# Incidence of total hip replacement for primary osteoarthrosis in Iceland 1982–1996

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We report the incidence of total hip replacements performed in Iceland between 1982 and 1996. During this period, 3,403 hip arthroplasties were done. The annual number of procedures increased from 94 hips in 1982 to 323 hips in 1996. Annual rates of total hip replacements due to primary osteoarthrosis per $10^5$ inhabitants were 68 in 1982–1986, 90 in 1987–1991, and 114 in 1992–1996. In the years 1992–1996, the age-standardized incidence of total hip replacements for primary osteoarthrosis was 3/$10^5$ among patients younger than 39 years of age, while it was 621/$10^5$ among those 70–79 years of age. The mean age at surgery for primary osteoarthrosis was 69 years in both men and women.

Incidence rates in various countries are difficult to compare, but by using age-standardized data and correction for differences in population structures between Iceland and Sweden, we find that the incidence of total hip replacement for primary osteoarthrosis of the hip is at least 50% higher in Iceland than in Sweden. This difference is consistent with the higher prevalence of hip osteoarthrosis observed in Iceland than in Sweden.

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We assessed the incidence of total hip replacements in various age groups in Iceland for the years 1982–1996, compared the Icelandic incidence with the incidences in the other Nordic countries, and estimated future demands in Iceland for this procedure.

## Patients and methods

In this article we use the term total hip replacement (THR) for a cemented arthroplasty of the hip (both acetabulum and femur). No uncemented hip arthroplasties were done in Iceland during this period. Through a computer-aided search of hospital records, we obtained information from all 6 orthopedic clinics in Iceland that performed hip arthroplasties during the period 1982–1996. Information on sex, age at surgery, diagnosis, type of prosthesis was registered. In 3 of the 6 hospitals, one of the authors checked all patient records to find the correct diagnosis. Thus, 2,500 of 3,403 cases were verified against original patient records, and the proportion of errors in the computer database diagnosis was less than 2/100. Errors were excluded from further analysis. In revision cases, information was obtained directly from the patient records. The annual number of total hip replacements was calculated and related to the population of Iceland in the same period. For comparison, the annual incidence of primary total hip replacement in Sweden during the same time period was calculated from data published by the Swedish National Hip Arthroplasty Register (Malchau and Herberts 1998) and from the Norwegian Arthroplasty Register (Havelin et al. 1993).

Data on Icelandic, Swedish and Norwegian population structures for the relevant periods were obtained from Statistics Iceland (Hagstofan Island), Statistics Sweden (Statistiska Centralbyrån, Sweden) and from Statistics Norway (Statistiska Centralbyrån, Norway).

Table 1. Annual number of hip arthroplasties in Iceland for years 1982–1996, related to diagnosis

| Year | OA | Fractures | RA | CHD/T | Revisions | Total |
|---|---|---|---|---|---|---|
| 1982 | 77 | 6 | 3 | 2 | 6 | 94 |
| 1983 | 151 | 19 | 6 | 6 | 12 | 194 |
| 1984 | 154 | 19 | 9 | 3 | 13 | 198 |
| 1985 | 150 | 14 | 3 | 10 | 29 | 206 |
| 1986 | 119 | 12 | 5 | 5 | 28 | 169 |
| 1987 | 144 | 9 | 4 | 8 | 29 | 194 |
| 1988 | 167 | 15 | 6 | 9 | 36 | 233 |
| 1989 | 140 | 19 | 6 | 9 | 41 | 215 |
| 1990 | 169 | 14 | 5 | 12 | 51 | 251 |
| 1991 | 160 | 17 | 11 | 4 | 43 | 235 |
| 1992 | 213 | 16 | 4 | 7 | 59 | 299 |
| 1993 | 166 | 16 | 8 | 9 | 42 | 241 |
| 1994 | 157 | 20 | 8 | 10 | 49 | 244 |
| 1995 | 211 | 19 | 8 | 10 | 59 | 307 |
| 1996 | 221 | 22 | 6 | 11 | 63 | 323 |
| Total | 2,399 | 237 | 92 | 115 | 560 | 3,403 |

OA Osteoarthrosis, RA Rheumatoid arthritis, CHD/T Childhood hip diseases and tumors

## Results

During the period 1982–1996, 3,403 total hip replacements were performed on 1,563 men and 1,840 women in Iceland. The annual number of procedures increased from 94 hips in 1982 to 323 hips in 1996 (Table 1). During this period, the annual incidence of total hip replacements increased from 43 to 133 per $10^5$ inhabitants. Primary osteoarthrosis accounted for 71% of the procedures, fractures 7%, and arthritis 3%, revisions 16% and other causes 3%. The 1982–1996 mean annual total incidence of total hip replacements per $10^5$ inhabitants was 92, and primary osteoarthrosis accounted for 65 of these. The annual incidence of THR for primary osteoarthrosis per $10^5$ inhabitants increased from 68 in 1982–1986, to 90 in 1987–1991 and 114 in 1992–1996. In the years 1982–1996, the age-standardized incidence of total hip replacements for primary osteoarthrosis was $2/10^5$ among those younger than 39 years of age, $499/10^5$ among those 70–79 years of age, and $314/10^5$ among those over 80 years of age (Table 3). In the years 1992–1996, the age-standardized incidence in those older than 49 years of age was $448/10^5$/year and $319/10^5$ of these were due to primary osteoarthrosis. In the population over 59 years of age, the THR incidence for primary osteoarthrosis in Iceland was $488/10^5$/year in the same period. The mean age at surgery of those with primary osteoarthrosis was 69 years in both men and women. The incidence rates of hip arthroplasty for men (48%) and women (52%) in Iceland due to primary osteoarthrosis were similar (Table 2) and consistent with the similar prevalence rates of hip osteoarthrosis observed (Ingvarsson et al. 1999).

Of the 237 total hip replacements done for hip fractures, 102 were done for fractures as primary treatment and 135 as secondary treatment.

During the 15-year study period, 560 revisions were done ($15/10^5$/year). The incidence of revisions increased from $2.5/10^5$ in 1982 to $25/10^5$ in 1996. Of the revised patients, 268 were men and 292 were women with the same mean age of 71 years at revision surgery. Among the revisions, 442 had their primary arthroplasty done because of primary osteoarthrosis, 7 because of arthritis, 82 because of fractures; (56 hemiarthroplasties

Table 2. Number of hip arthroplasties in Iceland 1982–1996 related to sex and age at operation

| | OA | | Fractures | | RA | | CHD/T | | Revisions | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age | M | F | M | F | M | F | M | F | M | F | M | F | Total |
| –39 | 9 | 11 | 2 | 2 | 4 | 10 | 11 | 11 | 6 | 6 | 32 | 40 | 72 |
| 40–49 | 18 | 43 | 3 | 5 | 4 | 4 | 13 | 5 | 4 | 13 | 42 | 70 | 112 |
| 50–59 | 135 | 165 | 5 | 10 | 5 | 11 | 5 | 13 | 18 | 24 | 168 | 223 | 391 |
| 60–69 | 448 | 431 | 11 | 54 | 9 | 20 | 5 | 23 | 59 | 70 | 532 | 598 | 1,130 |
| 70–79 | 422 | 429 | 15 | 66 | 7 | 13 | 7 | 9 | 142 | 117 | 593 | 634 | 1,227 |
| 80+ | 130 | 158 | 20 | 44 | 3 | 2 | 4 | 9 | 39 | 62 | 196 | 275 | 471 |
| Total | 1,162 | 1,237 | 56 | 181 | 32 | 60 | 45 | 70 | 268 | 292 | 1,563 | 1,840 | 3,403 |

OA Osteoarthrosis, RA Rheumatoid arthritis, CHD/T Childhood hip diseases and tumors, M male, F female.

Table 3. Age-standardized incidence (n/$10^5$/year) of THR for primary osteoarthrosis in Iceland, Sweden and Norway

| | Iceland | | | | Sweden | Norway |
|---|---|---|---|---|---|---|
| Age | 1982–1986 | 1987–1991 | 1992–1996 | 1982–1996 | 1992–1996 | 1987–1991 |
| –39 | 2 | 3 | 3 | 2 | 0 | 4 |
| 40–49 | 8 | 16 | 18 | 17 | 14 | 19 |
| 50–59 | 93 | 78 | 113 | 97 | 67 | 82 |
| 60–69 | 281 | 327 | 342 | 333 | 228 | 247 |
| 70–79 | 421 | 400 | 621 | 499 | 367 | 406 |
| 80+ | 154 | 376 | 396 | 314 | 95 | 176 |

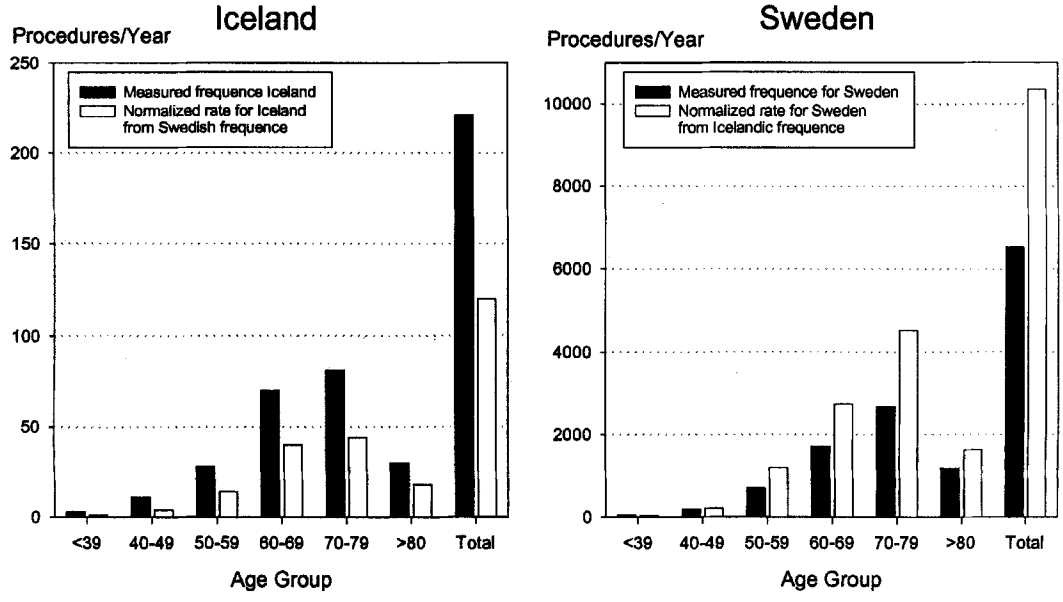
Table 4. Projected number of THR for primary osteoarthrosis in Iceland for the years 2000–2015 calculated from age-standardized incidence (n/$10^5$/year) of THR for primary osteoarthrosis in Iceland during the years 1992–1996

| Age | 2000 | 2005 | 2010 | 2015 |
|---|---|---|---|---|
| –39 | 1 | 1 | 1 | 1 |
| 40–49 | 7 | 8 | 7 | 7 |
| 50–59 | 32 | 38 | 43 | 48 |
| 60–69 | 66 | 72 | 89 | 107 |
| 70–79 | 94 | 98 | 95 | 93 |
| 80+ | 31 | 35 | 39 | 44 |
| Total | 231 | 252 | 274 | 300 |

were revised to total hip replacements) and 29 for other reasons.

## Discussion

Comparisons of the incidence of total hip replacements between regions and countries are often more complex than first thought, because of differences in demographics and reporting, and changes with time. Most studies on the incidence of total hip replacements have reported the overall incidence, often without specifying how the overall incidence was calculated, and not accounting for differences in age distribution between the patients and the general population, and without specifying the underlying diagnosis, when making comparisons with other reports. Thus, the overall incidence of total hip replacements varies in different reports between 58 and 131/$10^5$/year (Melt-




Normalized frequencies of total hip replacement for primary hip osteoarthrosis (OA) in Iceland and Sweden. Filled bars indicate age-class rates for each country. Normalized data for shaded bars were generated by using, e.g., data for age-class incidence of total hip replacements in Iceland (Table 3) to calculate how many procedures would be done in Sweden (based on knowledge of the size of Swedish age-classes), if the rates were similar to those in Iceland. Likewise, Swedish age-class data for incidence were applied to the Icelandic population structure. Thus, incidence rates for the two countries could be compared taking into account differences in population structure between the two countries.

on et al. 1982, Jonsson and Lidgren 1987, Overgaard et al. 1991, Paavolainen et al. 1991, Havelin et al. 1993, Malchau et al. 1993, Hoaglund et al. 1995, Malchau and Herberts 1998). For Sweden, an overall annual incidence per 100,000 was reported to be 130 in 1990 (Malchau et al. 1993). For Norway, between the years 1987 and 1991, the corresponding rate was reported to be 140 (Havelin et al. 1993), for Finland, it was 58 in 1980–1988 (Paavolainen et al. 1991), and for Denmark 70 in the years 1988–1990 (Overgaard et al. 1991). A report from San Francisco, USA, showed large racial differences in the incidence of total hip replacements (Hoaglund et al. 1995). Among whites, the overall incidence was $75/10^5$, of which $50/10^5$ were due to primary osteoarthrosis in 1984–1988.

In the 15-year period 1982–1996, the overall incidence of total hip replacements in Iceland (all ages) was $92/10^5$/year of which $65/10^5$ were due to primary osteoarthrosis. The THR incidence in Sweden in the same period was $108/10^5$/year of which $74/10^5$ were due to primary osteoarthrosis. In the 5-year period 1992–1996, the overall incidence of THR in Iceland was $114/10^5$/year of which $77/10^5$ were due to primary osteoarthrosis. The incidence in Sweden for the latter period was $130/10^5$/year, of which $80/10^5$ were due to primary osteoarthrosis. Thus, on the basis of these overall incidence rates, not adjusted for age, there seems to be no difference between Sweden and Iceland.

However, in the population over 49 years of age, the total hip replacement incidence in Sweden in 1992–1996 was $384/10^5$/year, of which primary osteoarthrosis accounted for $209/10^5$ (Malchau and Herberts 1998). The corresponding incidence in Iceland in the same age group and same period was $448/10^5$/year and $319/10^5$ of these were due to primary osteoarthrosis. In the population over 59 years of age in this same period, the THR incidence of primary osteoarthrosis in Sweden was $287/10^5$, while the corresponding rate in Iceland was $488/10^5$/year. This illustrates the importance of using age-adjusted incidence rates when making comparisons between populations.

We have shown that the overall incidence rates reported above are difficult to compare, even for the same periods, because of differences in population structure between the various countries. In order to make useful comparisons of 'true' rates of total hip replacement, we must correct for differences in the population profile. To make such a correction, we may, for example, use the age-class data on incidence of total hip replacements for primary osteoarthrosis in Iceland (Table 3), to calculate how many procedures would be done in Sweden (based on knowledge of the size of Swedish age-classes), if the rates in Sweden for each age-class were similar to those in Iceland. Likewise, we may, for comparison, apply Swedish age-class data for incidence to the Icelandic population structure (Figure). With these corrections for differences in population structure, we find that the rate of total hip replacement for primary osteoarthrosis is at least 50% higher in Iceland than in Sweden (Figure). Rates for Norway in 1987 to 1991 appear rather similar to those for Sweden between 1992 and 1996 (Table 3).

The incidence of total hip replacements for primary osteoarthrosis in Iceland thus appears to be higher than in the other Nordic countries and in San Francisco, USA. The reasons for this difference are not obvious. Indications for replacement should be about the same in Iceland as in Sweden and Norway, since almost all Icelandic orthopedic surgeons are trained there. Waiting lists for joint surgery exist in all the Nordic countries. However, the prevalence of hip osteoarthrosis is known to be much higher in Iceland than in other Nordic countries (Ingvarsson et al. 1999). Possibly, genetic factors contribute to these prevalence differences (Ingvarsson 1991, Ingvarsson and Lohmander 1996).

The annual number of total hip replacements in Iceland has been rising steadily since 1982 and demand does not yet appear to have been met (Tables 1 and 3). The future demand for THR for primary osteoarthrosis in Iceland can be estimated from the age-standardized figures shown here, taking into account the expected increase in the Icelandic population (Statistics Iceland). The estimated annual need for THR procedures for primary osteoarthrosis will thus rise from 221 in 1996, to 252 in the year 2005, and to 300 in the year 2015 (Table 4). The need for revision surgery may also be expected to rise but, since no implant sur-

vival data are available for THR in Iceland, no such estimates can be made. Since estimates do not take into account a possible further increase in incidence of THR in Iceland, they should be regarded as conservative estimates.

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Havelin I L, Espehaug B, Vollset E S, Engeseter B L, Langeland N. The Norwegian arthroplasty register. Acta Orthop Scand 1993; 64: 245-51.

Hoaglund T F, Oishi S C, Gialamas G G. Extreme variation in racial rates of total hip arthroplasty for primary coxarthrosis: A population-based study in San Francisco. Ann Rheum Dis 1995; 54: 107-10.

Ingvarsson T. Seventeen siblings with coxarthrosis. J Bone Joint Surg (Br) 1991; 73:165.

Ingvarsson T, Lohmander L S. An Icelandic family with hip osteoarthrosis. Ann Rheum Dis 1996; 55: 691.

Ingvarsson T, Hägglund G, Lohmander L S. Prevalence of hip Osteoarthritis in Iceland. Ann Rheum Dis 1999. In press.

Jonsson R, Lidgren L. Incidence of hip replacement in southern Sweden. Acta Orthop Scand 1987; 58: 226-30.

Malchau H, Herberts P. Prognosis of total hip replacement. Scientific exhibition presented at the 65th Annual Meeting of the American Academy of Orthopedic Surgeons, February 19-23, 1998, New Orleans, USA 1-16.

Malchau H, Herberts P, Ahnfelt L. Prognosis of total hip replacement in Sweden. Acta Orthop Scand 1993; 64: 497-506.

Melton J L, Stauffer N R, Chao Y S E, Ilstrup M D. Rates of total hip arthroplasty. A population-based study. N Engl J Med 1982; 307: 1242-5.

Overgaard S, Hansen N L, Knudsen M H, Mossing N. Epidemiological studies on total hip arthroplasty in the county of South Jutland, Denmark, in the 1980s. Acta Orthop Scand (Suppl 246) 1991; 62: 42.

Paavolainen P, Hämäläinen M, Mustonen H, Slätis P. Registration of arthroplasties in Finland. Acta Orthop Scand (Suppl 241) 1991; 62: 27-30.