Swedish National Total Hip Arthroplasty register. *Acta Orthop Scand Suppl* 2000; 71: 1-33.
41. Peterson MG, Hollenberg JP, Szatrowski TP et al. Geographic variations in the rates of elective total hip and knee arthroplasties among Medicare beneficiaries in the United States. *J Bone Joint Surg Am* 1992; 74: 1530-9.

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E-table 1 Gender and age standardized frequency 1 for primary total hip arthroplasties per 100,000 inhabitants, by period of time

	No. of prostheses	1989–1990	1991–1995	1996–2000	2001–2005	2006–2008	RR ² [95% CI] 2006–08 vs. 1991–95
Total	112,514	116	109	121	143	140	1.28 (1.25–1.30)
Gender							
Men	34,479	79	76	80	96	99	1.30 (1.26–1.35)
Women	78,035	146	137	154	181	173	1.27 (1.24–1.30)
Age							
0–39	2,056	4.3	4.1	4.2	4.2	4.4	1.08 (0.94–1.24)
40–49	4,438	36	33	32	38	42	1.27 (1.16–1.39)
50–59	13,783	142	117	124	151	155	1.33 (1.25–1.40)
60–69	31,456	391	366	401	433	435	1.18 (1.14–1.23)
70–79	43,921	602	576	632	786	758	1.32 (1.28–1.36)
80+	16,860	312	332	400	500	458	1.37 (1.31–1.44)
Diagnosis ³							
Idiopathic coxarthrosis	81,510	77	74	85	109	109	1.46 (1.43–1.50)
Rheumatoid arthritis	3,390	4.0	4.2	4.0	3.7	3.1	0.74 (0.66–0.83)
Sequelae femoral neck fracture	11,690	16	14	14	12	10	0.70 (0.66–0.75)
Sequelae congenital dysplasia	8,203	10	8.9	8.4	9.6	9.5	1.05 (0.98–1.13)
Sequelae congenital dysplasia with dislocation	815	2.3	1.4	0.7	0.4	0.4	0.31 (0.23–0.41)
Sequelae Perthes' disease/ epiphysiolysis	1,480	1.6	1.6	1.6	1.8	1.8	1.12 (0.95–1.31)
Ankylosing spondylitis	476	0.5	0.5	0.6	0.5	0.5	0.82 (0.61–1.11)
Fracture	1,103	0.3	0.3	0.7	3.0	3.0	9.60 (7.44–12.0)
Osteonecrosis of the femoral head	1,597	0.6	0.9	1.5	3.6	3.6	3.99 (3.37–4.17)
Other	2,572	2.3	2.4	2.7	3.1	3.1	1.16 (1.02–1.31)

¹ Gender and age distribution in Norway 1989–2008 as standard (when relevant)

² Rate ratio (RR) adjusted for gender and age (when relevant). Poisson regression

³ More than one cause may have been reported to the Norwegian Arthroplasty Register