SWESPINE
THE SWEDISH SPINE REGISTER

THE 2012 REPORT

SEPTEMBER 2013

SWEDISH SOCIETY OF SPINAL SURGEONS

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Introduction

This report was written in autumn 2013, marking Swespine's 21st year of existence. This year's report is the 14th and contains 8890 patients, an increase, almost by tradition, in the number of surgeries over the previous year.

The year has been successful for the register on both the national and international level. On a national level, the Register Center has now been implemented and is in full operation. We hope that this structure will help us to achieve our goal of improving the follow-up rate after 1, 2, 5 and 10 years.

Several scientific papers have resulted from the register over the past year (see reference list). In addition, the entire annual report was published in the European Spine Journal as a 20-page article that has generated considerable attention abroad. Spine Tango, Eurospine's registry, subsequently published its report with a similar structure in order to be able to compare the results of the two registers.

Work on quality-based reimbursement for spine surgery continued during the year and an outcome prognosis model (measured by Global Assessment) after 1 year has been launched. This prognosis is based on the patients' demographic data in order to adjust for the case mix that can be expected in back surgery patients. We used this model for this year's analysis chapter, which can be seen on page 28.

Moreover, we have initiated an experiment in cooperation with Registercentrum Sydost (RCSO) to evaluate whether the PROMs in the register can be used to predict outcomes in individual patient groups in order to improve selection for surgical treatment.

The Swedish Association of Local Authorities and Regions (Sveriges Kommuner och Landsting, SKL) strongly supports patient participation in the register, which will be justified in the long term. For this reason, a collaboration with Qulturum in Jonkoping is now underway, with completion expected in early 2014.

Patient-Reported Experience Measurement (PREM), describing patient satisfaction with health services, is also a measure of healthcare quality; here, too, a project is underway primarily to evaluate the situation. The job has been outsourced to Indikator, Institutet för Kvalitetsindikatorer (Institute for Quality Indicators), which has extensive experience of this type of analysis. We expect to be able to publish the results of this evaluation in our report next year.

The option of direct patient data entry online is being evaluated for the application, which is ready and will first be beta-tested at Spine Center Göteborg.

Internationally, Swespine has taken the initiative, along with the International Consortium for Health Outcomes (ICHOM, a non-profit organization headed by Karolinska Institutet, Harvard Business School and Boston Consulting Group) to study the potential for creating a common international register platform. An initial meeting was held at the ISSLS meeting in Scottsdale, Arizona, in spring 2013, with back healthcare representatives from essentially the entire world. The group has a strong interest in creating a common "core data set" and monthly teleconferences are now being held in which Peter Fritzell belongs to the project

group, while Olle Hägg and Björn Strömqvist belong to the work group, which includes register representatives from Europe, the US, Australia and Southeast Asia. The project has made good progress and the goal is to be able to compare outcome data from different countries relating to both nonsurgical and surgical treatment of spinal disease. A first version of the international registry will be presented in November in Boston.

Sept. 24, 2013

Peter Fritzell Olle Hägg Björn Knutsson

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Lena Oreby

The study was carried out with support from the National Board of Health and Welfare/Swedish Association of Local Authorities and Region 2012 grant for national quality registers.

I. Preoperative and surgical data on lumbar spine procedures in 2012

A total of 8012 patients who had had lumbar spine surgery at a total of 44 departments were entered in the register in 2012. In 2011, 7529 patients from 38 departments were entered in the register.

The distribution of diagnoses for patients operated in 2012 was as follows: Disc herniation 28%, central spinal stenosis 44%, lateral spinal stenosis 7%, spondylolisthesis 4%, segmental pain/DDD (disc degenerative disorder) 8% and other 9%; see figure 1.

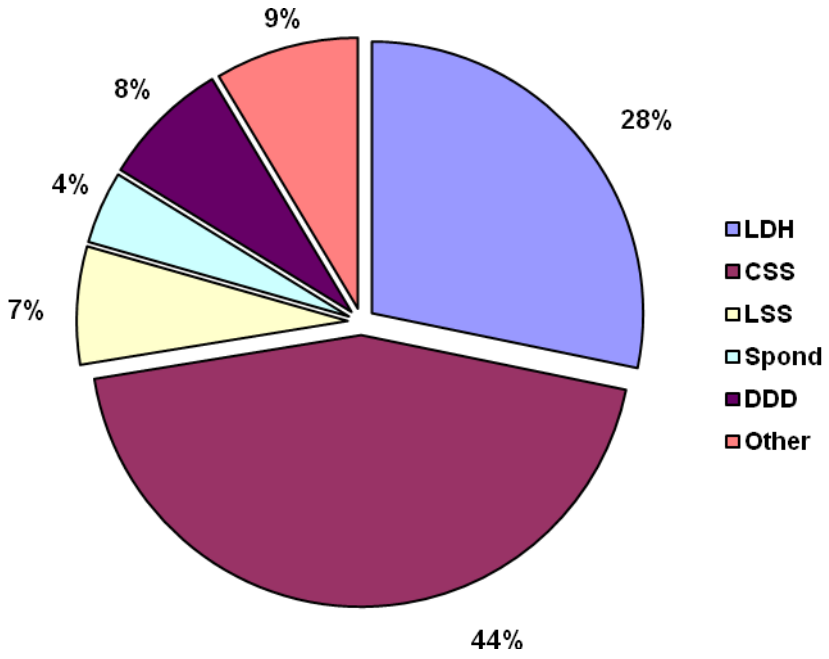


Fig. 1. Breakdown by diagnosis in the total material 2012, 8012 patients.

Diagnosis-related patient demographics and surgical data are presented below. For each variable there is a varying amount of missing data that is not included in the percent calculations.

Disc herniation

Demographic data

In 2012, 2262 disc herniation surgeries were registered. The patients included 54% men and 46% women. The proportion of smokers was 16%. Mean patient age was 45 (14–90) years and figure 2 shows the age distribution.

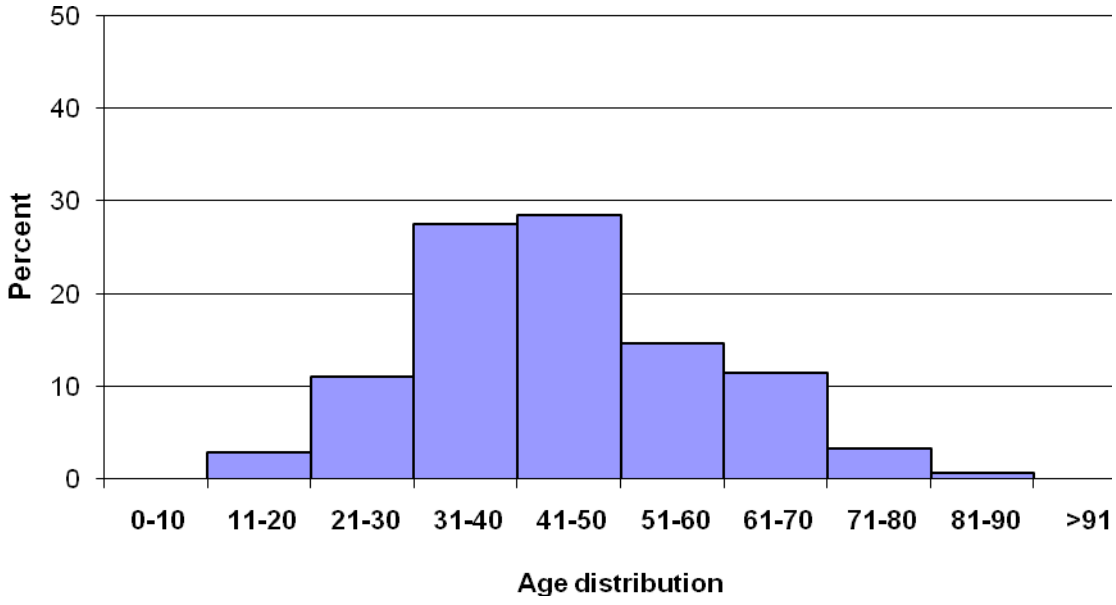


Fig 2. Distribution by age, disc herniation, n = 2262.

The registered disc herniation removal was the first lumbar spine surgery for 87% of patients, while 13% had been previously operated.

Preoperative duration of back pain was as follows: 6% had no back pain, 12% had a history of back pain for less than 3 months, 49% 3-12 months, 14% 1-2 years and 19% more than 2 years. Preoperative duration of leg pain/sciatica was as follows: 1% had no leg pain, 17% had leg pain for less than 3 months, 55% for 3-12 months, 15% for 1-2 years and 12% had pain for more than 2 years. Mean back pain on the visual analog scale (VAS) was 50 with a spread from 0–100, while mean leg pain/sciatica on the VAS was 68 with the same spread from 0–100. Distribution regarding both back and leg pain can be seen in figures 3 and 4.

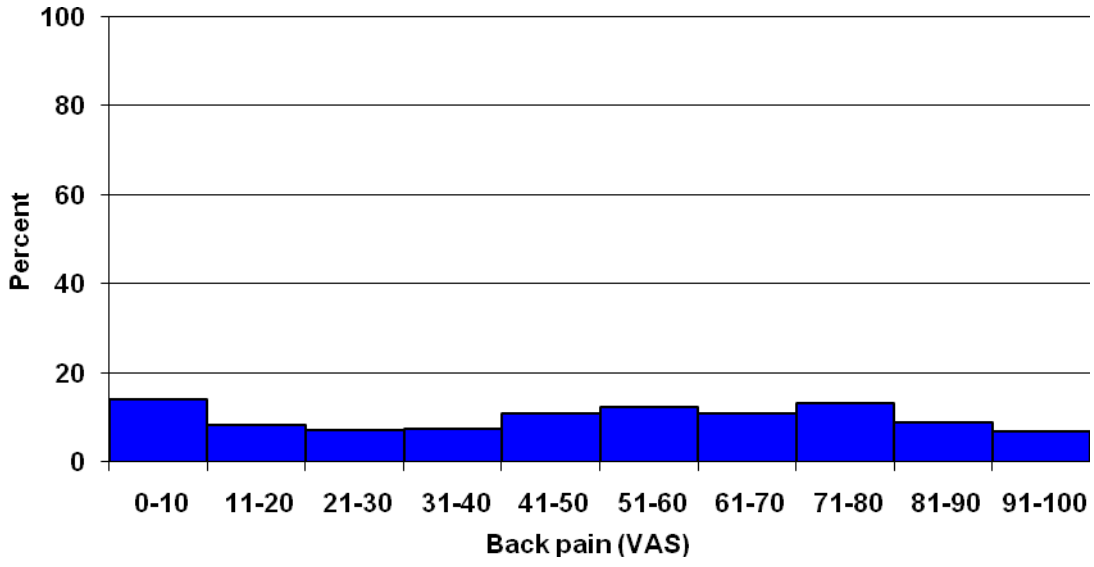


Fig 3. Distribution of back pain intensity measured with VAS (visual analogue scale) preoperatively in patients with disc herniation (%).

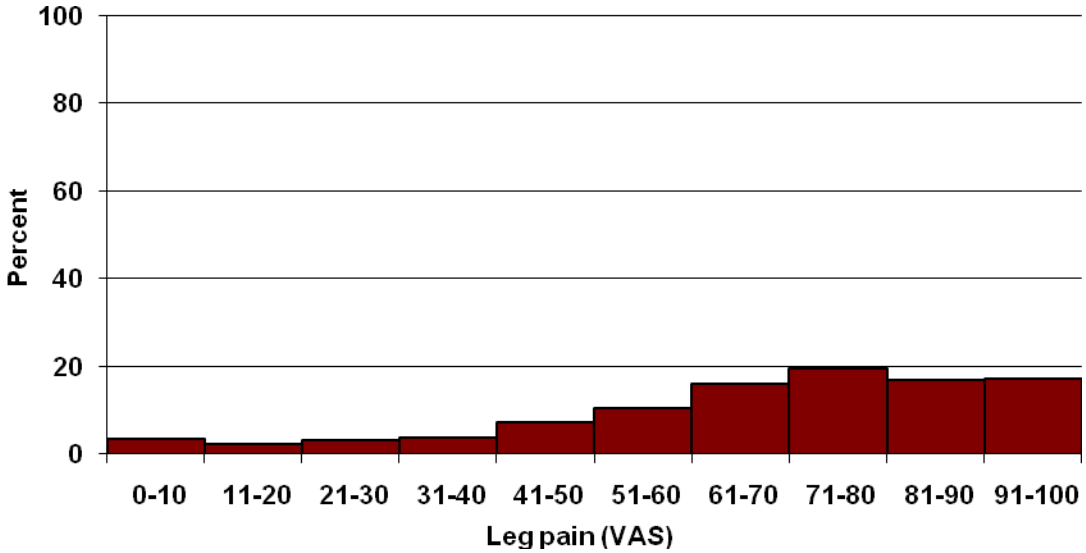


Fig 4. Distribution of leg pain intensity measured with VAS (visual analogue scale) preoperatively in patients with disc herniation (%).

Regular analgesic use was reported by 63% of patients, intermittent use by 27%, while 10% reported that they did not take any form of analgesics.

Walking distance was estimated at less than 100m by 30% of patients, 100–500m by 23% of patients, 500 m–1km for 15% of patients and more than 1 km by 33% of patients.

Surgical data

Conventional discectomy was carried out in 48% of cases and microscopic discectomy in 41%. The remaining procedures consisted of various combinations mainly involving decompressive surgery for patients with disc herniation and spinal stenosis. Mean length of stay in days, i.e., time from admission through discharge, was 2.58 (0-28).

Central spinal stenosis

Demographic data

A total of 3540 patients were registered for operations for central spinal stenosis in 2012. The patients included 46% men and 54% women. Mean age was 68 (19–97) years. Figure 5 shows the age distribution.

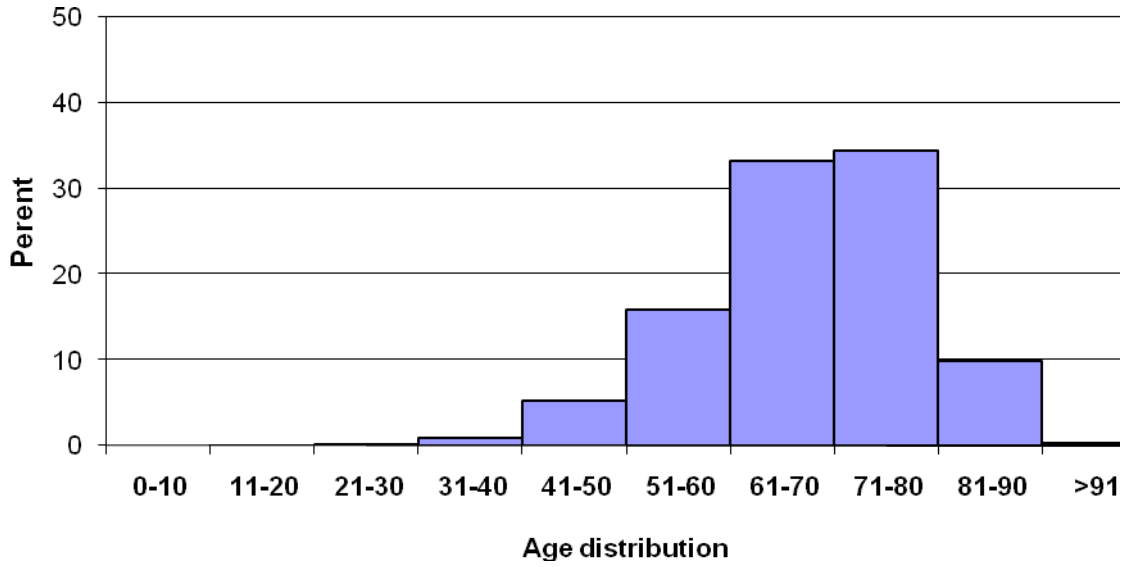


Fig 5. Distribution by age, central spinal stenosis, n = 3540 patients.

The proportion of smokers was 10%. For 78% of patients this operation was their first surgery, while 22% had been previously operated one to three times.

Preoperative duration of back pain was as follows: 5% had no back pain, 2% had a history of back pain for less than 3 months, 19% 3-12 months, 22% 1-2 years and 53% more than 2 years. Regarding leg pain, 4% of patients had no leg pain, 3% of patients with central spinal stenosis reported leg problems for less than 3 months, 27% for 3-12 months, 27% for 1-2 years and 39% reported problems for more than 2 years.

Mean back pain on the VAS in the group was 58 (0-100) and mean leg pain/sciatica (VAS) 63 (0–100). Figures 6 and 7 present the distribution of reported VAS.

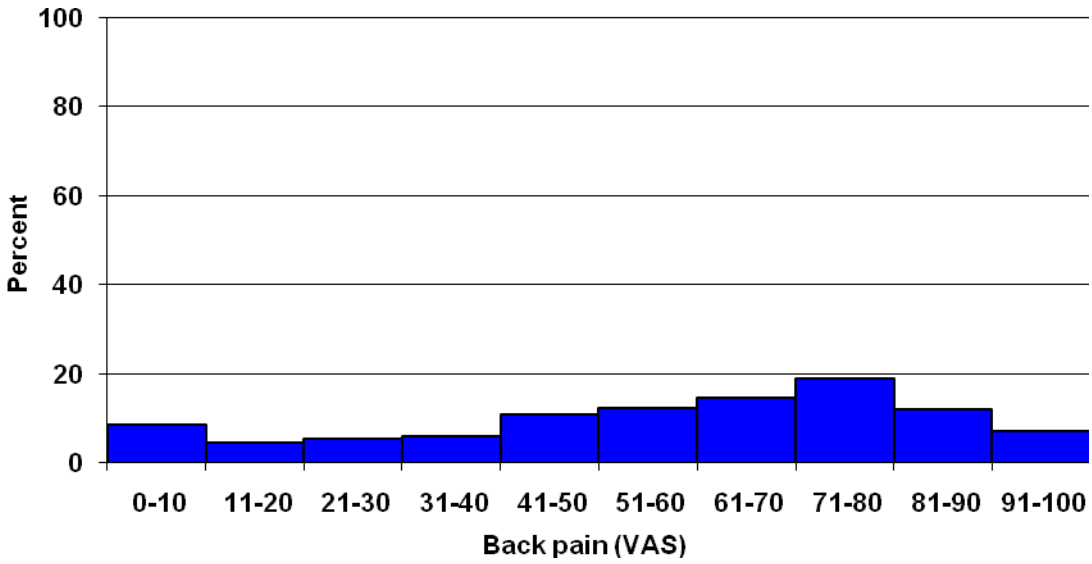


Fig 6. Distribution of back pain intensity measured with VAS (visual analogue scale) preoperatively in patients with central spinal stenosis (%).

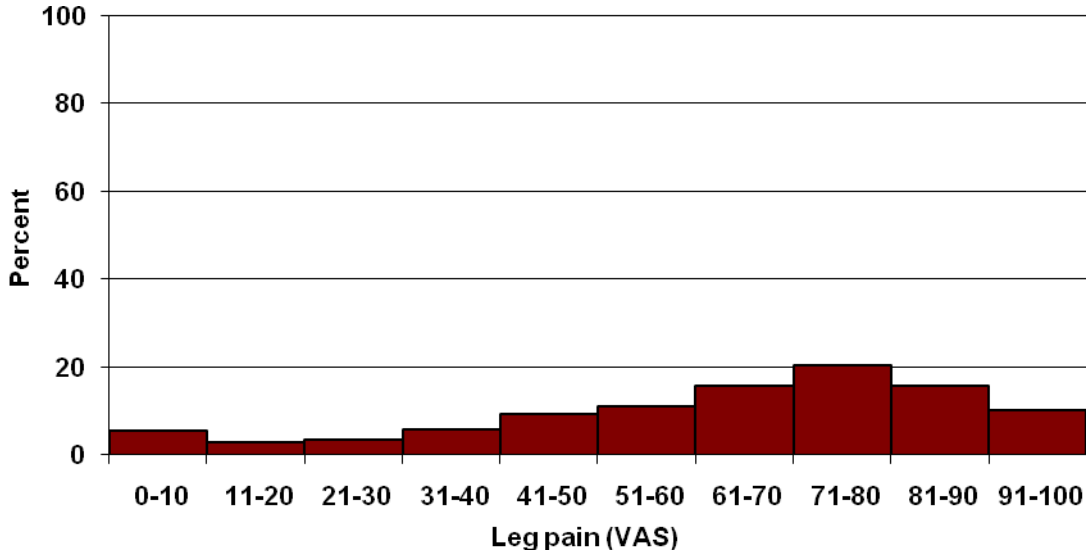


Fig 7. Distribution of leg pain intensity measured with VAS (visual analogue scale) preoperatively in patients with central spinal stenosis (%).

Among patients with central spinal stenosis, 56% reported regular use of analgesics, 29% reported intermittent use and 15% reported that they did not take any analgesic medication.

Walking distance was estimated at less than 100m by 42% of patients, 100–500m by 29% of patients, 500 m–1km for 14% of patients and more than 1 km by 16% of patients.

Surgical data

In 76% of cases only decompressive surgery was carried out, in 55% conventional surgery and in 21% of cases microscopic surgery. Decompression combined with posterior instrumented fusion was carried out in 18% of cases, decompression + posterior non-instrumented fusion in 2%, Decompression + TLIF in 1% and other procedures in 3%.

Mean length of stay in days was 4.16 (0-30).

Lateral spinal stenosis

Demographic data

During the year 562 patients were operated for lateral spinal stenosis. The patients included 48% men and 52% women. The group included 14% smokers.

Mean age was 61 (21–92) years and Figure 8 shows the age distribution.

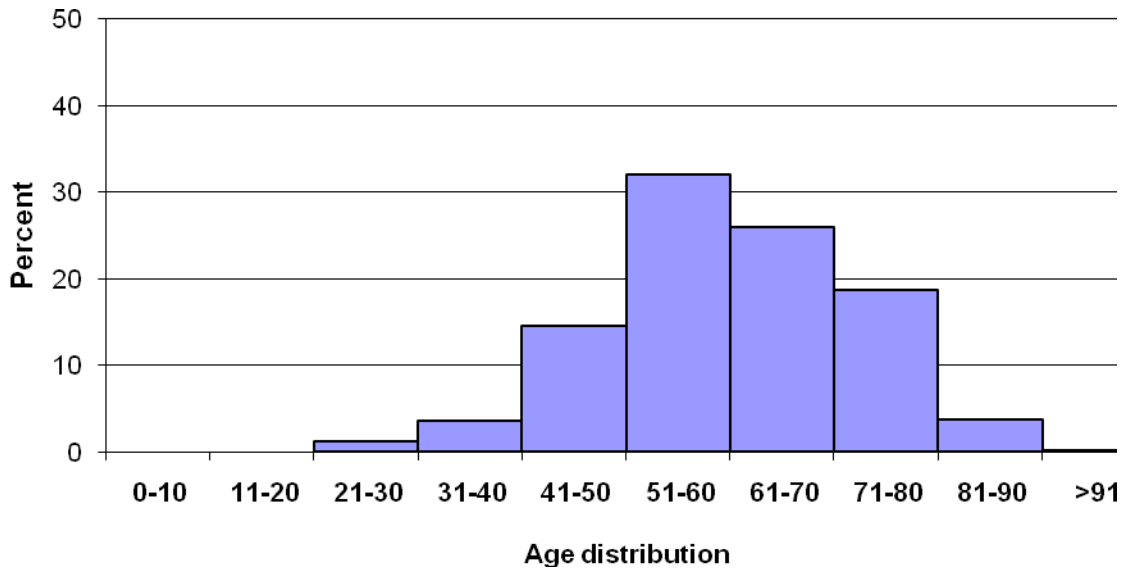


Fig 8. Distribution by age, lateral spinal stenosis, n = 562.

The majority of patients with lateral spinal stenosis, 73%, had had no previous spine surgery while 27% had been operated on one or more times before the current procedure.

Preoperative duration of back pain was as follows: 5% had no back pain, 2% had a history of less than 3 months of back pain, 22% 3-12 months, 21% 1-2 years and 51% more than 2 years. Regarding leg pain, 1% of patients with lateral spinal stenosis had no leg pain, 2% of patients reported leg problems for less than 3 months, 29% for 3-12 months, 27% for 1-2 years and 41% reported problems for more than 2 years. Mean back pain on the VAS in the group was 56 (0–100) and mean leg pain (VAS) 66 (0–100). Figures 9 and 10 present the distribution of reported VAS.

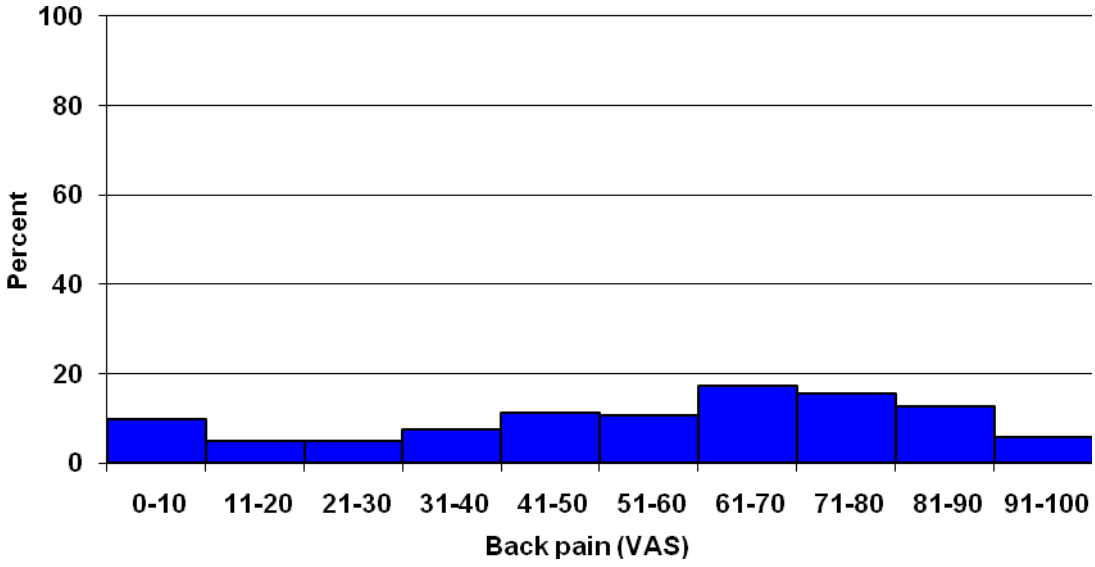


Fig 9. Distribution of back pain intensity measured with VAS (visual analogue scale) preoperatively in patients with lateral spinal stenosis (%).

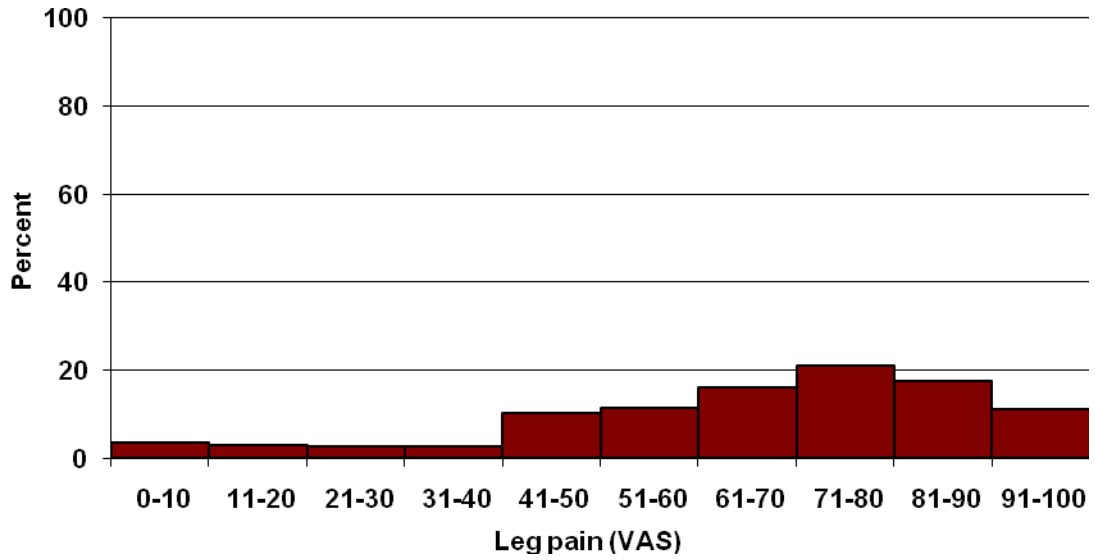


Fig 10. Distribution of leg pain intensity measured with VAS (visual analogue scale) preoperatively in patients with lateral spinal stenosis (%).

Regular analgesic use was reported by 57% of patients, intermittent use by 28%, and 15% reported they did not take any analgesics. The majority of patients reported limited walking ability, 31% reported they were able to walk less than 100m, 34% were able to walk 100–500m, 14% 500 m–1 km and 21% had a walking distance of more than 1 km.

Surgical data

Decompression surgery was the type of procedure in 69% of the cases, including 48% conventional and 21% microscopic decompression. 20% had decompression + posterior instrumented fusion and 3% decompression + TLIF. Mean length of stay was 3.25 (0-26).

Isthmic Spondylolisthesis

Demographic data

A total of 347 patients, including 46% men and 54% women, were reported for 2012. This group included 9% smokers. Mean age was 50 (12–92) years and figure 11 shows the age distribution.

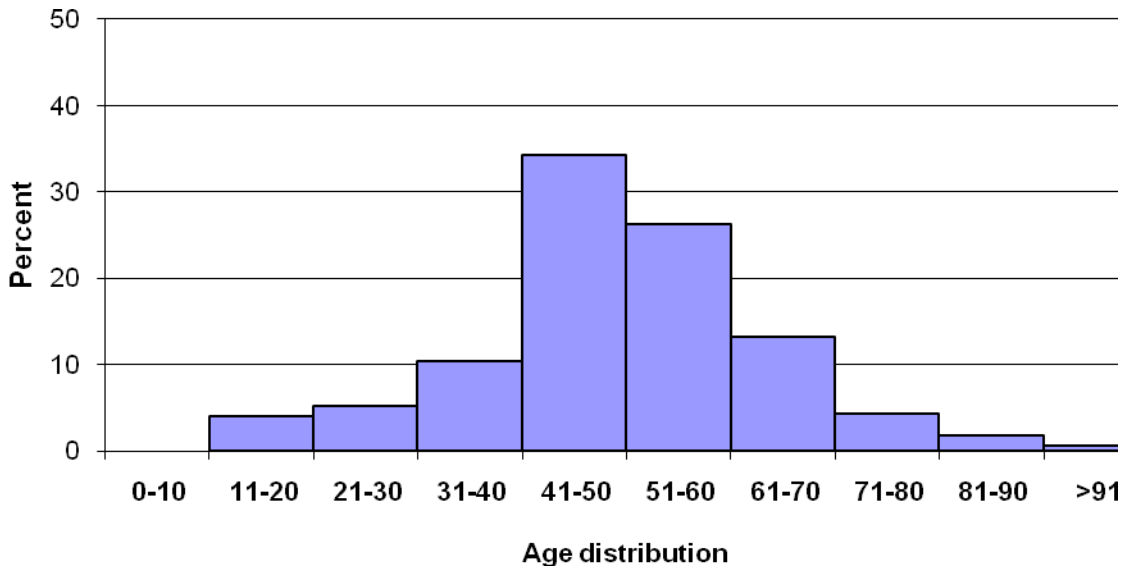


Fig 11. Distribution by age, spondylolisthesis, n = 347 patients.

For 88% of patients the current procedure was the first time they had surgery on the lumbar spine, while the remainder had one or two previous procedures.

Preoperative duration of back pain was as follows: 3% had no back pain, 1% had a history of back pain for less than 3 months, 12% 3-12 months, 20% 1-2 years and 65% more than 2 years. Regarding leg pain, 11% of patients with spondylolisthesis had no leg pain, 2% of patients with spondylolisthesis reported leg problems for less than 3 months, 17% 3-12 months, 24% 1-2 years and 47% reported problems for more than 2 years.

Preoperative lumbar pain on the VAS was 62 (0–100) and preoperative leg pain was 55 (0–100). Figures 12 and 13 present the distribution of pain on the VAS.

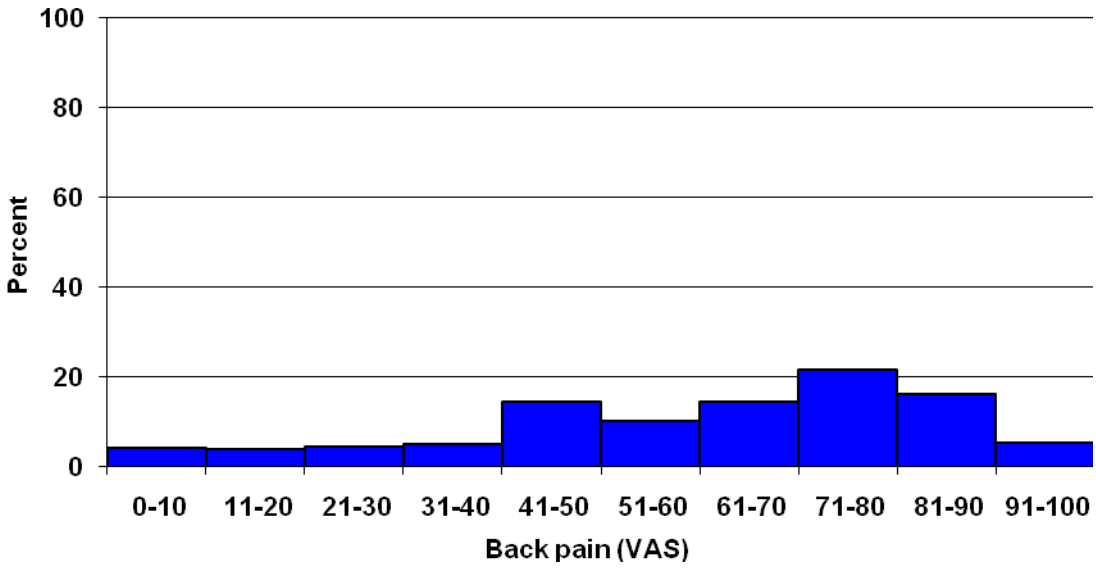


Fig 12. Distribution of back pain intensity measured with VAS (visual analogue scale) preoperatively in patients with spondylolisthesis (%).

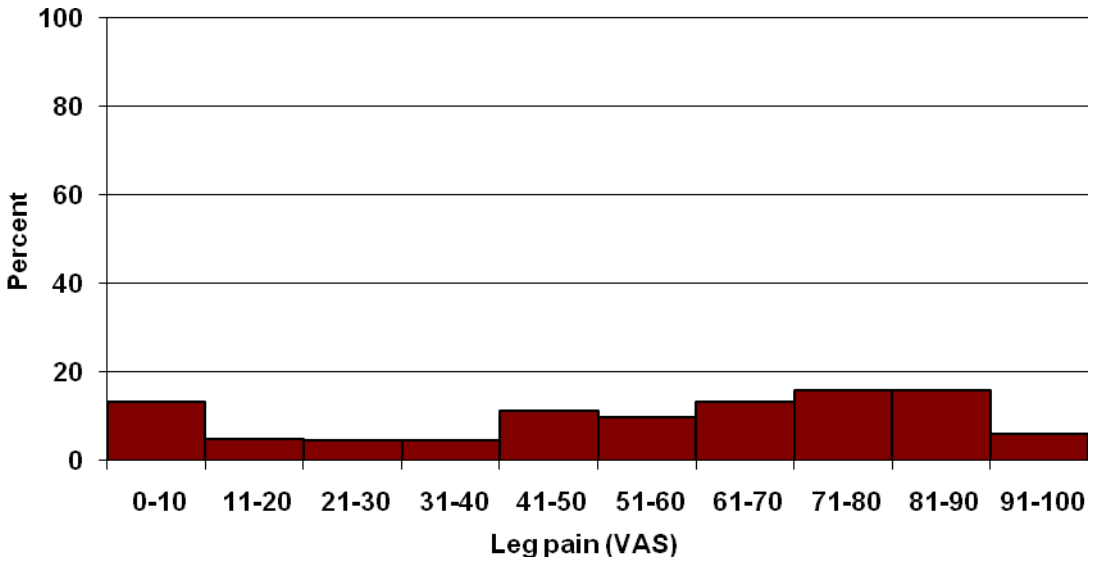


Fig 13. Distribution of leg pain intensity measured with VAS (visual analogue scale) preoperatively in patients with spondylolisthesis (%).

Regular analgesic use was reported by 49% of patients, intermittent use by 31% of patients while 20% did not use analgesics.

Walking distance was estimated at less than 100m by 18% of patients, 100–500m by 26% of patients, 500 m–1km for 18% of patients and more than 1 km by 38% of patients.

Surgical data

Patients with spondylolisthesis had a variety of different procedures. They are presented in descending order of frequency: Decompression + instrumented fusion 57%, posterior instrumented fusion 17%, PLIF with or without implant 12%, Decompression + TLIF 4%, Decompression + PLIF 3%, decompression + non-instrumented fusion 2%, posterior non-instrumented fusion 1% and decompressive interventions in the remaining cases.

Mean length of stay in days was 5.10 (1-15).

DDD (disc degenerative disorder)/segmental pain

Demographic data

A total of 612 patients were registered for surgical intervention for DDD in 2012, including 45% men and 55% women. The proportion of smokers was 6%. Mean age was 47 (20–811) years and figure 14 shows the age distribution.

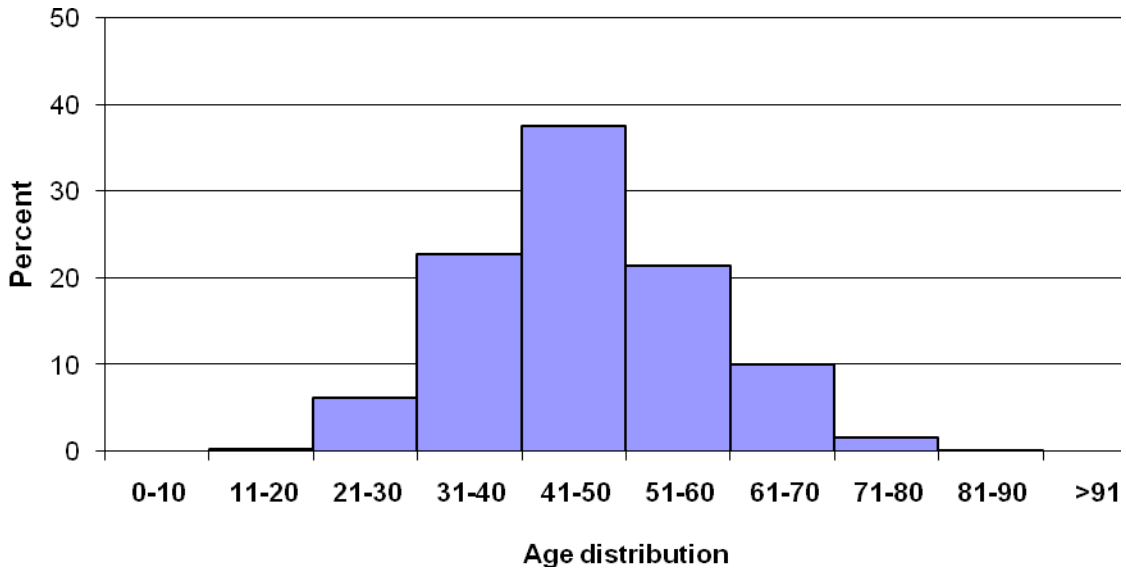


Fig 14. Distribution by age, DDD, N = 612 patients.

In this group of patients, 64% had surgery for the first time, while 36% had been operated one or more times previously.

Preoperative duration of back pain in patients with DDD was as follows: 13% 3-12 months, 18% 1-2 years and 69% had a history of back pain for more than 2 years. Regarding leg pain, 21% of patients with DDD had no leg pain, 1% reported leg problems for less than 3 months, 15% 3-12 months, 22% 1-2 years and 42% reported problems for more than 2 years.

Estimation on the VAS scale for back pain showed a mean of 65 (0-100) and leg pain, 43 (0-100). Figures 15 and 16 present the distribution of pain on the VAS.

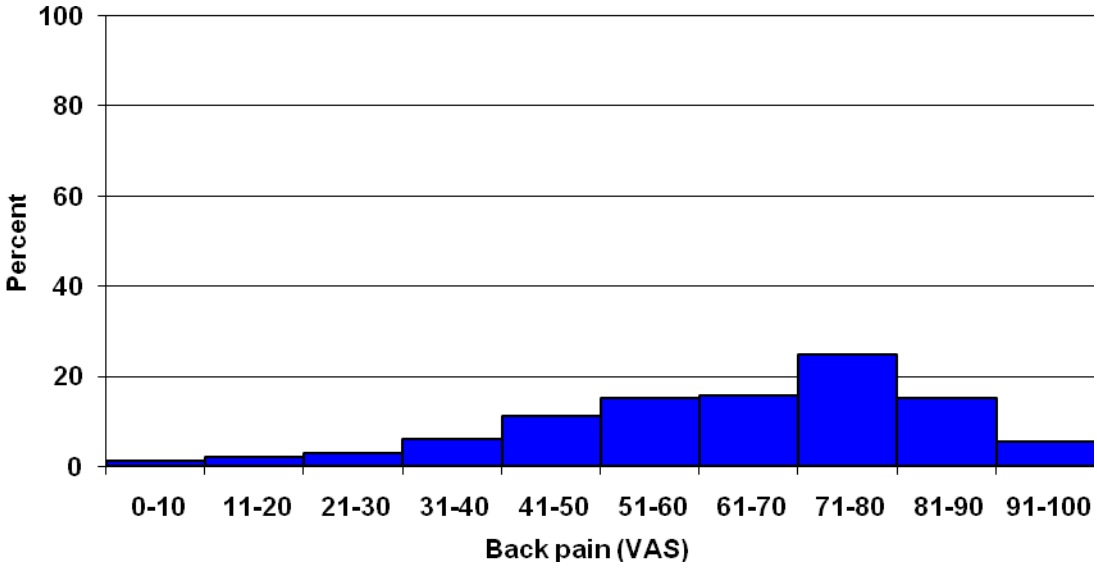


Fig 15. Back pain on the visual analogue scale preoperatively in patients with DDD (%).

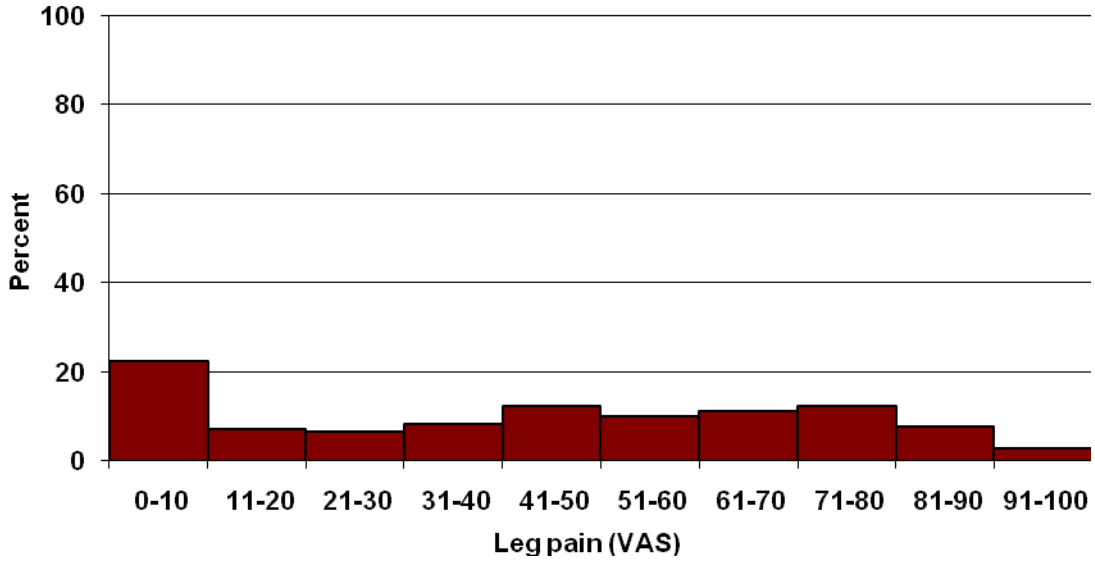


Fig 16. Leg pain on the visual analogue scale preoperatively in patients with DDD (%).

Regular analgesic use was reported by 56% of patients, intermittent use by 35% while 10% never took analgesics.

Walking distance was estimated at less than 100m by 11% of patients, 100–500m by 20% of patients, 500 m–1km for 24% of patients and more than 1 km by 45% of patients.

Surgical data

A wide surgical treatment spectrum was also seen for this diagnosis, as follows: Posterior instrumented fusion 33%, PLIF 20%, disc replacement 17%, decompression + posterior

instrumented fusion 12%, decompression + TLIF 5%, TLIF 3%, decompression + PLIF 3%, ALIF with instrument 2%, decompression + posterior non-instrumented fusion, 2% posterior non-instrumented fusion 1% as well as a smaller quantity other interventions. Mean length of stay was 4.90 (0-14) days.

II. 1-year follow-up of lumbar spine procedures in Sweden in 2012

A total of 7659 patients were operated in 2011 and 5719 (75%) completed 1-year of follow-up (FU). The distribution is as follows: disc herniation 1534, central spinal stenosis 2771, lateral spinal stenosis 436, spondylolisthesis 263 and DDD 485. Patients with "other operations" (230) are not presented in the following results.

Disc herniation

Of 1534 patients who were operated for lumbar disc herniation and completed 1-year follow-up, 56% were men and 44% women, with a mean age of 45 (15–91) years.

Mean preoperative VAS for back pain was 51, compared with 26 at FU. The corresponding figures for leg pain were 67 preoperatively, and 22 at FU. Figures 17 and 18 showVAS for back and leg pain preoperatively and at FU.

Surgical interventions: 45% conventional discectomy, 41% microscopic discectomy, 9% decompression surgery alone and 5% other procedures.

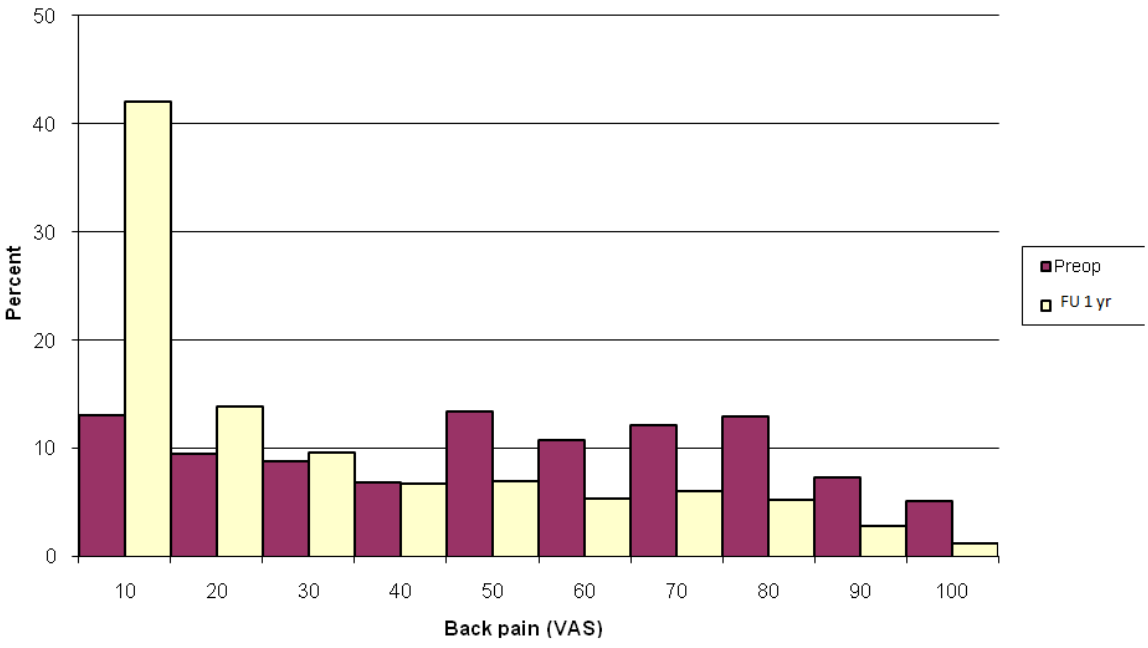


Fig 17. Distribution of back pain intensity measured with VAS (visual analogue scale) preoperatively and at 1 year FU in patients operated for lumbar disc herniation in 2011 (%).

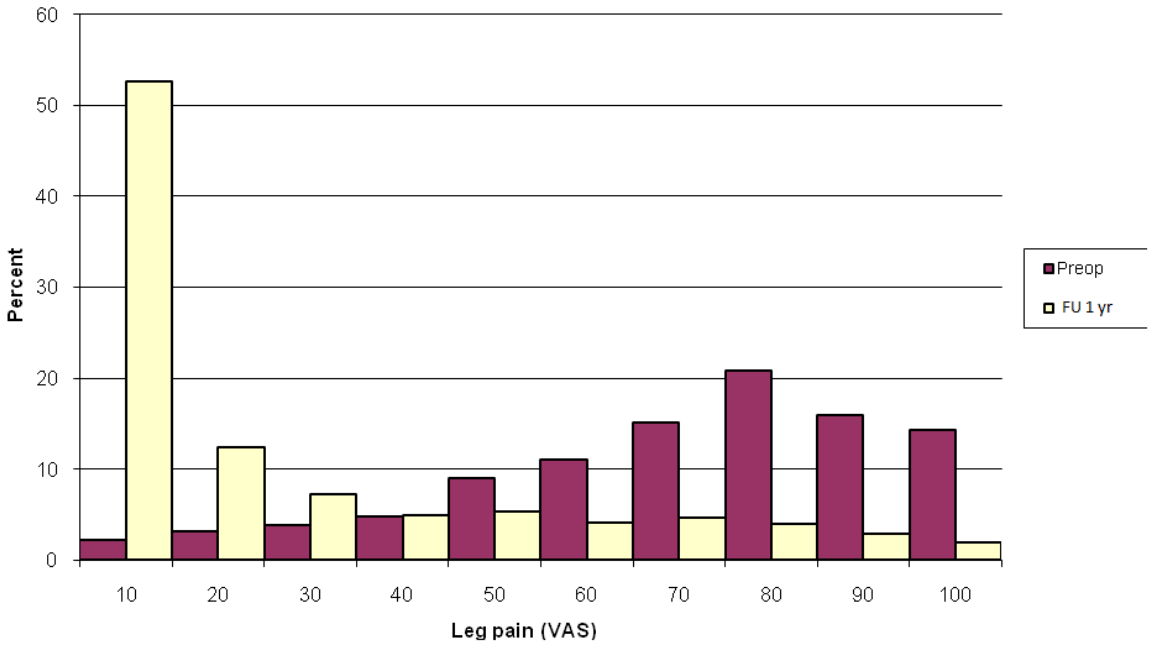


Fig 18. Distribution of leg pain intensity measured with VAS (visual analogue scale) preoperatively and at 1 year FU in patients operated for lumbar disc herniation in 2011 (%).

Patient rated improvement of back pain measured with Global Assessment at FU: Completely pain-free 20%, significantly improved 47%, somewhat improved 17%, unchanged 5% and deteriorated 4%; 6% did not have preoperative back pain.

Patient rated improvement of leg pain measured with Global Assessment at FU: Completely pain-free 36%, significantly improved 39%, somewhat improved 14%, unchanged 5% and deteriorated 4%; 2% had no preoperative leg pain.

Overall patient satisfaction with surgical outcome: 76% were satisfied, 16% uncertain and 8% dissatisfied.

Use of analgesics at 1 year FU: Regular 18%, intermittent 31%, none 51%.

Ability to walk at 1 year FU: < 100m 5%, 100-500m 7%, 500m-1 km 11%, >1 km 77%, a substantial improvement compared with preoperatively.

Figure 19 shows health-related quality of life as measured with the SF-36 preoperatively and at 1 year FU.. The improvement is significant in all domains except “General health”.

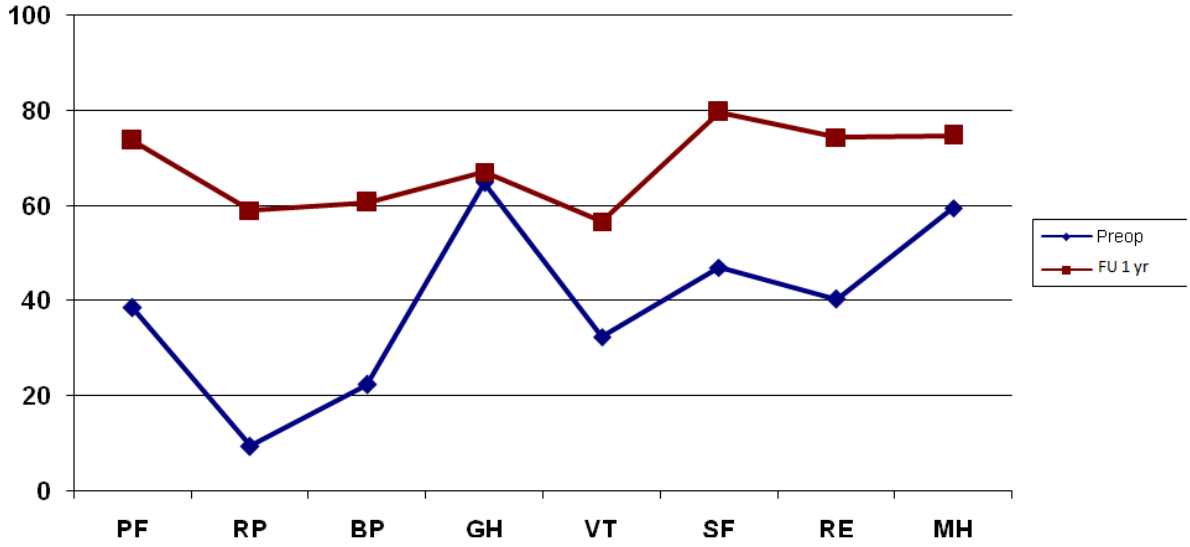


Fig 19. SF-36 preoperatively and at 1 year FU for patients operated for lumbar disc herniation in 2011.

The results from the EQ-5D-analysis are presented both as EQ-5D 5, i.e. the answers of the 5 questions included in the questionnaire, and also on the VAS scale, EQ-VAS. The results for lumbar disc herniation are as follows: Mean value of EQ-5D 5 preoperatively: 0.2, at 1 year FU0.71. Mean VAS preoperatively (max 100): 46, at 1 year FU 70.

Central spinal stenosis

This group includes 2771 patients with a mean age of 68 (23–95) years.

Gender distribution: 44% men, 56% women.

Surgical intervention: Decompression alone 72%, decompression + posterior instrumented fusion 20%, decompression + posterior non-instrumented fusion 3%, decompression + PLIF 1%, decompression + TLIF 1% and other interventions 3%.

Mean preoperative VAS for back pain was 61, compared with 35 at one year FU. The corresponding figures for leg pain were 64 and 35 respectively. Figures 20 and 21 show VAS for back and leg pain, before surgery and at 1 year FU.

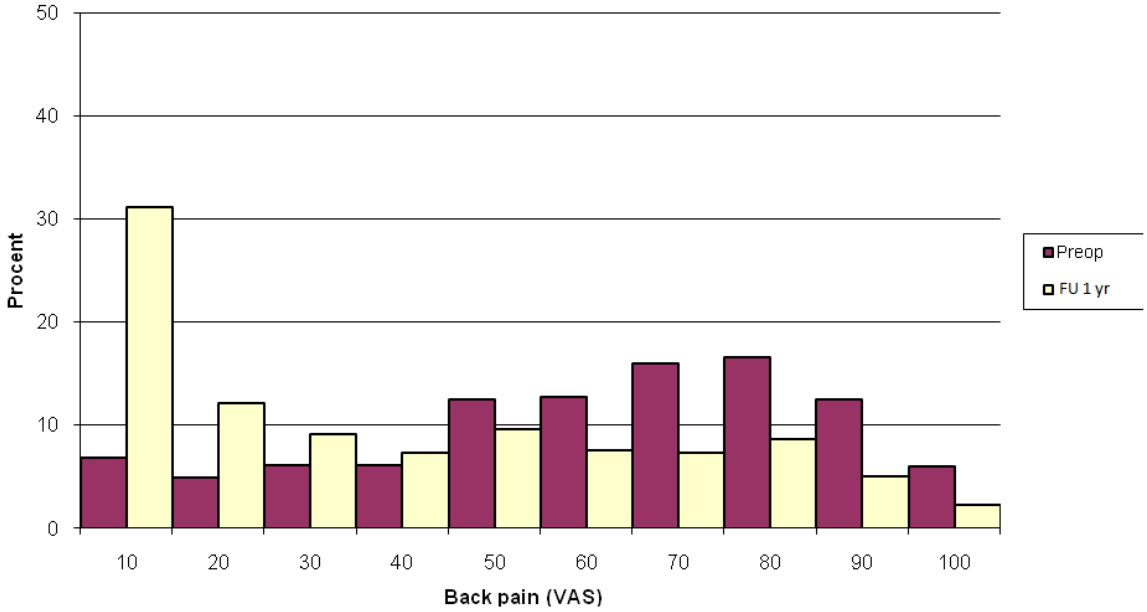


Fig 20. Distribution of back pain intensity measured with VAS (visual analogue scale) preoperatively and at 1 year FU in patients operated for lumbar central spinal stenosis in 2011 (%).

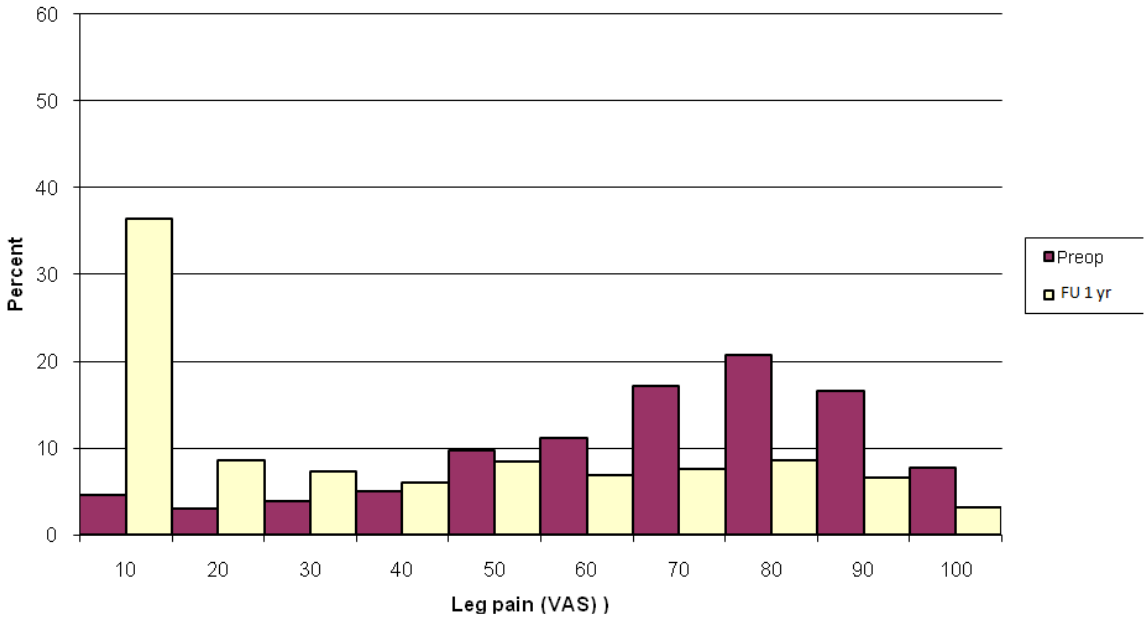


Fig 21. Distribution of leg pain intensity measured with VAS (visual analogue scale) preoperatively and at 1 year FU in patients operated for lumbar central spinal stenosis in 2011 (%).

At 1 year FU, 15% of patients felt they were completely pain-free, 35% significantly improved, 21% somewhat improved, 12% unchanged and 9% deteriorated with regard to back pain; 9% had no preoperative back pain. The corresponding figures for leg pain were 24% completely pain-free, 28% significantly improved, 19% somewhat improved, 12% unchanged and 11% deteriorated; 7% reported no preoperative leg pain.

Overall patient satisfaction with the procedure was as follows: 64% were satisfied, 23% uncertain and 13% dissatisfied with the surgical outcome.

Analgesic use at 1 year FU: Regular 31%, intermittent 33%, none 36%.

Ability to walk at 1 year FU: < 100m 20%, 100-500m 22%, 500m-1 km 15%, >1 km 44%, a substantial improvement compared with preoperatively.

In addition, one year postoperatively patients in the central spinal stenosis category demonstrated improvement of SF-36 score on all points except "General health". The improvement was less pronounced than in disc herniation, see figure 22.

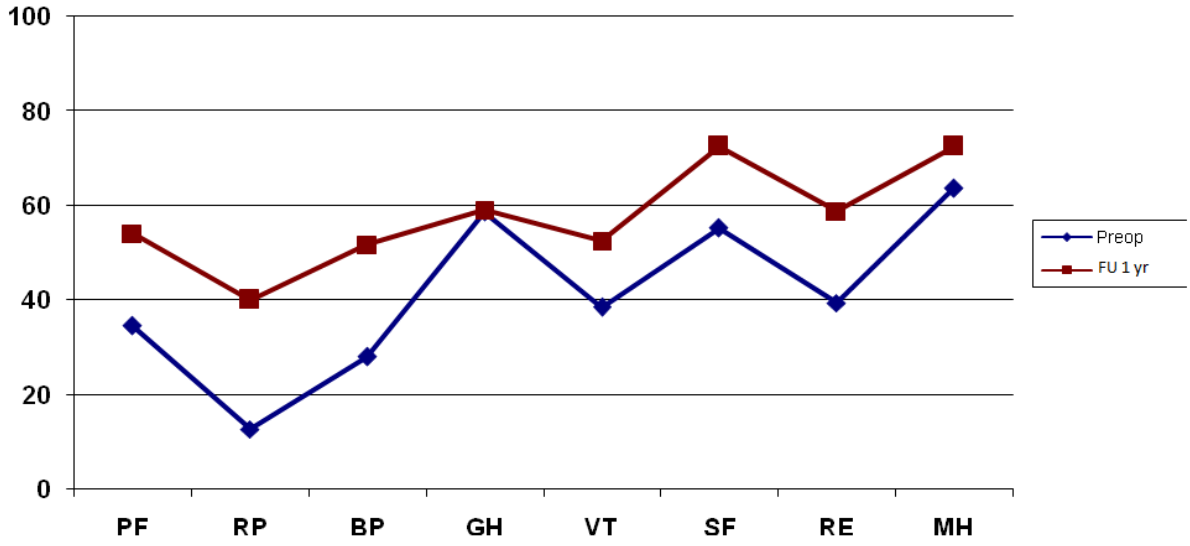


Fig 22. SF-36 preoperatively and at1 year FU for patients operated for lumbar central spinal stenosis 2011.

Mean figure for EQ-5D 5 preoperatively: 0.36, at 1 year FU0.62. Mean VAS preoperatively (max 100): 48, at1 year FU63.

Lateral spinal stenosis

This patient group included 436 patients with a mean age of 61 (18–88) years. Gender distribution was 52% men and 48% women. Decompression alone was used in 71% of cases, decompression + posterior fusion in 20% (18% instrumented and 2% non-instrumented), decompression + TLIF 3%, decompression + PLIF 1% and other procedures 5%.

Mean preoperative VAS for back pain was 56, compared with 36 one year postoperatively. The corresponding figures for leg pain were 67 and 36 respectively. Figures 23 and 24 show the distribution of pre- and postoperative VAS for back and leg pain.

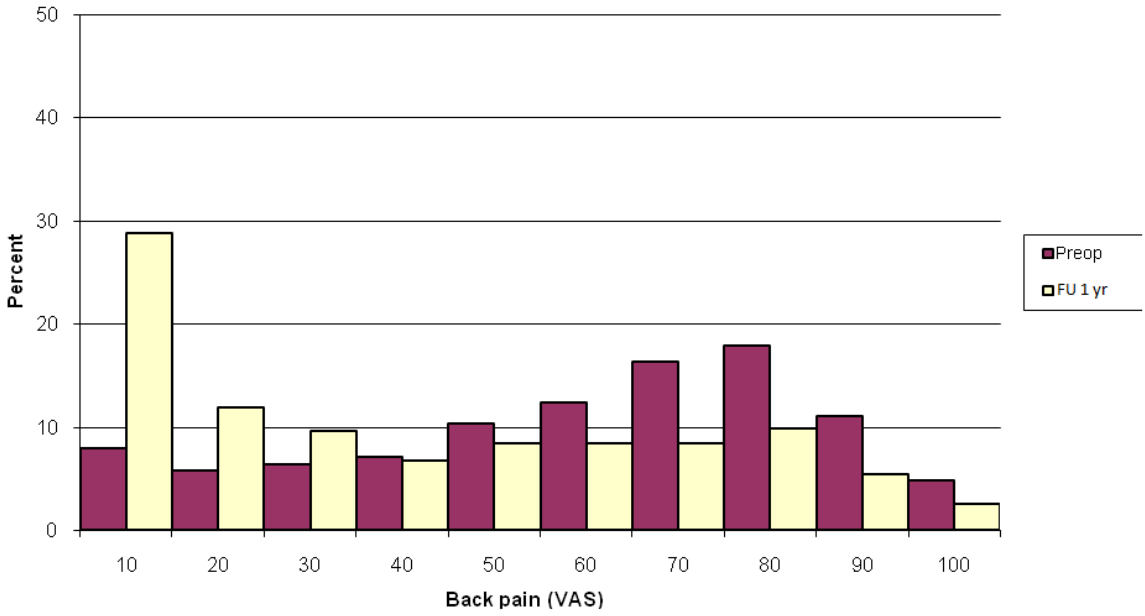


Fig 23.Distribution of back pain intensity measured with VAS (visual analogue scale) preoperatively and at 1 year FU in patients operated for lumbar lateral spinal stenosis in 2011 (%).

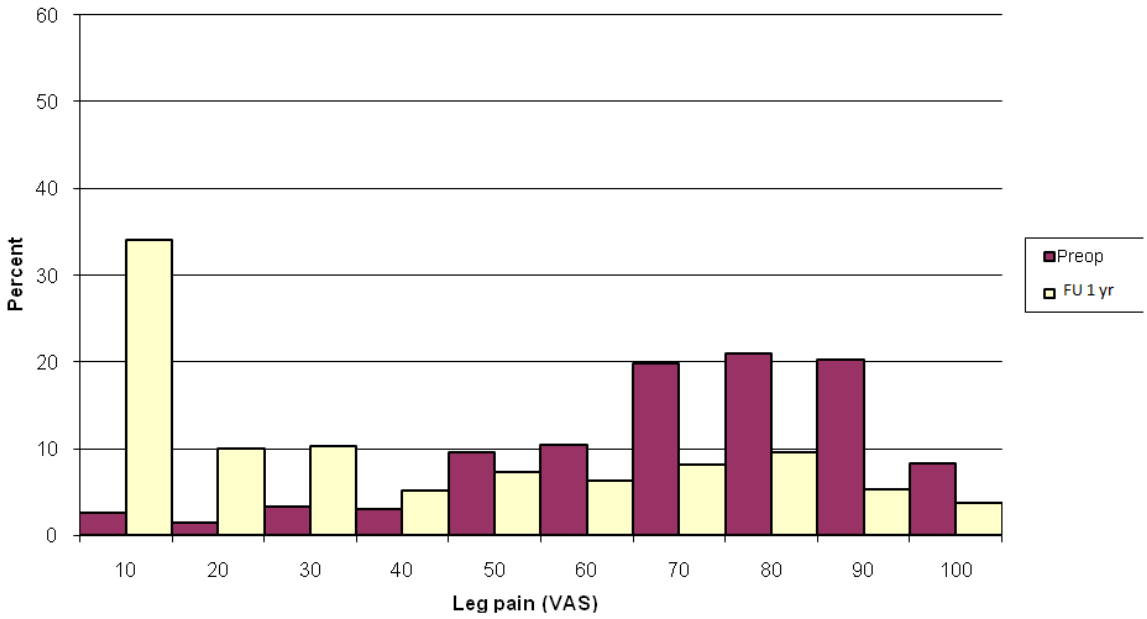


Fig 24. Distribution of leg pain intensity measured with VAS (visual analogue scale) preoperatively and at 1 year FU in patients operated for lumbar lateral spinal stenosis in 2011 (%).

One year postoperatively, 14% of patients were completely pain-free, 37% significantly improved, 21% somewhat improved, 14% unchanged and 8% deteriorated with regard to back pain. 6% had no preoperative back pain. The corresponding figures for leg pain were 24% completely pain-free, 31% significantly improved, 18% somewhat improved, 16% unchanged and 8% deteriorated; 2% did not have leg pain previously.

Patient satisfaction with surgical outcome: 65% satisfied, 21% uncertain and 14% dissatisfied.

Medication use at 1 year FU: Regular 33%, intermittent 33%, none 34%.

Ability to walk one year postoperatively: walking distance of < 100m 15%, 100–500m 8%, 500m–1 km 16% and > 15 km 51%.

The patient group operated for lateral spinal stenosis also showed improvement in SF-36 scores, though somewhat less pronounced; see figure 25.

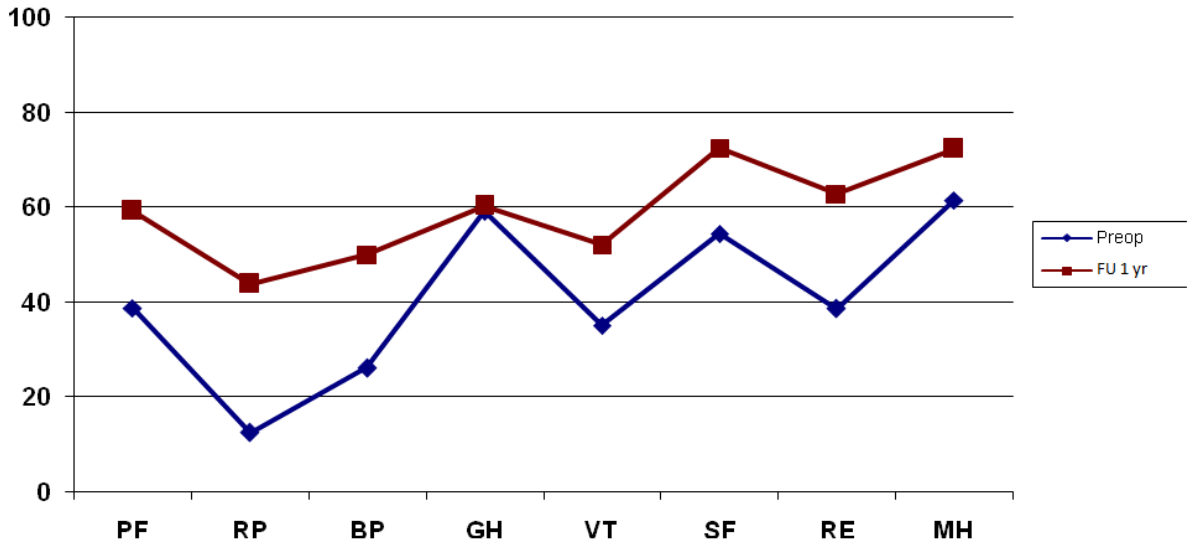


Fig 25. SF-36 preoperatively and at1 year FUfor patients operated for lumbar lateral spinal stenosis in 2011.

Mean figure for EQ-5D 5 preoperatively: 0.32, 1 year postoperatively 0.59. Mean VAS preoperatively (max 100): 45, 1 year postoperatively 63.

Isthmic Spondylolisthesis

In all, 263 patients operated during the period for spondylolisthesis completed 1-year follow-up. Mean age was 50 (14–82) years; gender distribution 47% men and 53% women.

Among the patients with spondylolisthesis, 53% were operated with decompression and posterior instrumented fusion, 15% with posterior instrumented fusion alone, 14% with PLIF, 4% with decompression alone, 4% with decompression + TLIF, 4% with decompression + posterior non-instrumented fusion, 2% with decompression + PLIF, 1% with posterior non-instrumented fusion, 2% with decompression + PLIF, 1% posterior non-instrumented fusion and 3% other procedures.

Mean preoperative VAS for back pain was 62, compared with 29 at one year FU. The corresponding figures for leg pain were 55 and 25 respectively. Figures 26 and 27 show VAS recordings of back and leg pain preoperatively and at 1 year FU.

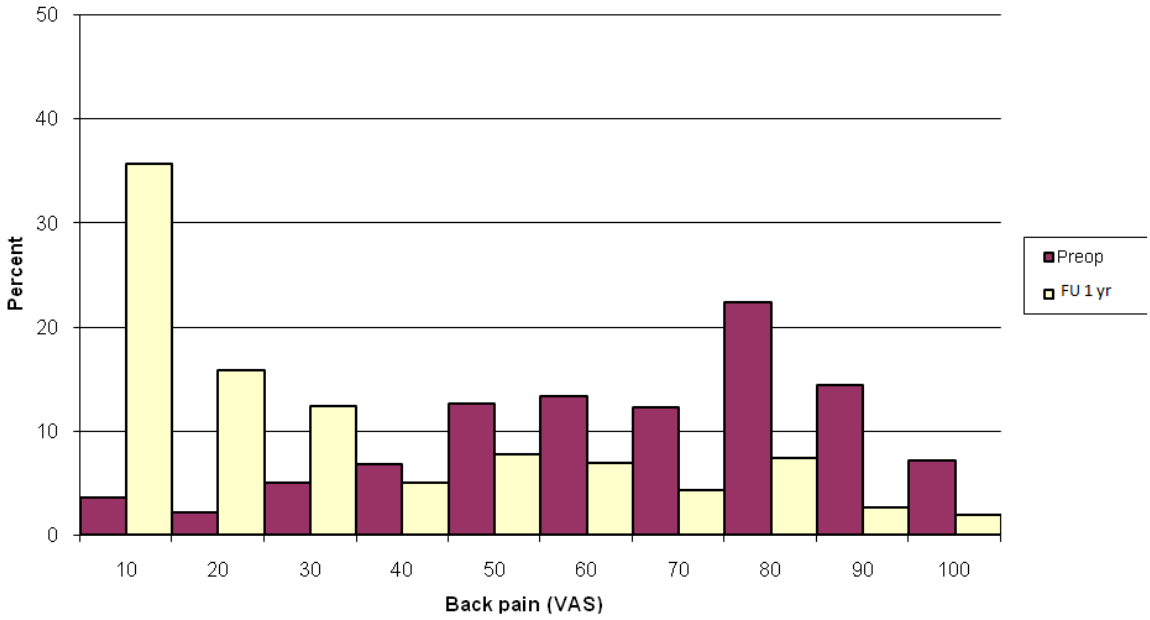


Fig 26. Distribution of back pain intensity measured with VAS (visual analogue scale) preoperatively and at1 year FU in patients operated for spondylolisthesis in 2011 (%).

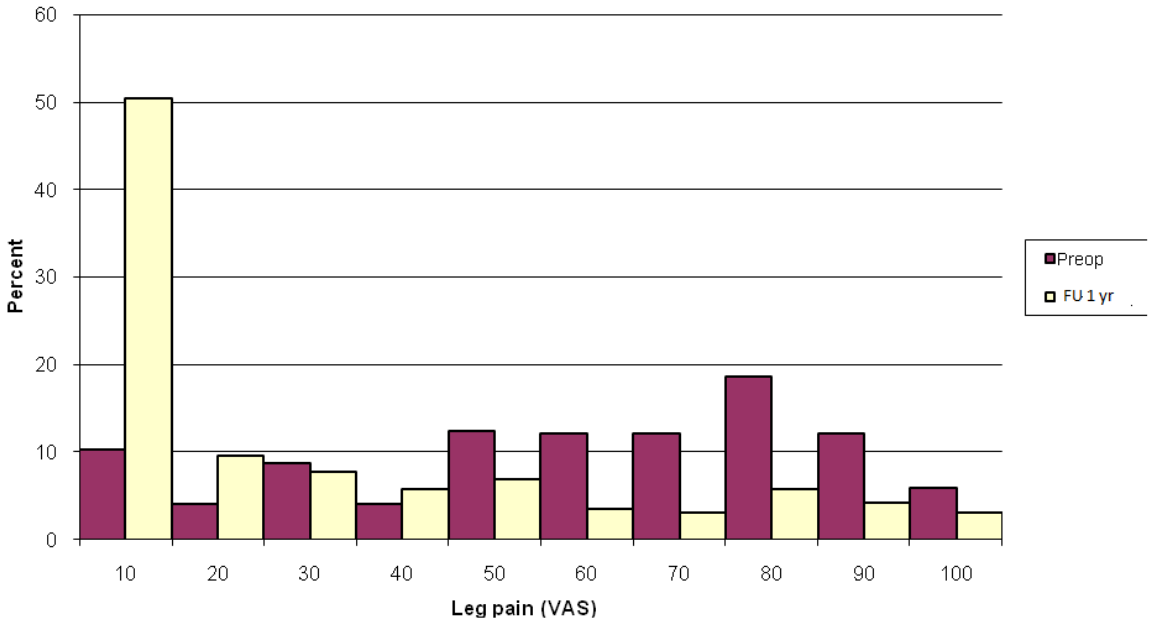


Fig 27. Distribution of leg pain intensity measured with VAS (visual analogue scale) preoperatively and at 1 year FUin patients operated for spondylolisthesis in 2011 (%).

At the 1-year follow-up, 17% of patients felt they were completely pain-free, 42% significantly improved, 22% somewhat improved, 7% unchanged and 6% deteriorated with regard to back pain; 6% did not have back pain previously. The corresponding figures for leg pain were 31% completely pain-free, 30% significantly improved, 16% somewhat improved, 8% unchanged and 8% deteriorated; 7% reported no preoperative leg pain.

Overall patient satisfaction with the operation: 72% satisfied, 19% uncertain and 9% dissatisfied.

Regular intake of analgesics at one year FU was reported by 24%, intermittent use by 31% and no intake of analgesics at all by 46%.

Ability to walk at one year FU: < 100m 6%, 100-500m 8%, 500m-1 km 13%, >1 km 73%, a substantial improvement compared with preoperatively.

Spondylolisthesis patients showed good improvement in their SF-36 scores at one year FU compared with preoperatively; see figure 28.

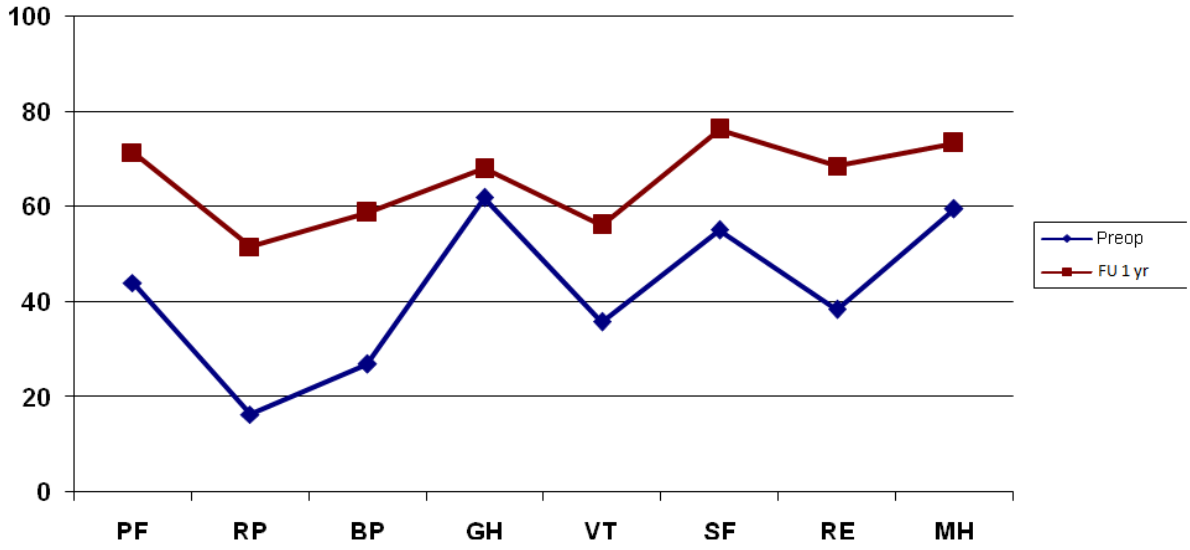


Fig 28. SF-36 preoperatively and at 1 year FU for patients operated for spondylolisthesis in 2011.

Mean value for EQ-5D preoperatively: 0.33, 1 year postoperatively 0.71. Mean VAS preoperatively (max 100): 46, 1 year postoperatively 70.

DDD (disc degenerative disorder)/segmental pain

In all, 1-year follow-up was completed by 485 patients operated during the period. Mean age was 47 (16–80) years, gender distribution 43% men and 57% women.

In 29% of cases patients with DDD were operated with posterior instrumented fusion, in 18% with PLIF, in 18% with disc replacement, in 15% with decompression + posterior instrumented fusion, in 5% with decompression + TLIF, in 5% with TLIF, in 5% with decompression + PLIF, in 1% with posterior non-instrumented fusion and in 4% with other procedures.

Mean preoperative VAS for back pain was 65, compared with 30 at one year FU. The corresponding figures for leg pain were 43 and 23 respectively. Figures 29 and 30 show VAS recordings of back and leg pain preoperatively and at one year FU.

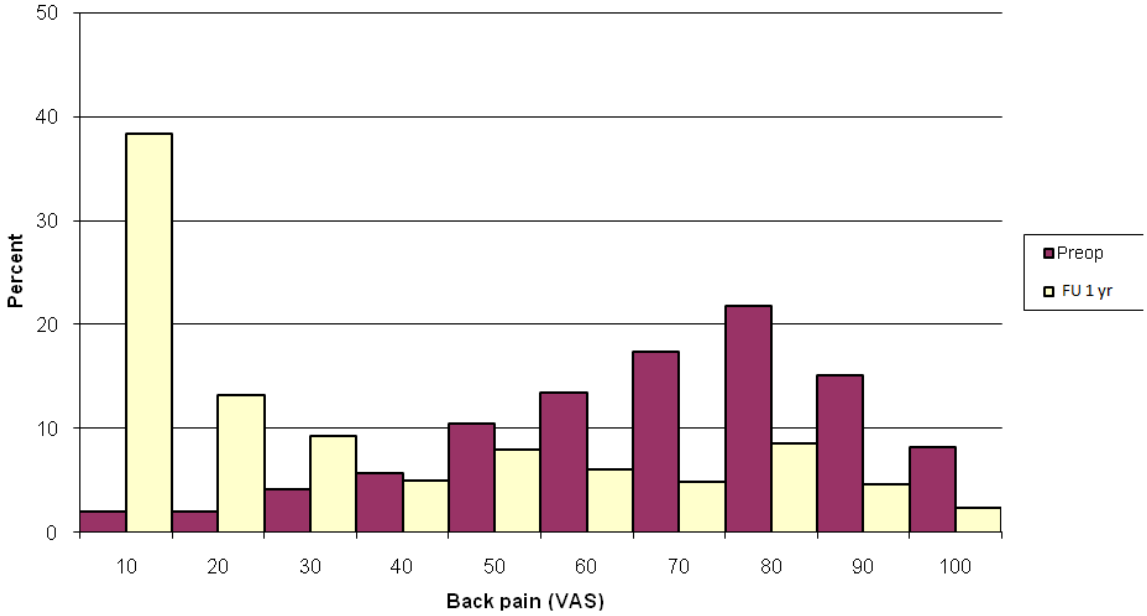


Fig 29. Distribution of back pain intensity measured with VAS (visual analogue scale) preoperatively and at1 year FU in patients operated for DDD in 2011 (%).

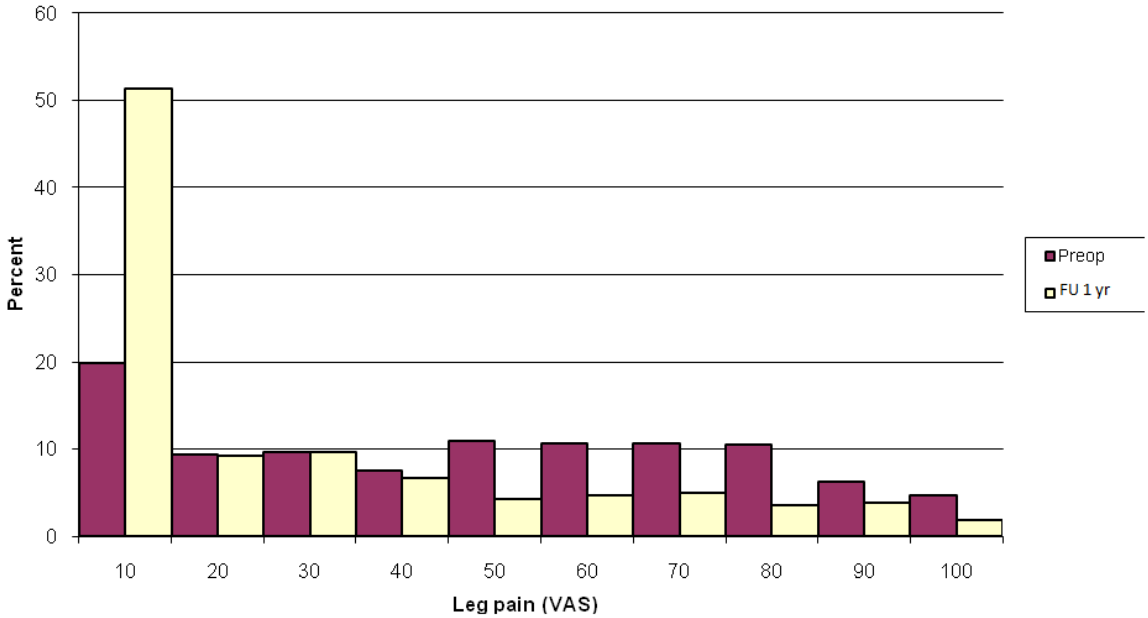


Fig 30. Distribution of leg pain intensity measured with VAS (visual analogue scale) preoperatively and at 1 year FU in patients operated for DDD in 2011 (%).

At one year FU, patients operated for DDD perceived back pain as follows: Completely pain-free 19%, significantly improved 46%, somewhat improved 17%, unchanged 11% and deteriorated 6%; 1% did not have back pain previously.

Corresponding figures for leg pain: Completely pain-free 24%, significantly improved 29%, somewhat improved 17%, unchanged 9% and deteriorated 9%; 14% reported no preoperative leg pain.

Regarding patient satisfaction with outcome of surgery, 74% were satisfied, 17% uncertain and 9% dissatisfied.

Among these patients, 29% took analgesics regularly one year postoperatively, 31% did so intermittently and 40% reported that they did not use any analgesics.

Ability to walk at one year FU: < 100m 5%, 100-500m 10%, 500m-1 km 13%, >1 km 72%, a substantial improvement compared with preoperatively.

Figure 31 shows the SF-36 profiles for patients operated for DDD preoperatively and at 1 year FU; the profiles are similar to the other diagnoses. Both the physical and mental domains show improvement.

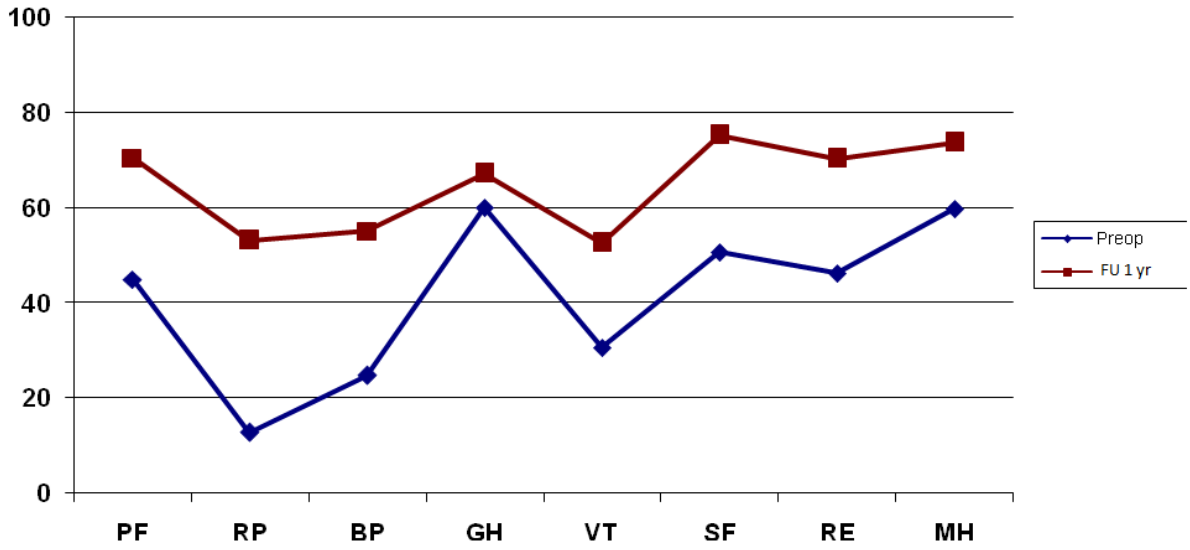


Fig 31. SF-36 preoperatively and 1 year postoperatively for patients operated for DDD in 2011.

Mean figure for EQ-5D 5 preoperatively: 0.32, at 1 year FU0.64. Mean value on the scale preoperatively (max 100): 45, at 1 year FU68.

Oswestry Disability index (ODI) pre-op and 1 year follow-up for all diagnoses

Below is a comparison of functional capacity as measured by the Oswestry disability index (ODI) preoperatively and at 1 year FU. All diagnoses show a significant reduction in measured functional limitation; most pronounced is disc herniation; see figure 32. A score of 0-20 is regarded as no or little "disability".

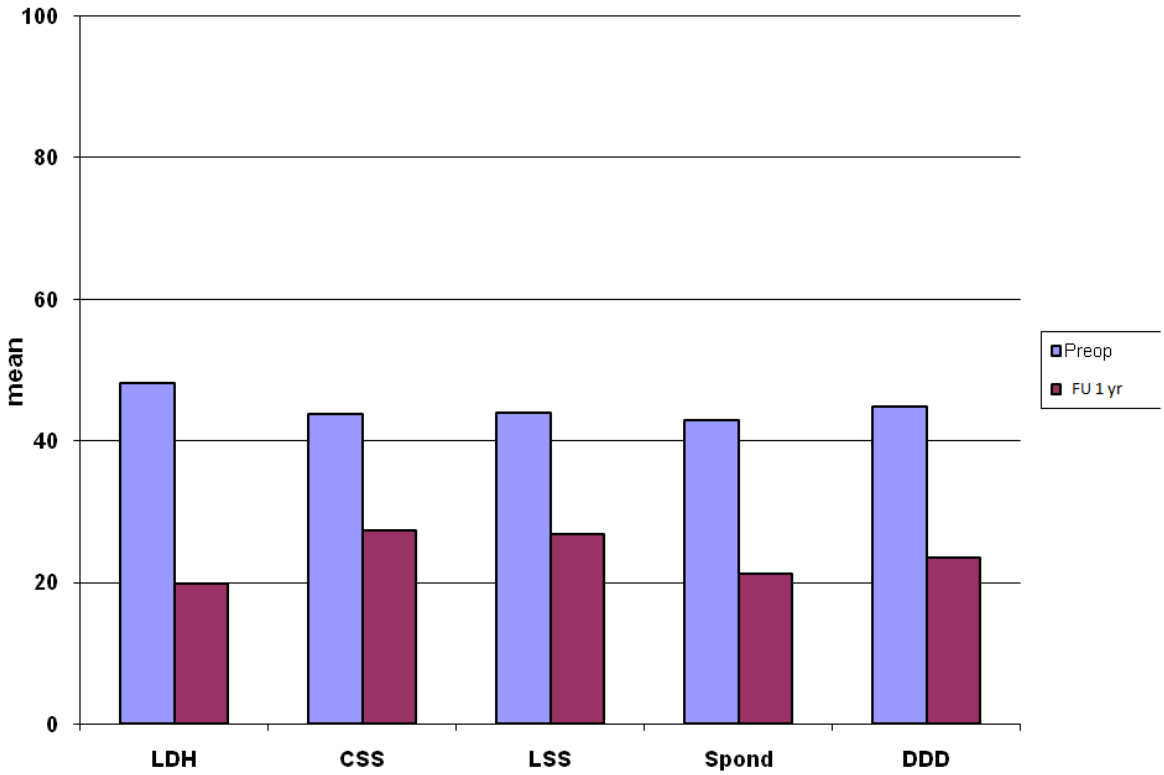


Fig 32. ODI score before and one year after lumbar spine surgery, related to diagnosis, for patients operated in 2011.

III. Analysis of outcome after lumbar spine surgery at 1-year follow-up by treatment center

The following section compares surgical outcomes at 1-year follow-up at the different centers in Sweden for the diagnoses presented above. To obtain a sufficient sample size the analysis is based on three years, 2009-2011. The comparison only includes centers that registered >=60 procedures with follow-up data during the three-year period. Outcomes and case-mix adjusted outcomes (see "Adjustment for case-mix" below) are reported for each outcome measure.

We would like to emphasize that the results presented here must be interpreted with great caution. The main reason is, that even with the case-mix adjustment, there are unknown confounders that also affect the outcome, but to an unknown degree.
A second reason is that even if a difference can be statistically significant, the size of the difference must be considered to determine whether it is clinically relevant.
A third reason is that for statistical reasons, the difference between two centers can be unreliable, even if the confidence interval does not overlap. The most reliable difference from a statistical point of view is in relation to the national average.

Adjustment for case mix

When comparing various care providers with respect to outcome of a treatment method based on data that do not consist of a random selection, consideration must be taken to the potential differences in patient case mix; i.e., whether the patients differ in some way that could influence the expected final outcome. Systematic differences in patient population could otherwise lead to different results that do not reflect differences in quality of care.

This problem is present in Swespine's outcome measures. Consequently this report presents figures adjusted for differences in case mix in order to compare outcome at different centersas fairly as possible. There is currently no accepted standard for how to adjust for case mix, but several proposals have been presented internationally. In this report, we basically followed the methodology presented by the British Department of Health: The Case-Mix Adjustment Methodology for Patient Reported Outcome Measures (PROMs), since it is suitable for the quantity of data in Swespine. The methodology is as follows:
Calculate the average outcome for each center (yi) and the average outcome for all centers(average)
Develop a statistical model that describes the outcomes using patient characteristics and characteristics of the centers. Then calculate what the outcome would be after removing characteristics of the centers from the model. Take the mean values of these calculated values per center(xi).
The adjusted value for each department then becomes yi,adjusted = average*yi/xi . The adjusted value therefore measures how well a department performs in relation to how well it is expected to perform when taking case mix into account.

Calculate error estimates for the adjusted outcomes and present values in appropriate diagrams.
Several of the outcome measures in Swespine – such as EQ-5D index, VAS scales and ODI – are all limited scales. Patient outcomes often end up close to the two extremes of the scale, and it is difficult to adjust for this appropriately in a statistical model. Modeling and

predicting the change in the outcome measure (at FU compared with preoperatively), makes it possible to obtain a distribution that better meets the requirements of statistical calculations.. For categorical variables such as the Global Assessment scale, the scale was adjusted to be a binary scale (successful/not successful surgery) in order to facilitate the analysis. For the statistically curious it can be mentioned that the hierarchical probit and GLS models were used for the regressions.

Choice of statistical model also includes the variables to be adjusted. The approach used in the analysis was to adjust for the variables assumed to have clinical relevance, and then change the selection if there were statistical reasons to do so. Relevant variables was analyzed within the framework of Vårdval Rygg (Care Choice Spine) in Stockholm County Council, and the same sample was used in this analysis. Relevant variables included: Smoking, Age, Pain intensity back (VAS), Pain intensity leg (VAS), Gender, Surgical history, Ability to work, Co-morbidity, Duration of back pain, Duration of leg pain and Number of levels operated.

The model explains variation in outcomes by using these variables, but in addition to these patient characteristics, there are other (unknown) factors that affect the outcome (confounders). The model cannot take the impact of these factors into account and therefore there is an unexplained variation in the outcomes. The case-mix adjustments that were made are therefore an important step forward to provide fair comparisons, while bearing in mind that there are still factors that require adjustment.
The diagrams used for VAS pain, ODI and EQ-5D index are scatter diagrams with error margins, with centers arranged based on patient volume. The diagrams should be interpreted to mean that if the confidence intervals do not capture the average outcome, the departments are significantly different compared with the averages for all departments combined (= national average). The margins of error for the adjusted values were calculated using a statistical bootstrap method.

For Global Assessment, a funnel plot was used instead. In this case, the confidence intervals are drawn as a funnel in the plot and centers that fall outside the funnel perform significantly differently than the average.

Both types of diagram are suitable for comparing outcomes at separate centers with the national average. However, in order to compare two centers with one another, the confidence intervals of the centers must be taken into account, which is not all that easy to do directly in the diagrams. Therefore caution should be used when ranking departments based on the diagrams.

Finally, for this type of adjustment to be fair and worthwhile, it is necessary to maintain good control of data quality and a continuous effort to update the models that try to explain the differences in outcomes. Side benefits include an in-depth understanding of why outcomes can differ so much despite similar conditions and enhancement of the quality assurance of Swespine as a registry.

The case-mix adjustment was developed in cooperation with the companies IVBAR (Institute of Value Based Reimbursement) and Quantify Research (contacts: JonasWohlin and Fredrik Borgström).

Comparison of diagnosis, by center

The Lumbar Disc Herniation section presents the number of surgical procedures and observations that serve as the basis for the calculations. We have omitted the corresponding tables for the other diagnoses due to lack of space. However, the Global Assessment funnel plots, in which the y-axis represents the number of surgeries and the centers are ranked with the lowest number on the left and the highest on the right, provide a reasonable idea of the number of operations data for the calculations.
The error-bar graphs also arrange the centers with the lowest number on the left and the highest on the right.
The "observed outcome" (unadjusted values), and "adjusted outcome," where the case-mix model was used to calculate the values, present the outcome measures for each diagnosis.
The unadjusted graphs show all departments that have an adequate number of operated patients with reported outcomes from the 1-year follow-up. In order to produce the adjusted outcomes, included patients must have completed both baseline and follow-up questionnaires. Centers with large dropout rates in the baseline questionnaire cannot be presented in the adjusted outcomes. Consequently, departments with a large dropout rate for the VAS back/leg pain questionnaire are not included in the plots with either observed or adjusted outcomes for VAS back/leg pain, and only with observed outcome for ODI and EQ-5D (provided that they otherwise met the volume requirements). These are: Sahlgrenska Univ. Hospital, Hudiksvall, Bollnäs, Sportsmed Göteborg, Simrishamn, Västervik and Vrinnevi Hospital Norrköping.

Table 1. Department Abbreviations.

Name	Abbreviation
Borås Hospital	**BOR**
Danderyd	**DAN**
Eksjö Hospital	**EKS**
Eskilstuna	**ESK**
Falu Hospital	**FAL**
Gävle Hospital	**GÄV**
St. Göran	**STG**
Halmstad Hospital	**HAL**
Helsingborg	**HEL**
Huddinge	**HUD**
Jönköping County Hospital	**JÖN**
Kalmar Hospital	**KAL**
Karlstad Hospital	**KAR**
Karolinska University Hospital	**KARO**
Linköping University Hospital	**LIN**
Skåne University Hospital Lund	**LUN**
Skåne University Hospital Malmö	**MAS**
Mölndal	**MÖL**
Vrinnevis Hospital Norrköping	**NOR**
Sahlgrenska University Hospital	**SAHO**
Skövde Hospital	**SKÖ**
Sundsvall Hospital	**SUN**
Söder Hospital	**SÖS**
Umeå University Hospital	**UME**

Uppsala University Hospital/orthopedics	**AKAO**
Varberg	**VAR**
NÄL	**NÄL**
Västervik Hospital	**VÄV**
Västerås Hospital	**VÄS**
Ängelholm Hospital	**ÄNG**
Örebro University Hospital	**ÖRE**
Östersund Hospital	**ÖST**
HudiksvallHospital	**HUK**
Oskarshamn	**OSK**
Nacka Hospital	**NAC**
Kungälv Hospital	**KUN**
Karlskoga Hospital	**KAS**
Simrishamn	**SIM**
Blekinge Hospital	**KAH**
Hässleholm	**HÄS**
Motala	**MOT**
Stockholm Spine Center	**SSC**
Skene	**SKE**
Spinal Surgery department Strängnäs	**RKS**
Uppsala University Hospital/orthopedics	**AKAN**
Göteborg Spinecenter	**GSC**
Växjö Hospital	**VÄX**
Aleris Ängelholm	**AÄN**

Disc herniation

The analysis is based on surgeries performed 2009-2011, and requires > = 60 operations with follow-up data. Table 2 shows the data by center. The number of observations in the case-mix adjustment data may be greater than in the 1 year FU data because the case-mix model includes some preoperative variables which may have missing data at 1 year FU.

Table 2. Data presented by department.

FU1 data	Reg op	Data in adjustment model	Department
61	94	75	JÖN
63	290	84	LIN
73	100	34	KAH
73	144	88	MAS
74	140	92	LUN
77	189	88	KARO
82	133	97	ÖST
88	314	111	AKAO
96	246	0	SAHO
97	172	133	VÄS
103	164	138	ÖRE
105	162	120	SKÖ
115	159	131	SÖS
117	147	122	KAL
141	252	135	UME

150	221	169	FAL
197	272	234	GSC
201	320	238	NAC
203	356	318	RKS
661	956	829	SSC

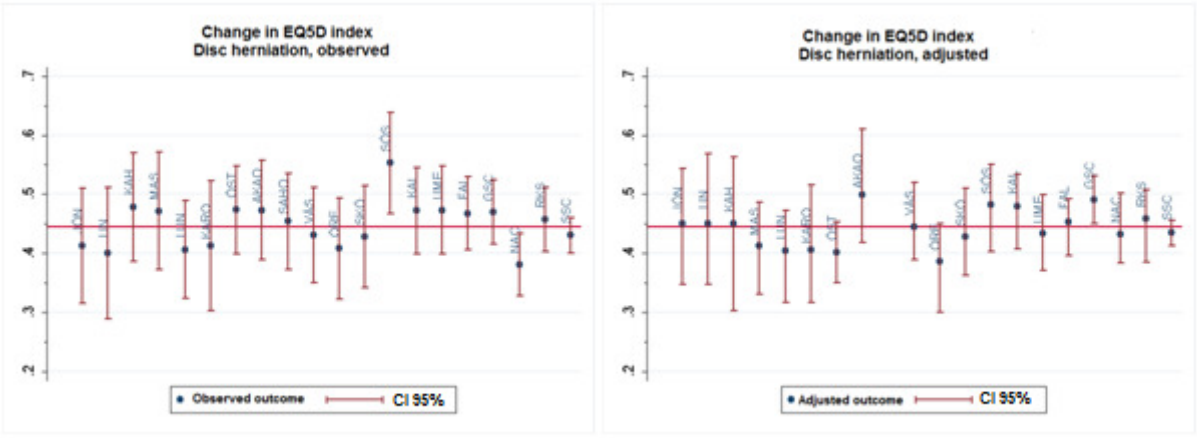


Fig 33-34. Observed and adjusted outcome of disc herniation surgery as measured by change in EQ5D. Values above the national average line (=larger change) are better than values below the line.

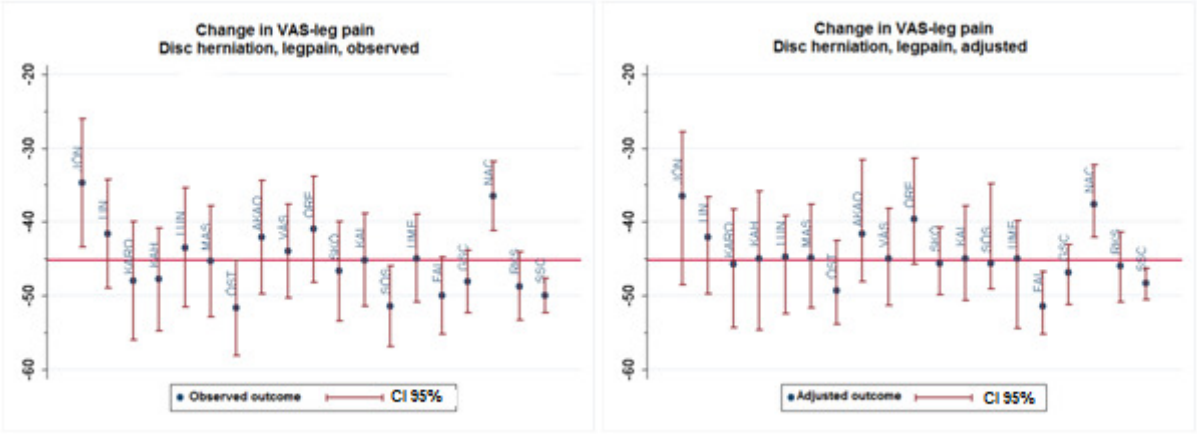


Fig 35-36. Observed and adjusted outcome of disc herniation surgery as measured by change in VAS-leg pain. Values below the national average line (=larger change) are better than values above the line.

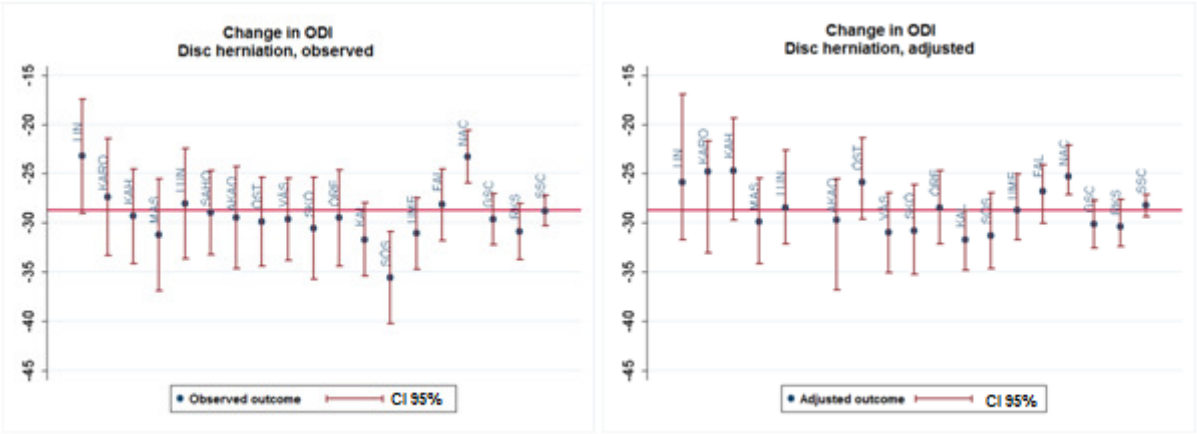
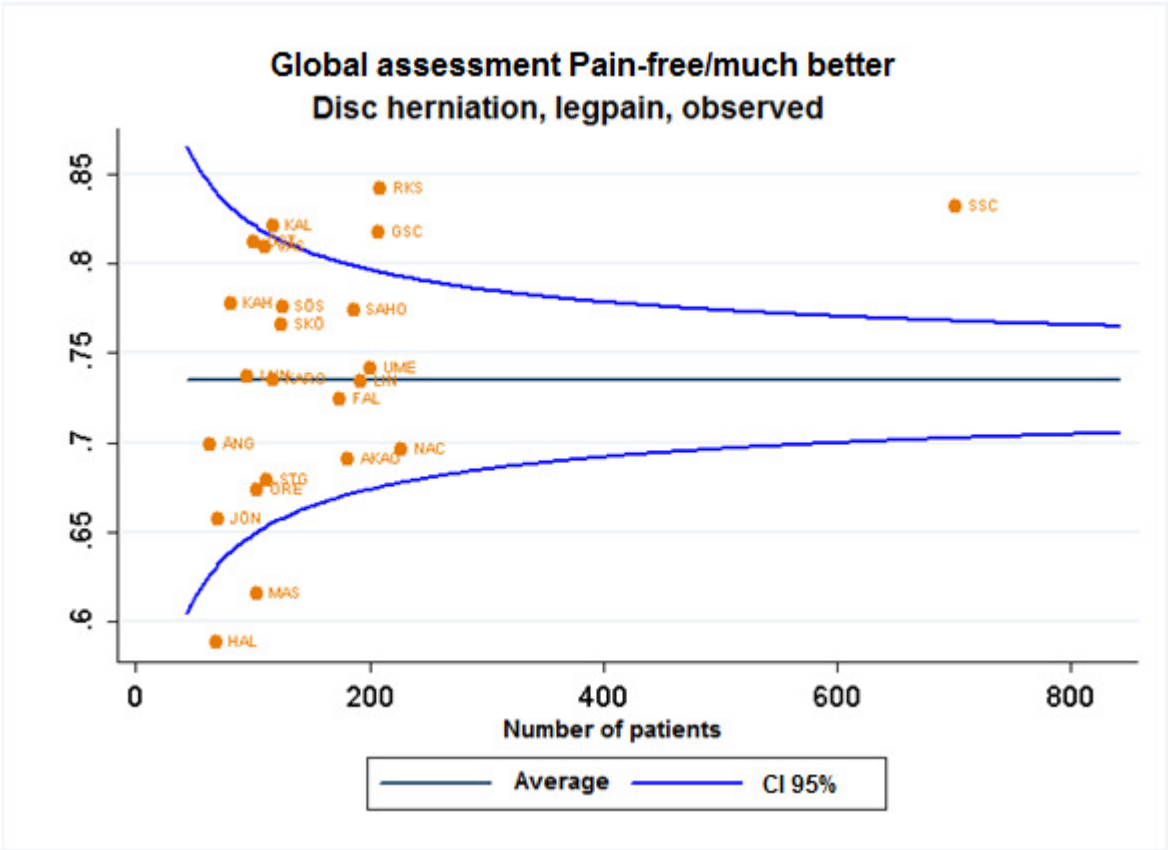


Fig 37-38. Observed and adjusted outcome of disc herniation surgery as measured by change in ODI. Values below the national average line (=larger change) are better than values above it.



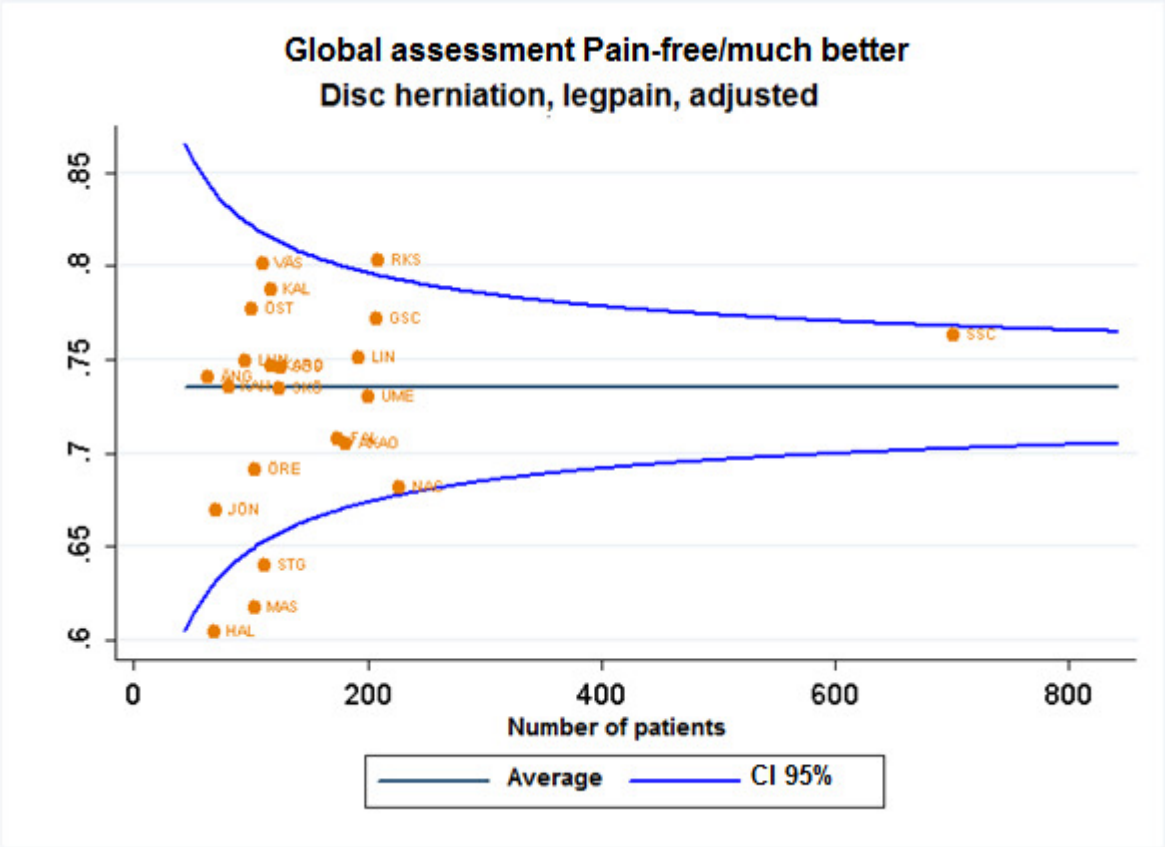


Fig 39-40. Funnel plot showing observed and adjusted outcome for Global Assessment = "pain-free/much better" regarding leg pain. Centers that fall within the funnel have outcomes that are not significantly different from the national mean. Values above the national average are better than values below it.

Central spinal stenosis

Outcomes for spinal stenosis surgery include both decompression and decompression + fusion. The analysis is based on surgeries performed 2009-2011, and requires > = 60 surgeries with follow-up data.

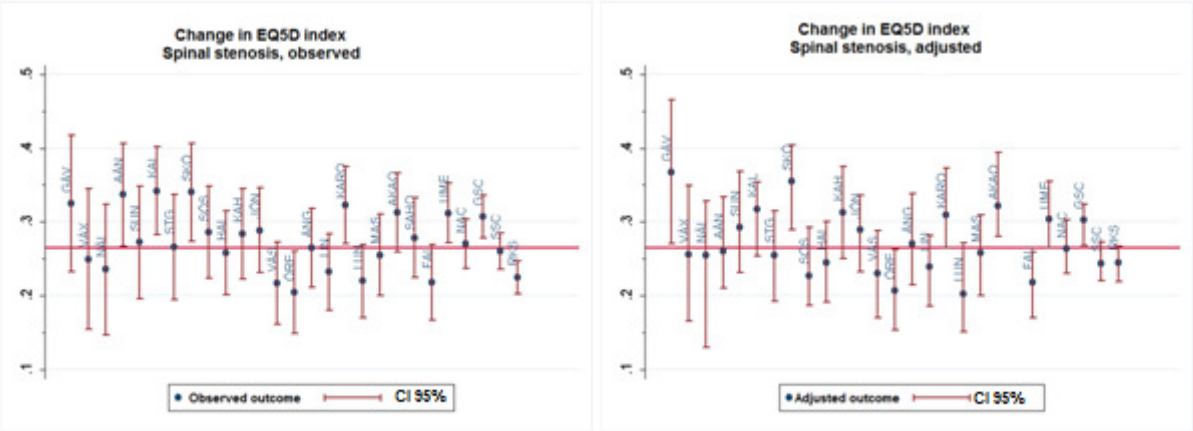


Fig 41-42. Observed and adjusted outcome regarding change in quality of life after decompression/decompression+fusion for central spinal stenosis as measured by EQ5D. Values above the national average line are better than those below it.

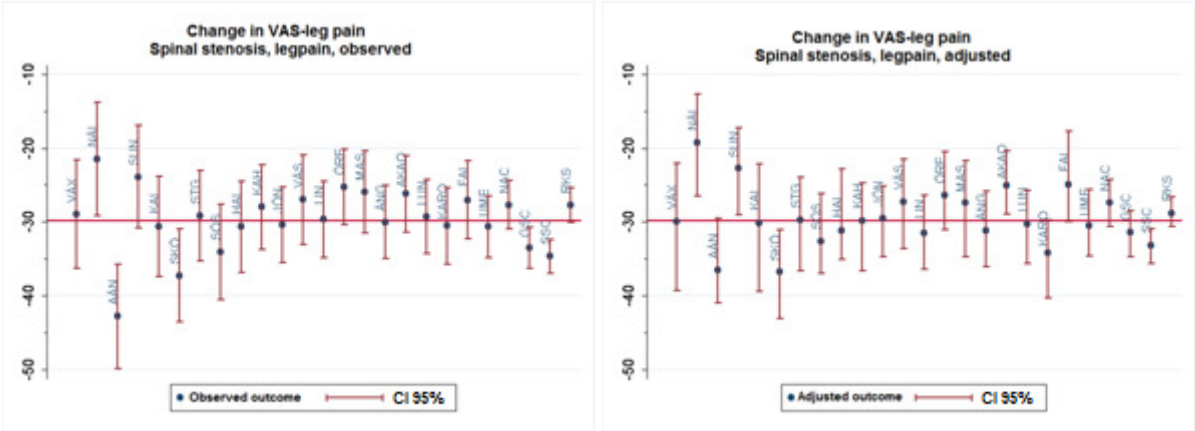


Fig 43-44. Observed and adjusted outcome after decompression/decompression+fusion for central spinal stenosis as measured by change in VAS-leg pain. Values below the national average line (=larger change) are better than values above.

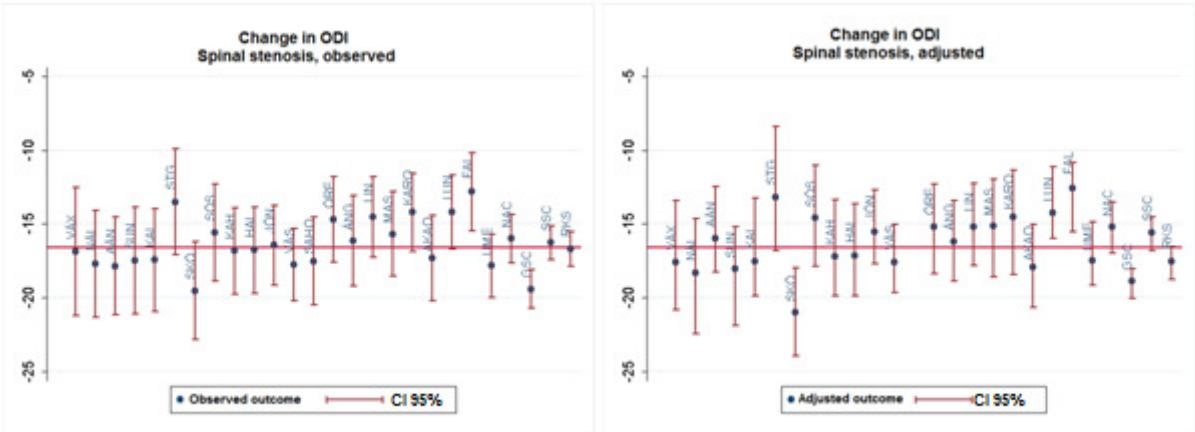
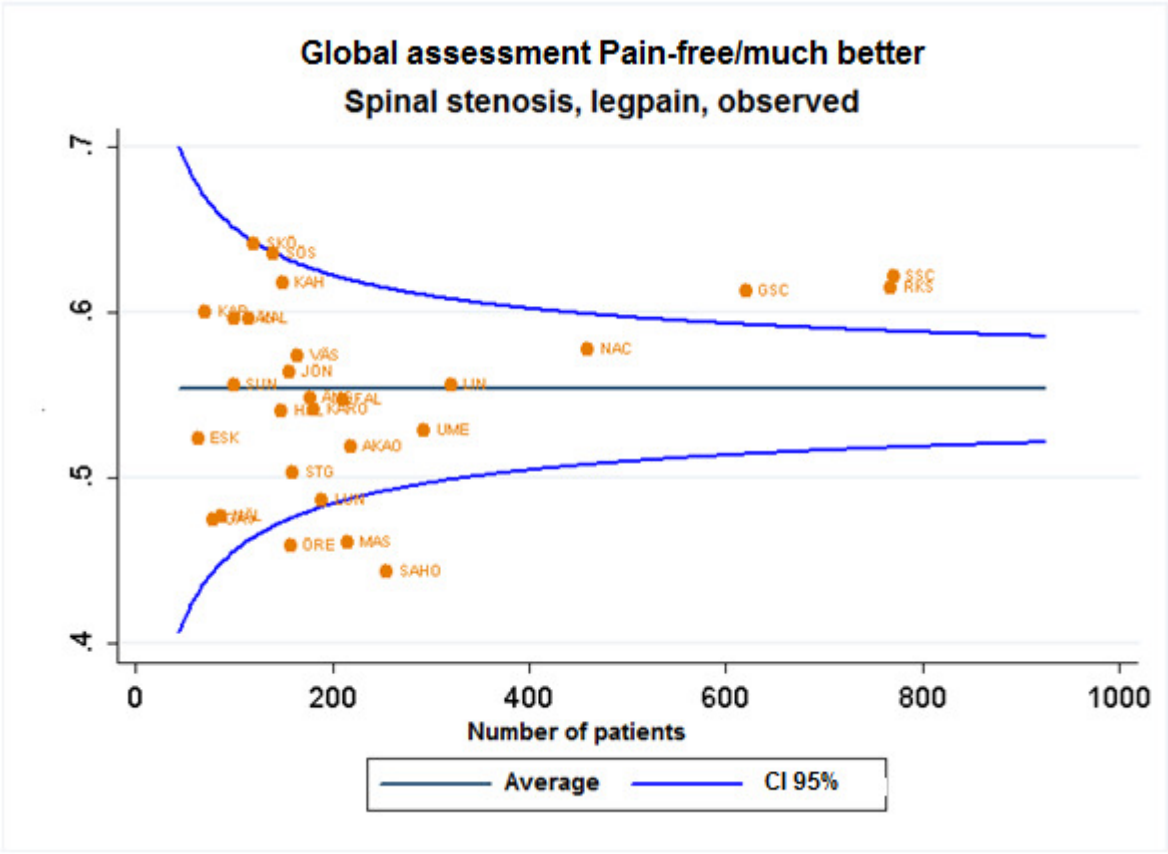


Fig 45-46. Observed and adjusted outcome of decompression/decompression+fusion for central spinal stenosis measured using change in ODI. Values below the national average line (=larger change) are better than values above.



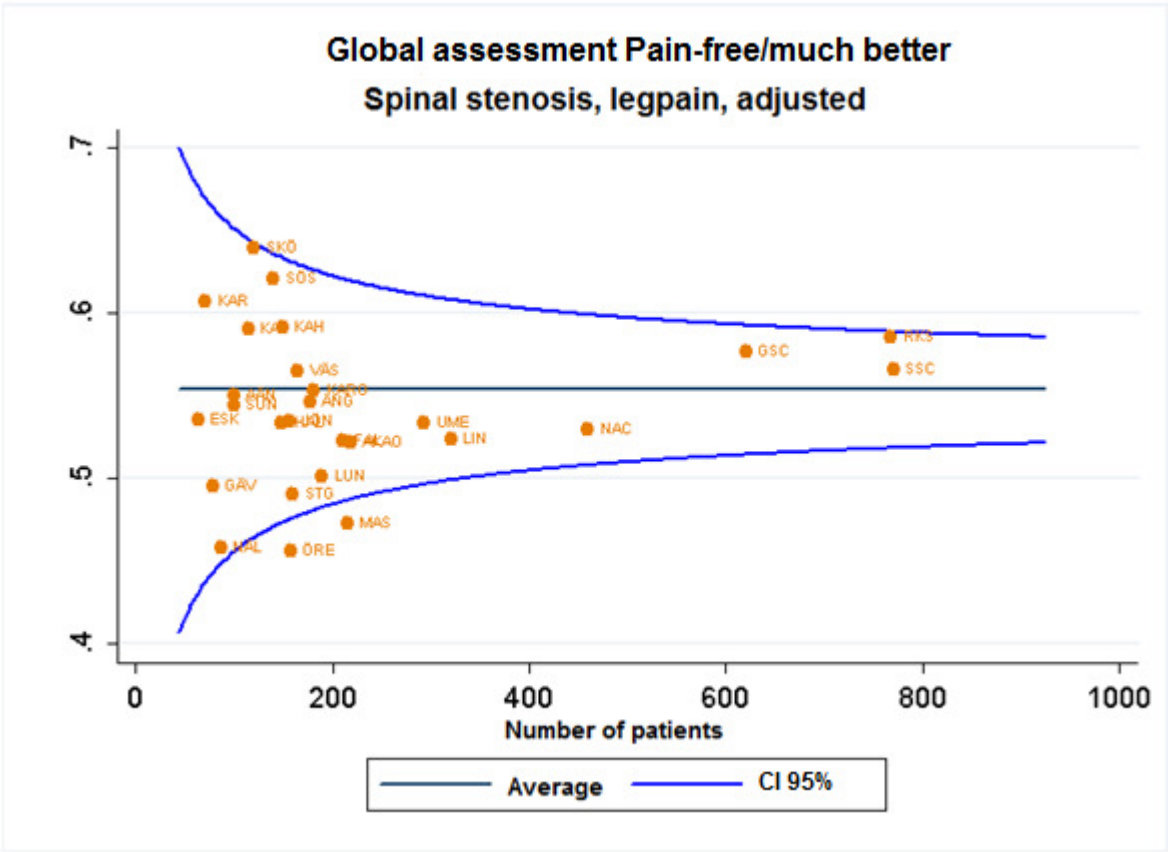


Fig 47-48. Observed and adjusted outcome after decompression/decompression+fusion for central spinal stenosis as measured by Global Assessment=Pain-free/much better, regarding leg pain. Values above the national average line are better than values below it.

Lateral spinal stenosis

The analysis is based on surgeries carried out 2009-2011, follow-up after 1 year and > = 60 operations with follow-up data at the evaluated departments.

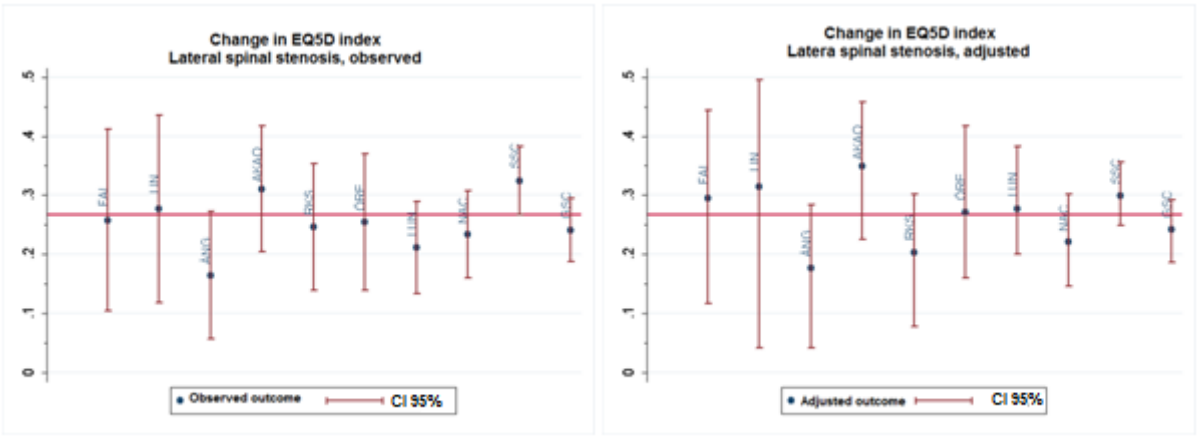


Fig 49-50. Observed and adjusted outcome after decompression and decompression+fusion as measured by change in quality of life score EQ-5D. Values above the national average line (=larger change) are better than values below the line.

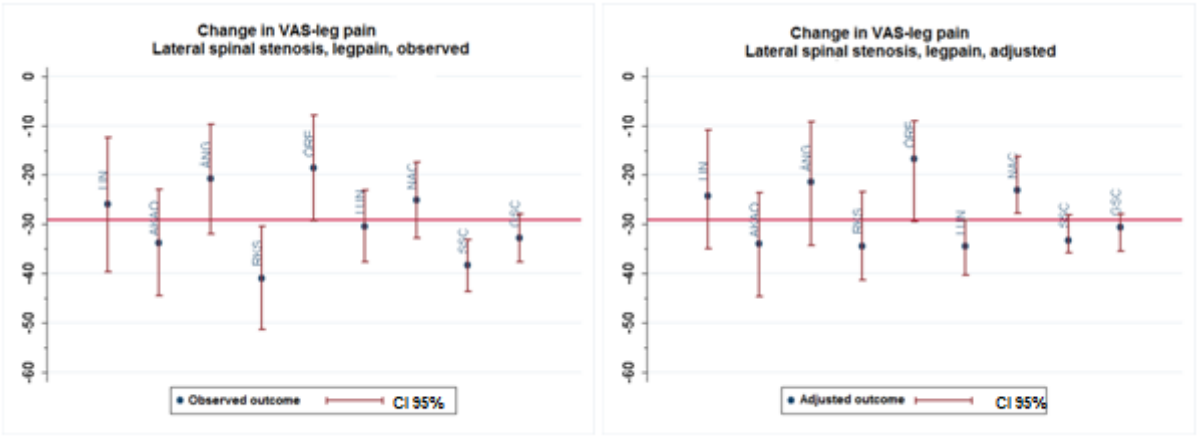


Fig 51-52. Observed and adjusted outcome after decompression/decompression+fusion for lateral spinal stenosis as measured by change in VAS-leg pain. Values below the national average line (=larger change) are better than values above.

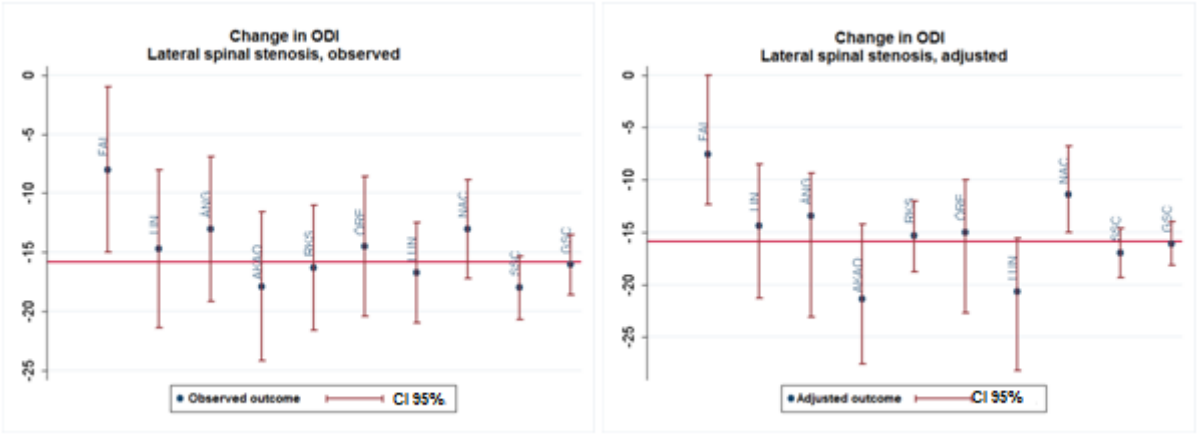
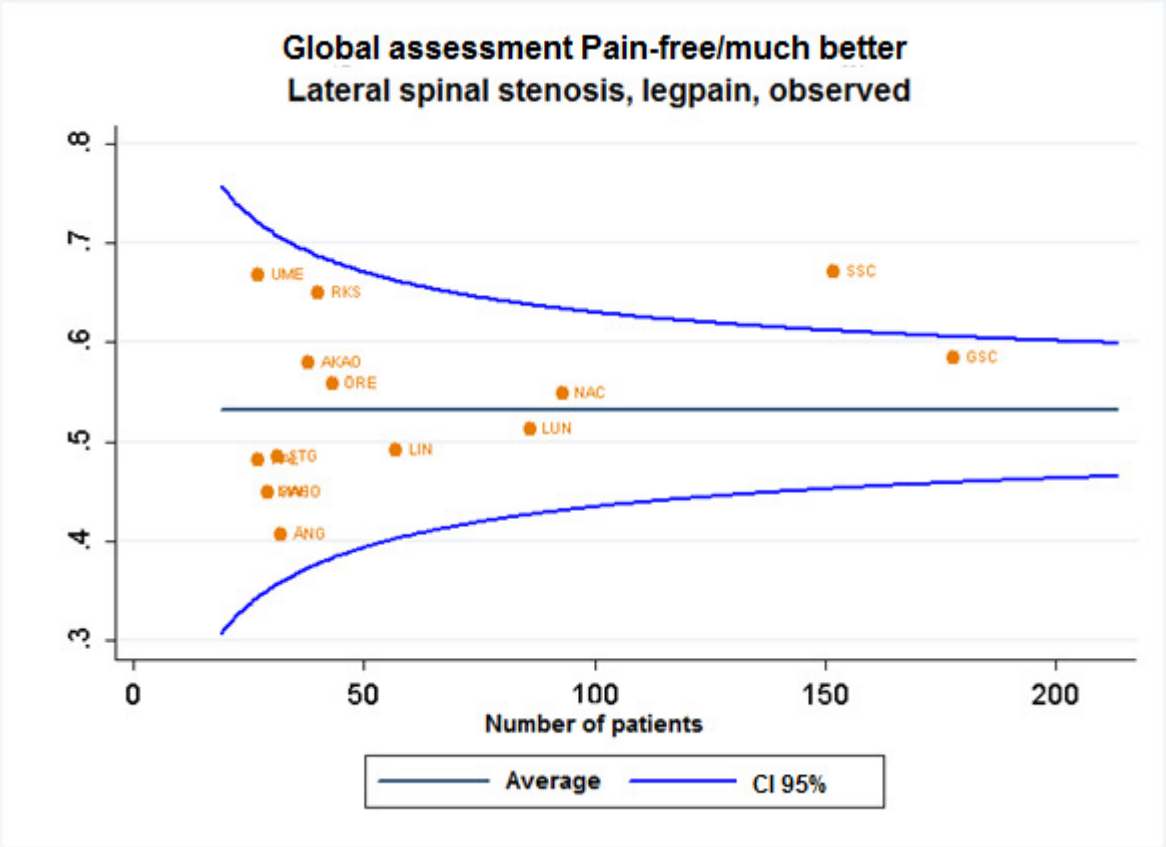


Fig 53-54. Observed and adjusted outcome of decompression/decompression+fusion for lateral spinal stenosis as measured by change in ODI. Values below the national average line (=larger change) are better than values above.



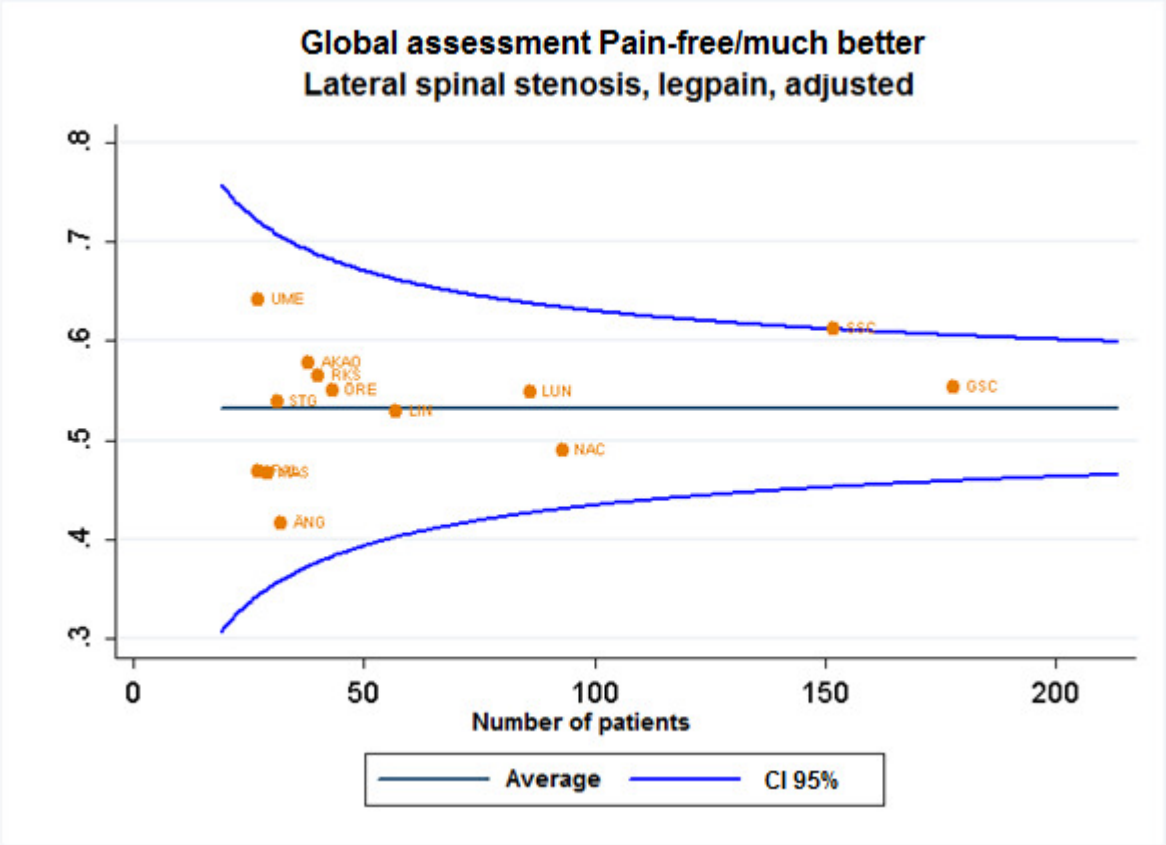


Fig 55-56. Observed and adjusted outcome after decompression/decompression+fusion for lateral spinal stenosis as measured by Global Assessment=Pain-free/much better, regarding leg pain.

Values above the national average line are better than values below the line.

DDD

The analysis is based on surgeries carried out 2009-2011, follow-up after 1 year and > = 60 operations with follow-up data at the evaluated departments.

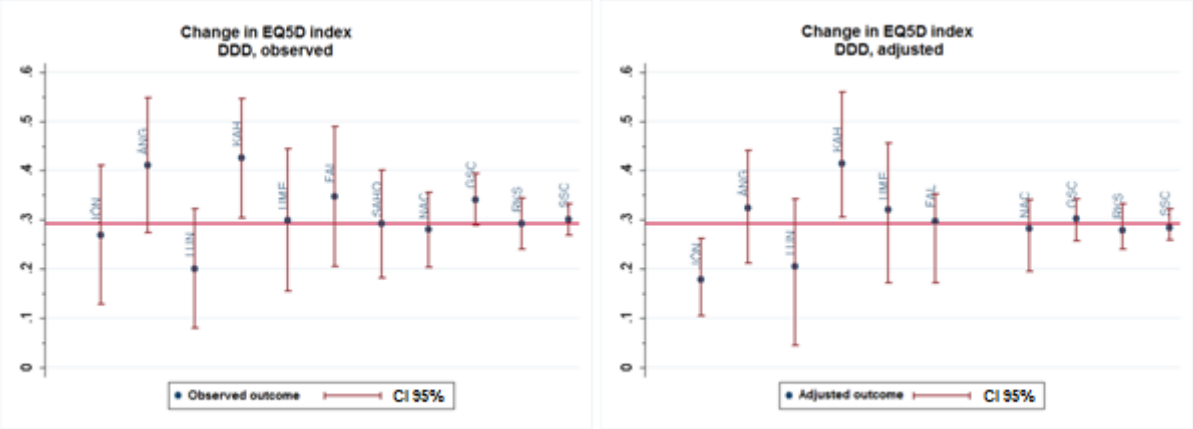


Fig 57-58. Observed and adjusted outcome after fusion/disc replacement for DDD as measured by change in quality of life score EQ5D. Values above the national average line (=larger change) are better than values below the line.

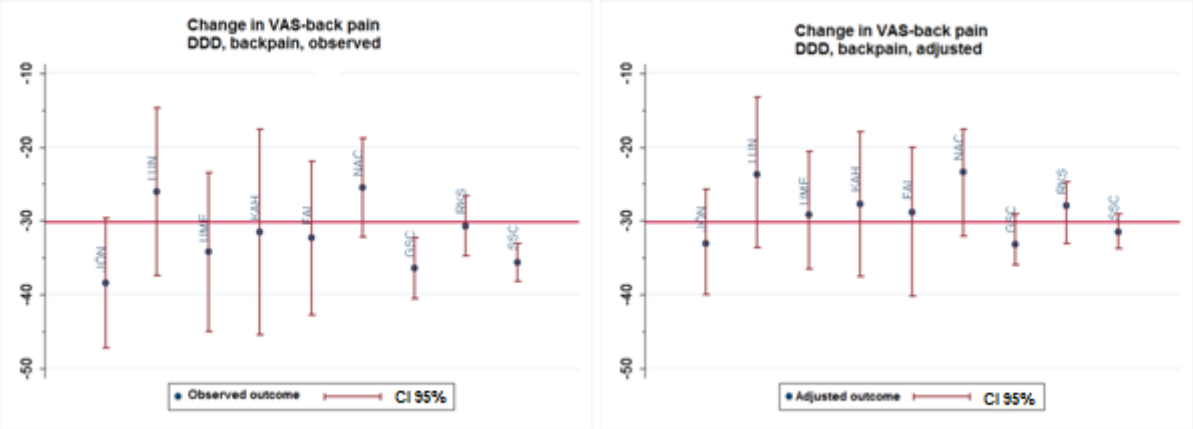


Fig 59-60. Observed and adjusted outcome of fusion/disc replacement for DDD, as measured by change in VAS-back pain. Values below the national average line are better than above.

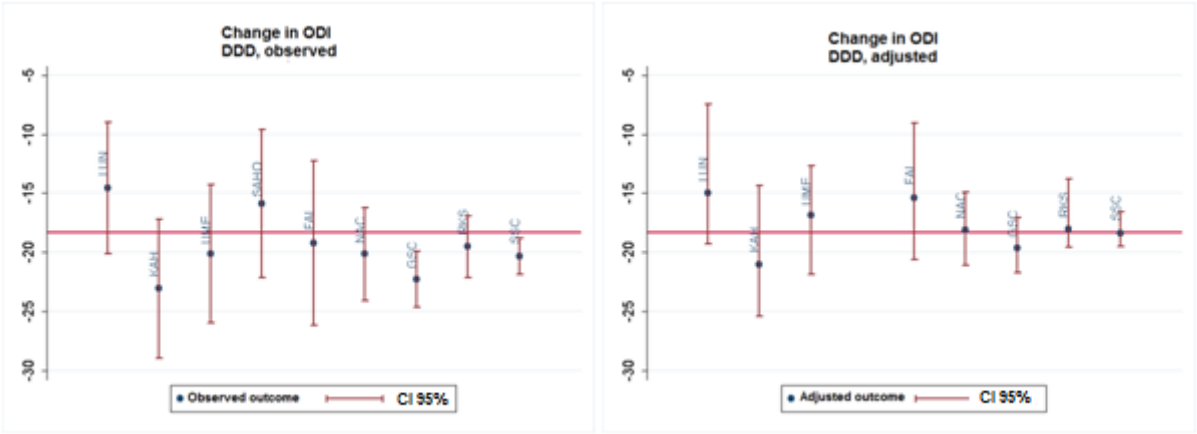
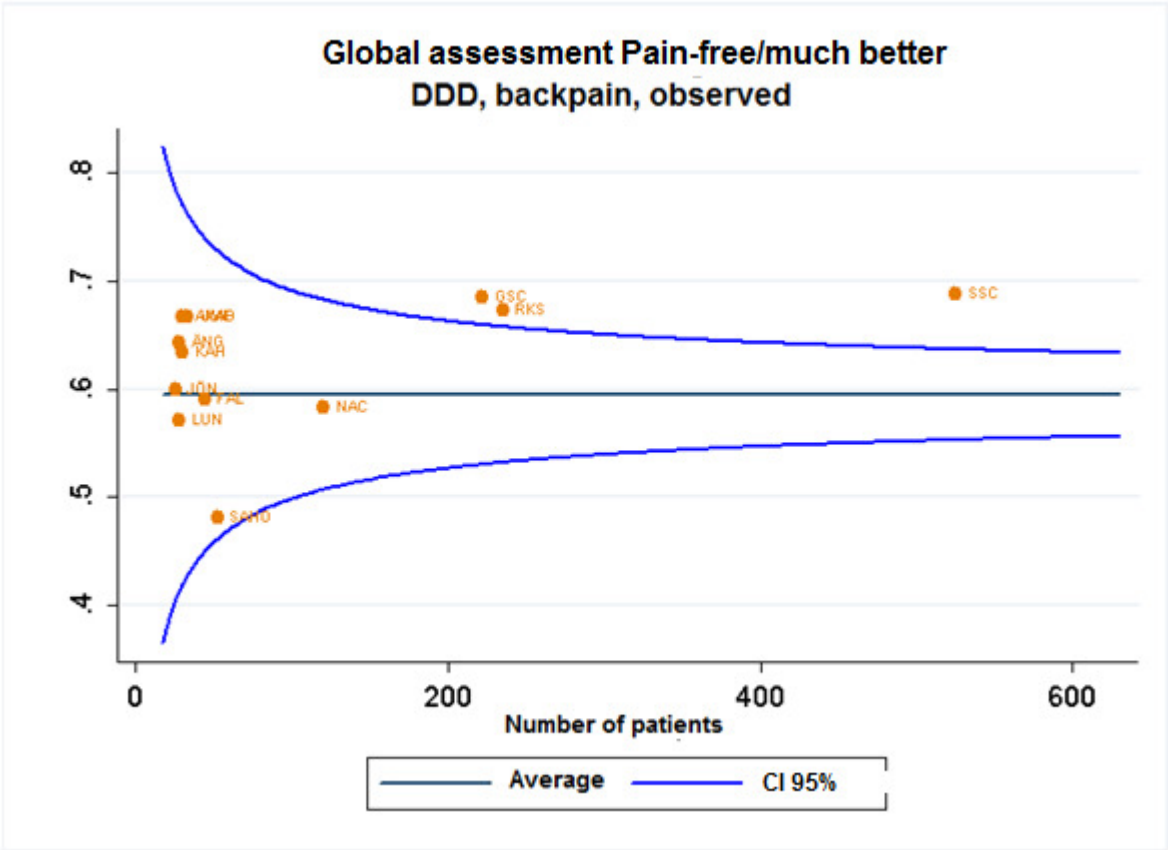


Fig 61-62. Observed and adjusted outcome of fusion/disc replacement for DDD, as measured by change in ODI. Values below the national average line (=larger change) are better than values above the line.



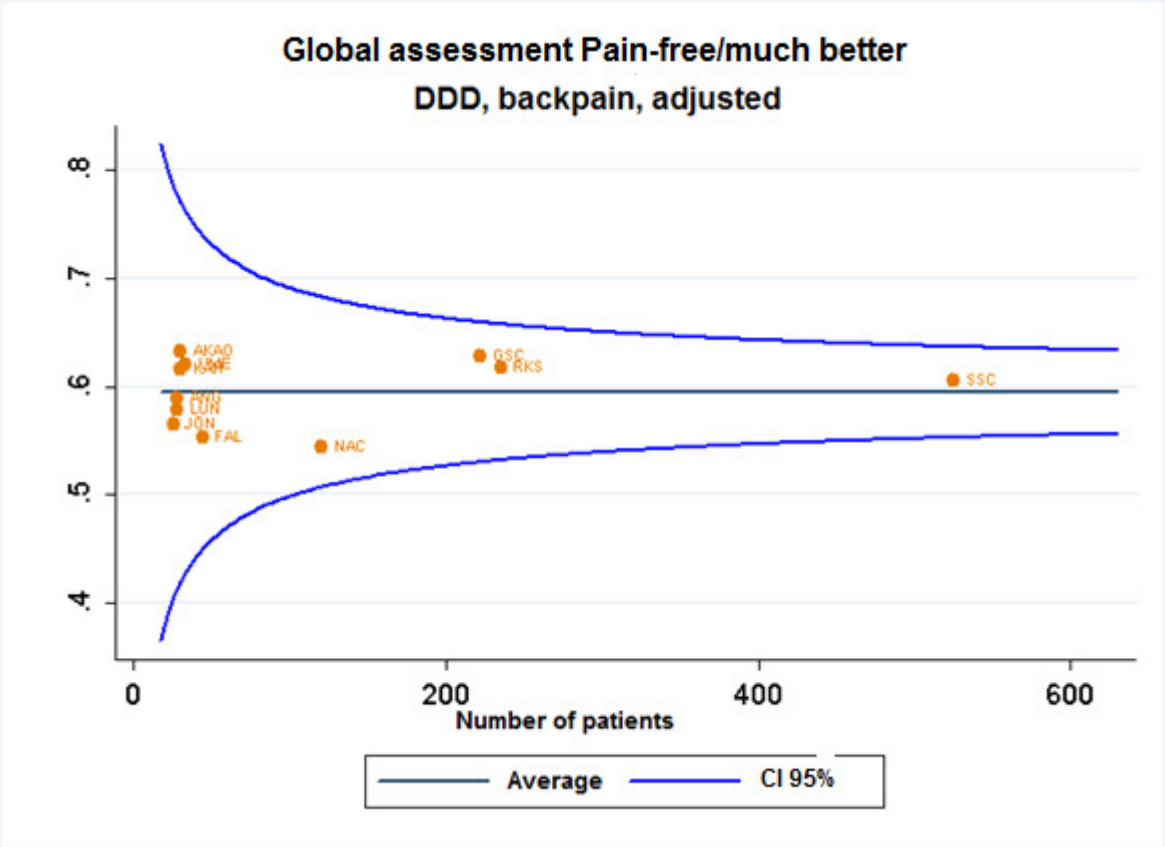


Fig 63-64. Observed and adjusted outcome of fusion/disc replacement for DDD as measured by Global Assessment = Pain-free/significantly improved regarding back pain.
Values above the national average line are better than values below the line.

Isthmic spondylolisthesis.

The analysis is based on surgeries carried out 2009-2011, follow-up after 1 year and > = 60 operations with follow-up data at the evaluated departments.

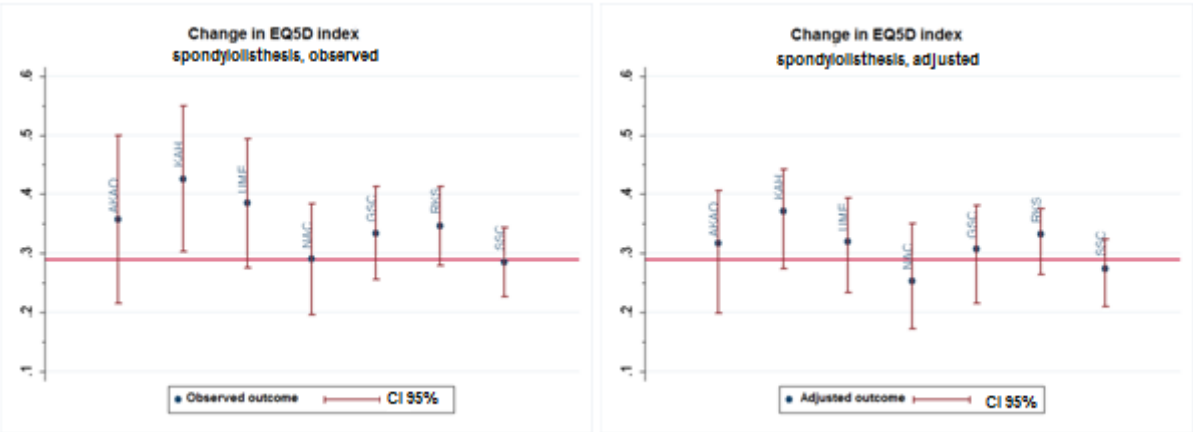


Fig 65-66. Observed and adjusted outcome after fusion for isthmic spondylolisthesis as measured by change in quality of life score EQ-5D. Values above the national average line (=larger change) are better than values below the line.

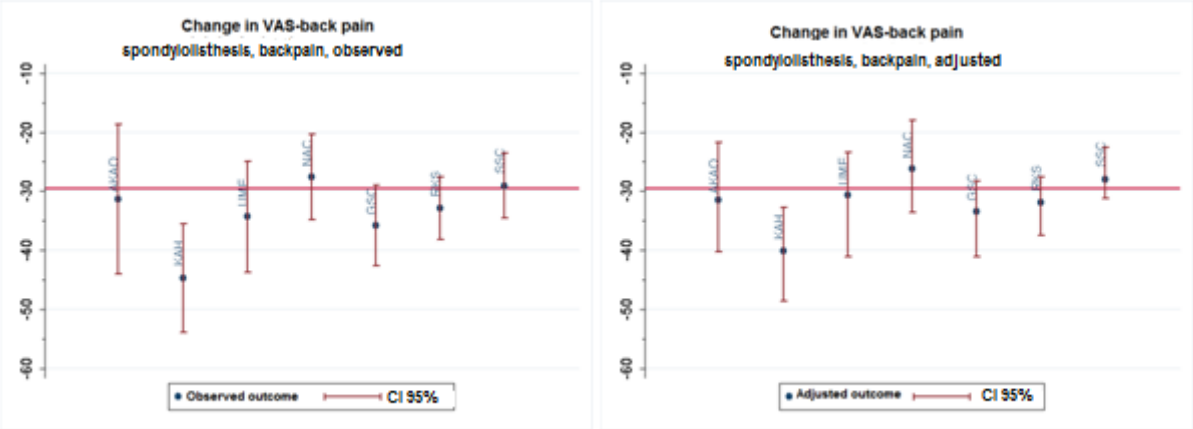


Fig 67-68. Observed and adjusted outcome of fusion for isthmic spondylolisthesis, as measured by change in VAS-back pain. Values below the national average line are better than values above the line.

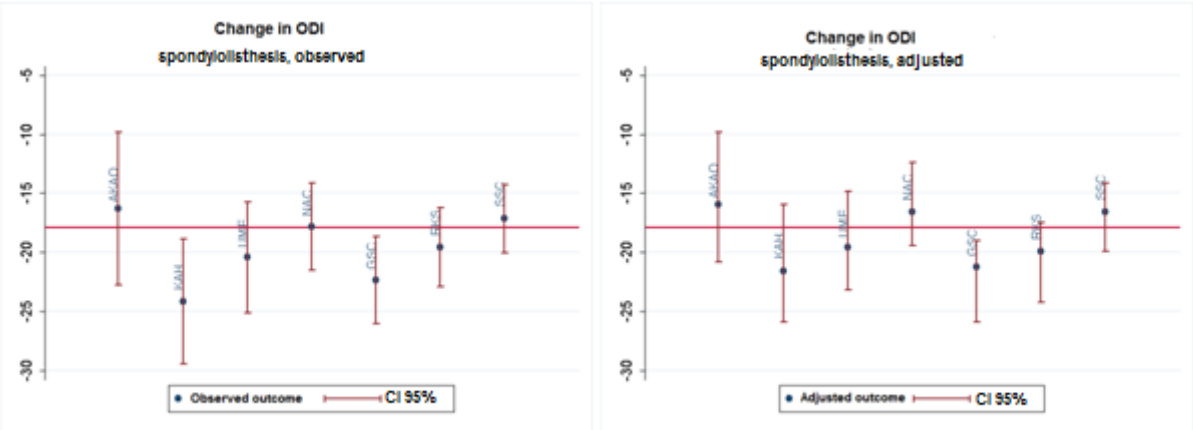
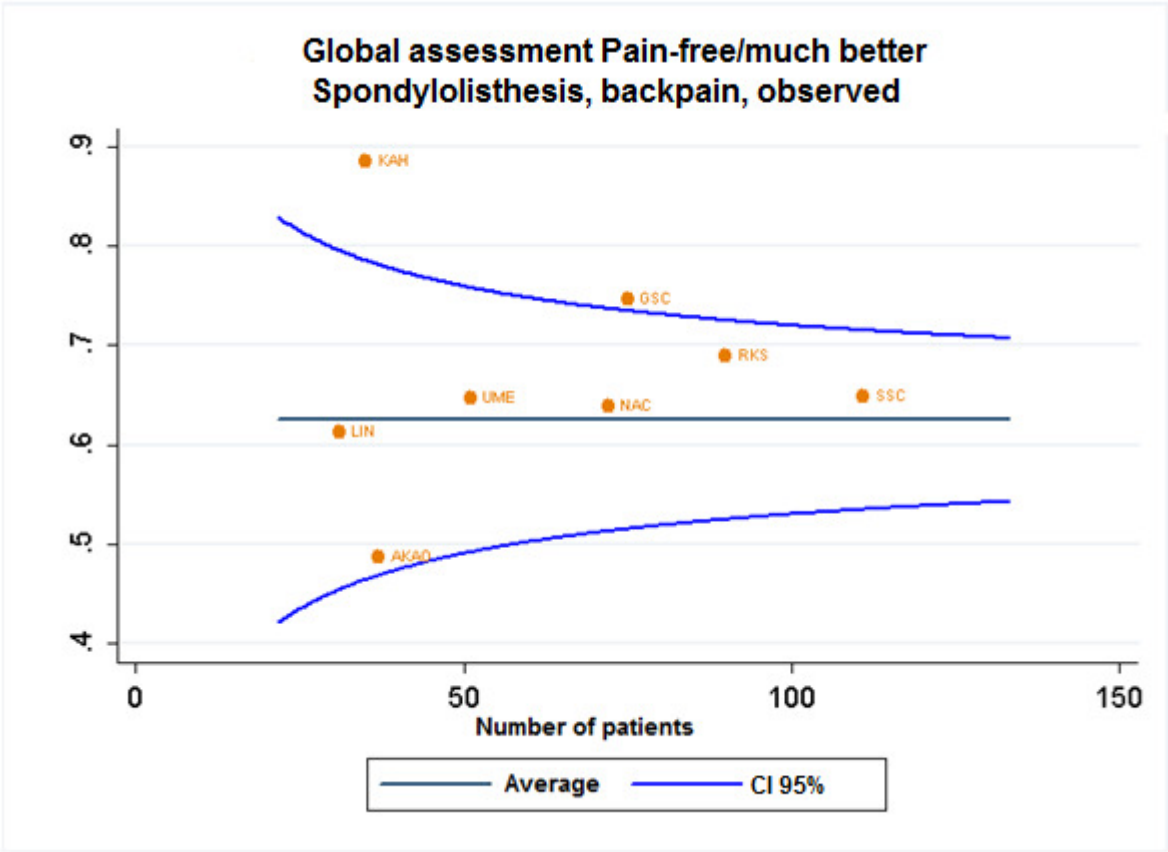


Fig 69-70. Observed and adjusted outcome of fusion for isthmic spondylolisthesis, as measured by change in ODI. Values below the national average line are better than values above the line.



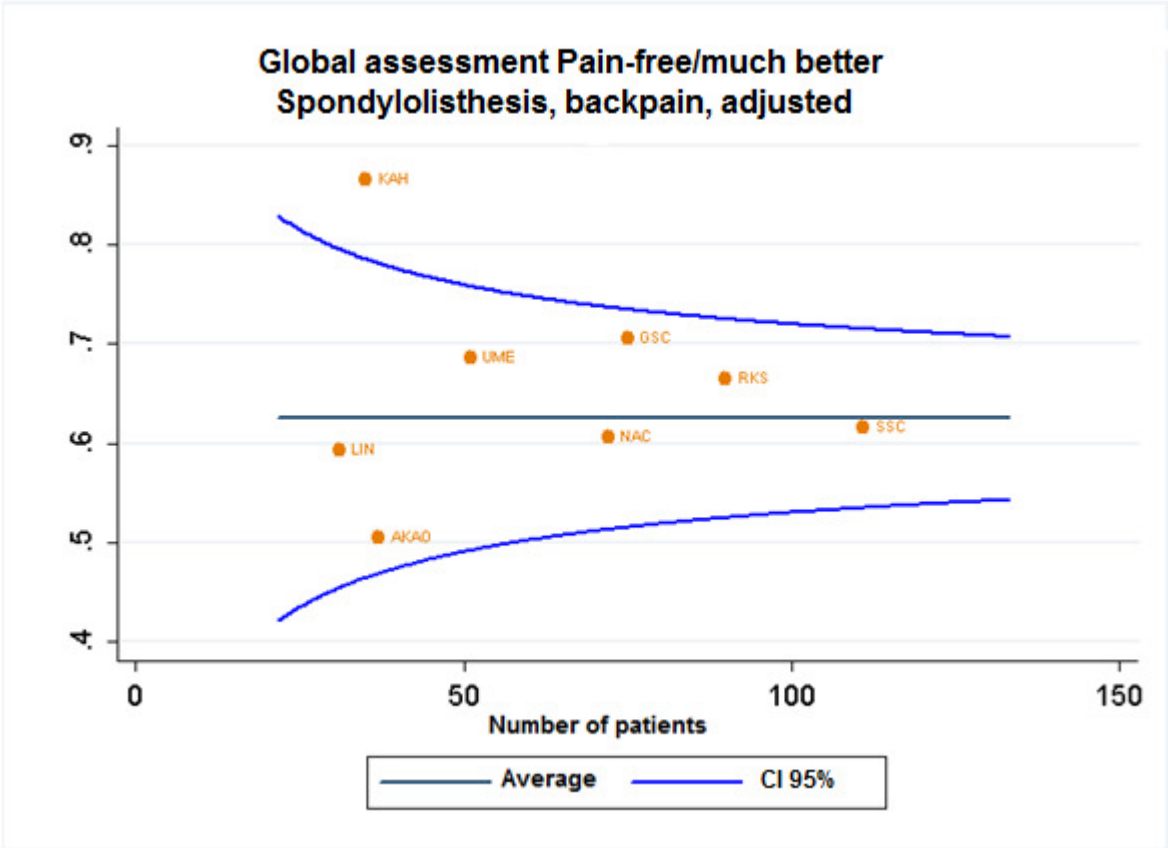


Fig 71-72. Observed and adjusted outcome of fusion/disc replacement for isthmic spondylolisthesis as measured by Global Assessment = Pain-free/much better regarding back pain. Values above the national average line are better than values below the line.

Discussion

One consistent trend is that the case-mix adjustment reduces the differences that emerged between the different centers in the observed outcome, and the deviations from the national average are less tangible and in most cases not statistically significant. Expressed differently, the outcome of degenerative lumbar spine surgery in separate centers is, with few exceptions, quite similar, as a sign of an appreciated good standard of Swedish spine surgery. While recognizing that the relevant case-mix model is preliminary and not comprehensive (there are unknown confounders), we still urge those centers, whose outcomes are significantly worse than the national average, to analyze the causes and consider potential improvements. One persistent problem for all departments is the follow-up rate, which needs to increase in order to improve the reliability of calculations and case-mix adjustment.

IV.2-year follow-up of lumbar spine procedures in Sweden in 2012

A total of 4236 patients operated on in 2010 have completed 1-year and 2-year follow-ups. The most common diagnoses are disc herniation, 1095, and central spinal stenosis, 2033 patients. In all, 328 patients had been operated for lateral spinal stenosis, 219 for spondylolisthesis and 430 for DDD. The remaining 131 had other diagnoses. Below is a comparison of several parameters assessed at 1-year and 2-year follow-up. Only patients who completed questionnaires at baseline, 1year FU and 2 years FU are included.

Table 3 presents pain on the VAS, diagnosis-related, over time.

Table 3. Pain on the VAS (mean), diagnosis-related.

	Back			**Leg**		
	Preop	**1 year**	**2 years**	**Preop**	**1 year**	**2 years**
Disc Herniation	44	23	26	65	20	23
Central stenosis	55	33	36	63	32	36
Lateral stenosis	52	32	35	65	34	35
Spondylolisthesis	58	28	33	52	22	26
DDD	62	28	28	40	21	22

Tables 4-8 present walking distance after the different procedures preoperatively as well as 1 and 2 years postoperatively.

Table 4. Walking distance, disc herniation (%)

	Preoperatively	**1 year**	**2 years**
< 100m	30	4	4
100m–500m	24	7	7
500m–1 km	15	10	12
>1 km	32	79	78

Table 5. Walking distance, central spinal stenosis (%)

	Preoperatively	**1 year**	**2 years**
< 100m	41	18	21
100m–500m	30	21	20
500m–1 km	15	17	16
>1 km	14	45	43

Table 6. Walking distance, lateral spinal stenosis (%)

	Preoperatively	**1 year**	**2 years**
< 100m	27	14	15
100m–500m	35	19	17
500m–1 km	15	18	15
>1 km	24	50	53

Table 7. Walking distance, isthmic spondylolisthesis (%)

	Preoperatively	**1 year**	**2 years**
< 100m	20	7	6
100m–500m	24	11	12
500m–1 km	20	12	15
>1 km	37	70	68

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Table 8. Walking distance, DDD (%)

	Preoperatively	**1 year postop**	**2 years postop**
< 100m	14	5	5
100m–500m	19	8	9
500m–1 km	22	12	10
>1 km	45	74	76

Tables 9-13 show consumption of analgesics preoperatively and at 1 and 2 years FU, related to diagnosis for surgery.

Table 9. Consumption of analgesics, disc herniation, preoperatively, at 1 and 2 years FU(%).

	Preoperatively	**1 year postop**	**2 years postop**
Regular	60	15	16
Intermittent	29	31	34
None	11	54	51

Table 10. Consumption of analgesics, central spinal stenosis preoperatively, 1 and 2 years postop (%).

	Preoperatively	**1 year postop**	**2 years postop**
Regular	53	29	30
Intermittent	30	34	34
None	17	38	36

Table 11. Consumption of analgesics, lateral spinal stenosis preoperatively, at 1 and 2 years FU(%).

	Preoperatively	**1 year postop**	**2 years postop**
Regular	55	29	32
Intermittent	27	34	34
None	18	37	35

Table 12. Consumption of analgesics, isthmic spondylolisthesis preoperatively, 1 and 2 years FU (%).

	Preoperatively	**1 year postop**	**2 years postop**
Regular	53	24	27
Intermittent	28	31	31
None	19	45	42

Table 13. Consumption of analgesics DDD preoperatively, at 1 and 2 years FU (%).

	Preoperatively	**1 year postop**	**2 years postop**
Regular	52	23	24
Intermittent	34	30	30
None	14	48	46

Table 14 presents patient-rated satisfaction with surgical outcome after 1 and 2 years.

Table 14. Patient-rated satisfaction with surgical outcome at 1 and 2 years FU, diagnosis-related.

	1 year			**2 years**		
	Satisfied	**Uncertain**	**Dissatisfied**	**Satisfied**	**Uncertain**	**Dissatisfied**
Disc Herniation	81	14	6	78	15	7
Central stenosis	67	22	11	63	23	14
Lateral stenosis	62	25	13	63	20	16
Spondylolisthesis	77	14	9	74	13	12
DDD	77	13	10	75	13	11

Tables 15-16 and figure 73 present quality of life as measured by EQ-5D and by VAS. All patient groups experience a significant improvement in quality of life postoperatively.

Table 15. EQ-5D means preoperatively, 1 year and 2 years postop, diagnosis-related.

	Preop	1 year postop	2 years postop
Disc Herniation	0.27	0.74	0.74
Central spinal stenosis	0.37	0.65	0.62
Lateral spinal stenosis	0.37	0.64	0.64
Spondylolisthesis	0.40	0.70	0.68
DDD	0.36	0.67	0.68

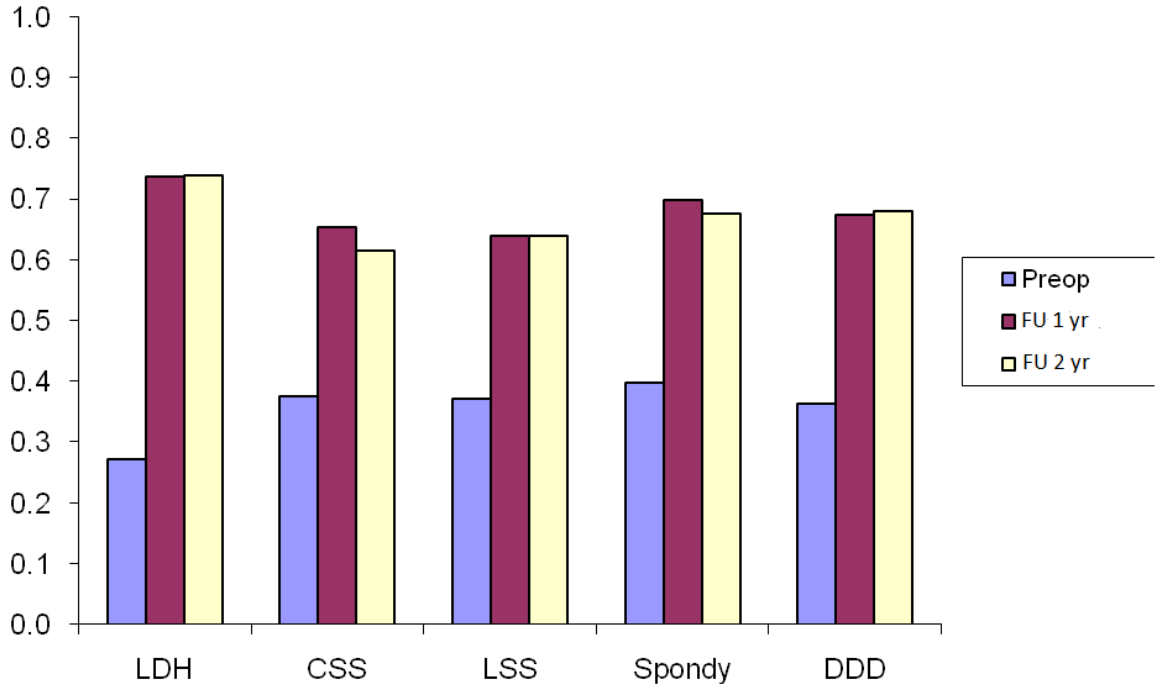

Fig 73. Quality of life preoperatively, at 1 and 2 years FU, as measured by EQ-5D.

Table 16. EQ-5D health assessment according to the VAS, means.

	Preop	1 year postop	2 years postop
Disc Herniation	46	74	73
Central spinal stenosis	49	66	63
Lateral spinal stenosis	48	66	66
Spondylolisthesis	50	69	68
DDD	46	70	70

Oswestry Disability Index (ODI) preoperatively, at 1 and 2 years FU for all diagnoses

Table 17. ODI results preoperatively, 1 and 2 years after lumbar spine surgery, diagnosis-related.

	Preoperatively	**1 year**	**2 years**
Disc Herniation	48	18	19
Central spinal stenosis	43	26	28
Lateral spinal stenosis	42	27	26
Spondylolisthesis	39	21	22
DDD	43	23	22

V. 5-year follow-up of lumbar spine procedures in Sweden in 2012

A total of 2275 patients completed 1, 2 and 5-year follow-up after having undergone lumbar spine surgery in 2007. The most common diagnoses are lumbar disc herniation, 663 and central spinal stenosis, 962 patients. In all, 168 patients had been operated for lateral spinal stenosis, 141 for spondylolisthesis and 280 for segmental pain (DDD). The remaining 61 had other diagnoses. Below is a comparison of several parameters at 1, 2 and 5-year follow-up. Only patients who completed questionnaires at baseline, 1 year FU, 2 years FU and 5 years FU are included.

Table 18 presents pain on the VAS, diagnosis-related, over time.

Table 18. Pain on the VAS (mean), diagnosis-related.

	Back				**Leg**			
	Preop	**1 year**	**2 years**	**5 years**	**Preop**	**1 year**	**2 years**	**5 years**
Disc Herniation	42	19	19	20	65	18	17	18
Central stenosis	52	28	31	36	60	29	32	36
Lateral stenosis	53	28	32	34	65	28	29	32
Spondylolisthesis	63	31	28	32	56	27	26	26
DDD	64	29	28	32	42	21	21	25

Tables 19-23 present walking distance after the different procedures preoperatively as well as at 1, 2 and 5 years FU.

Table 19. Walking distance, disc herniation (%)

	Preoperatively	**1 year**	**2 years**	**5 years**
< 100m	30	4	2	3
100m–500m	19	7	6	5
500m–1 km	15	8	8	8
>1 km	36	82	84	85

Table 20. Walking distance, central spinal stenosis (%)

	Preoperatively	**1 year**	**2 years**	**5 years**
< 100m	37	16	18	23
100m–500m	33	21	19	19
500m–1 km	16	15	15	16
>1 km	15	48	48	43

Table 21. Walking distance, lateral spinal stenosis (%)

	Preoperatively	**1 year**	**2 years**	**5 years**
< 100m	32	6	10	12
100m–500m	28	17	16	19
500m–1 km	17	16	18	15
>1 km	24	61	57	55

Table 22. Walking distance, spondylolisthesis (%)

	Preoperatively	**1 year**	**2 years**	**5 years**
< 100m	15	7	6	11
100m–500m	26	14	14	9
500m–1 km	16	8	9	11
>1 km	43	71	71	70

Table 23. Walking distance, DDD (%)

	Preoperatively	**1 year**	**2 years**	**5 years**
< 100m	15	6	7	7
100m–500m	20	9	7	9
500m–1 km	24	14	13	11
>1 km	42	71	73	73

Tables 24-28 show consumption of analgesics preoperatively and 1, 2 and 5 years postoperatively, related to diagnosis for surgery.

Table 24. Consumption of analgesics, disc herniation, preoperatively, 1, 2 and 5 years postoperatively (%).

	Preoperatively	**1 year**	**2 years**	**5 years**
Regular	58	13	13	13
Intermittent	28	28	30	30
None	14	59	57	57

Table 25. Consumption of analgesics, central spinal stenosis preoperatively, 1, 2 and 5 years postop (%).

	Preoperatively	**1 year**	**2 years**	**5 years**
Regular	49	25	28	30
Intermittent	33	32	32	32
None	18	43	41	38

Table 26. Consumption of analgesics, lateral spinal stenosis preoperatively, 1, 2 and 5 years postop (%).

	Preoperatively	**1 year**	**2 years**	**5 years**
Regular	49	25	26	26
Intermittent	37	37	37	33
None	15	39	37	41

Table 27. Consumption of analgesics, spondylolisthesis preoperatively, 1, 2 and 5 years postop (%).

	Preoperatively	**1 year**	**2 years**	**5 years**
Regular	38	19	20	23
Intermittent	38	34	33	29
None	24	47	47	48

Table 28. Consumption of analgesics DDD preoperative, 1, 2 and 5 years postop (%).

	Preoperatively	**1 year**	**2 years**	**5 years**
Regular	49	25	24	28
Intermittent	39	38	34	35
None	12	38	42	37

Table 29 presents patient-rated satisfaction with surgical outcome after 1, 2 and 5 years.

Table 29. Patient-rated satisfaction with surgical outcome at 1, 2 and 5 years FU, diagnosis-related.

	1 year			**2 years**			**5 years**		
	Satisfied	**Uncertain**	**Dis-satisfied**	**Satisfied**	**Uncertain**	**Dis-satisfied**	**Satisfied**	**Uncertain**	**Dis-satisfied**
Disc herniation	83	14	3	84	12	4	85	11	4
Central stenosis	69	21	11	67	22	11	66	21	13
Lateral stenosis	67	25	9	67	23	11	71	21	8
Spondylolisthesis	70	18	11	73	17	10	76	12	12
DDD	74	18	8	77	14	9	75	15	11

Tables 30-31 and figure 74 present quality of life as measured by EQ-5D and by VAS. All patient groups experience a significant improvement in quality of life postoperatively.

Table 30. EQ-5D means preoperatively, 1, 2 and 5 years postop, diagnosis-related.

	Preoperatively	**1 year postop**	**2 years postop**	**5 years postop**
Disc Herniation	0.30	0.76	0.77	0.79
Central stenosis	0.40	0.68	0.66	0.63
Lateral stenosis	0.34	0.70	0.65	0.66
Spondylolisthesis	0.38	0.64	0.66	0.67
DDD	0.37	0.67	0.68	0.68

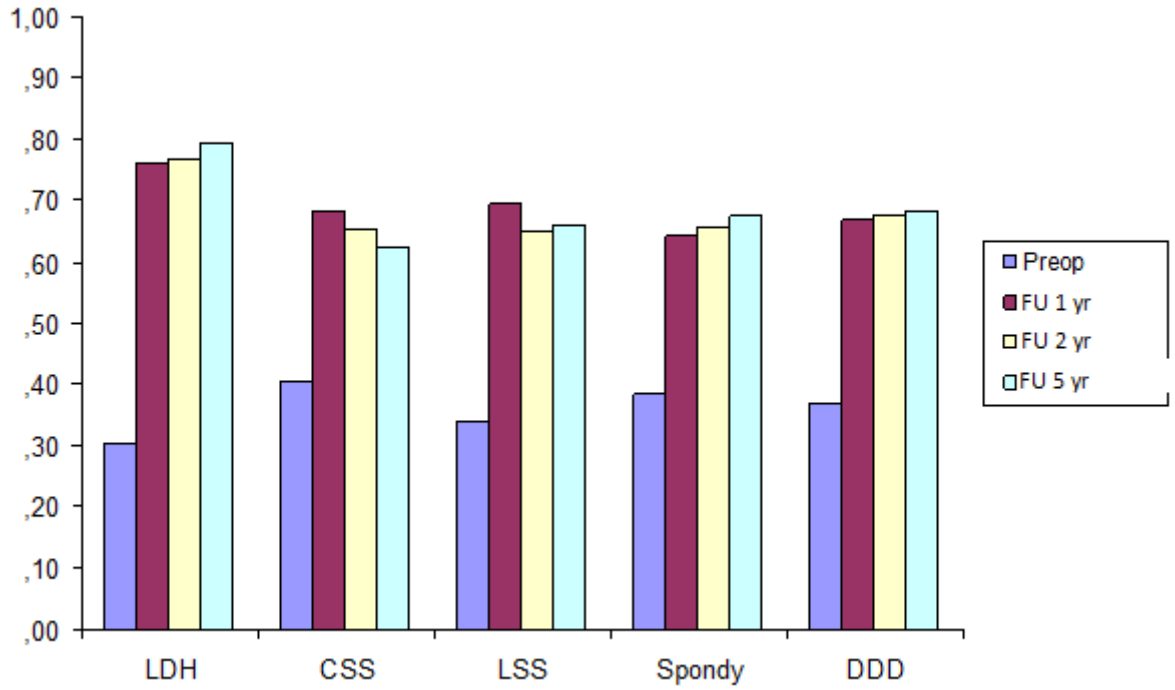

Fig 74. Quality of life preoperatively, at 1, 2 and 5 years FU, as measured by EQ-5D.

Table 31. EQ-5D health assessment according to the VAS, means.

	Preoperatively	**1 year postop**	**2 years postop**	**5 years postop**
Disc Herniation	46	75	75	76
Central stenosis	51	68	65	63
Lateral stenosis	49	68	65	65
Spondylolisthesis	49	67	67	68
DDD	49	69	68	68

VI. Surgery for degenerative cervical spine disease

In 2012, 870 patients were operated for degenerative cervical spine disease, including 52% men and 48% women. In all, 17% of the patients were smokers and 10% had previously had cervical spine surgery.

Preoperative duration of pain was as follows: <3 months 5%, 3-12 months 23%, 1-2 years 21% and more than 2 years 43%, while 8% denied any neck pain. Patients experienced radiation of pain to the arm(s) as follows: 6% of patients for <3 months, 34% for 3-12 months, 22% for 1-2 years and 30% for more than 2 years, while 8% denied any arm pain.

Regular consumption of analgesics was confirmed by 52% of patients, intermittent by 31% and none by the remaining 17%.

Estimated walking distance was reported by 12% of patients to be <100m, 11% 100-500m, 14% 500 m – 1 km and 63% >1 km. In all, 75% reported subjective deterioration of fine motor function in their hands.

Co-morbidity was reported in the form of heart disease 2%, neurological disease 4%, cancer 1%, other disease affecting ability to walk 9%, or other disease causing pain 14%. 71% denied co-morbidity.

Mean neck pain on the VAS was 56 with a spread from 0-100. The corresponding figures for arm pain were 51 with a spread from 0-100.

Mean EQ-5D was 0.39 for patients, while the results of the Neck Disability Index (NDI) were as follows: mean 62.4. The mean value of the European myelopathy score was 15.2.

Data on the procedure

In all, 48% of patients were operated for cervical disc herniation, 24% for cervical spinal stenosis, 23% for cervical foraminal stenosis, 1.3%, for segmental neck pain, 1.7% for rheumatoid arthritis, and 0.23% for ankylosing spondylitis; 1.4% were operated for some other diagnosis.

With respect to the neurological clinical picture, 12% of patients had no neurological findings, 60% radicular involvement, 22% medullary involvement and the remaining 7% combined radicular and medullary involvement. On the Ranawat score, patients were distributed as follows: I: 26%, II: 49%, IIIa: 21% and IIIb: 4%. Neurological deficit according to the Frankel Classification system was distributed as follows: A 4%, B 1%, C 13%, D 50%, E 31%.

Horizontal instability between C1-C2 was seen in 1.8% of cases, vertical between C0 and C2 in 0.1% of cases and subaxial between C2 and Th1 in 3.8% of cases. Combined instability was assessed to be present in 0.3% of cases.

Surgical interventions were as follows:
Disk removal without fusion 0.2%,
Disc removal with fusion without plate 5.6%,
Disc removal with fusion with plate 6.4%,

Disc removal with fusion cage without plate 28.3%,
Disc removal with fusion cage with plate 27%,
Corpectomy 3.8%,
Disc replacement 1.5%,
Transoral decompression 0%,
Laminectomy without fixation 6.1%,
Laminectomy with fixation 5.1%,
SKIP laminectomy 0.3%,
Laminoplasty 0.4%,
Foraminotomy 9.5%,
Combination laminectomy/foraminotomy 1.2%,
Posterior fixation without decompression 2.2%,
Other procedure without implant 0.4% and
Other procedure with implant 1.8%.

Anterior implant was used in 74% of cases and posterior in 9% of cases.

Results after 1-year follow-up

About 68% of the 758 patients operated in 2011 also had 1-year follow-up.

Average preoperative NDI in Sweden was 61 and postoperative 46.

Radiculopathy/arm pain improved from an average of 53 preoperatively to an average of 28 at 1 year FU.

Corresponding subjective scoring of change in arm pain one year postoperatively: Greatly improved 49%, somewhat improved 15%, unchanged 26% and 9% perceived worsening.

Patient assessment of change in walking distance at one year FU: <100m 7%, 100-500m 13%, 0.5-1 km 14%, >1 km 66%.

Quality of life as measured by EQ-5D improved from 0.38 preoperatively to 0.61 at one year FU.

VII. Spine fracture surgery

In 2012, 460 surgeries were registered for spinal column fractures. They were most common in the age group 60-69 years, and 70% were male.93% of the procedures registered were carried out at University Hospitals. According to AO classification, 29% of the fractures were type A, 46% type B and 25% type C (table 32).

Table 32. Fracture types according to AO classification (%).

Class A	Class B	Class C
29	46	25

The single largest group of fractures in the register involved Th11 – L2 fractures. Of the fractures registered to date, 75% were operated with posterior fusion with or without decompression and 2% with vertebroplasty. The most common age group was 60-69 years for this specific fracture too, but they also demonstrate clear peak at age 20-29 years. These fractures include both high-energy injuries in younger and middle-aged patients and osteoporotic fractures in older patients.

Neurological involvement in the form radiculopathy was seen in 16% of cases and in the form myelopathy in 18% of cases with the following distribution according to the Frankel Scale: A 33%, B 12%, C 32%, D 16% and E 8% (table 33).

Table 33. Neurological function according to the Frankel Classification system (percent)

Classification	**Percent**
A	33
B	12
C	32
D	16
E	8

Two years after surgery, 82% of patients were satisfied with the procedure, 12% uncertain and 5% dissatisfied. However, many of the patients probably had no or very moderate back pain before the fracture and have difficulty assessing what the status would have been without surgery. In all, 24% of patients took analgesics regularly and 31% occasionally. EQ-5D was 0.65 two years after the procedure.

VIII. Surgery for spinal metastases

In all, 178 patients are registered for spinal metastasis surgery; 6% were smokers. Indications for surgery are as follows: Neurological involvement 57.1%%, back/leg pain 15.2%, progressive deformity 0%, neurological involvement + back/leg pain 19%, neurological involvement + progressive deformity 1%, back pain + progressive deformity 3.8%, neurological involvement + back/leg pain + progressive deformity 3.8%; no specific indication for surgery was recorded for 41% of 178.

The primary tumor was known in 77% of cases and unknown in 23%. Among the known primary tumors the most common are listed in Table 34.

Table 34. Primary tumor in spinal metastasis (percent)

Primary tumor	**Percent**
Prostate	34
Lung	12
Breast	11
Kidney	7
GI tract	9
Blood-forming organs	8
Thyroid	1
Other known primary tumor	18
Unknown primary tumor	23

In 37% of cases a pathologic fracture was seen. Neurological involvement was distributed as follows on the Frankel Scale: A 3%, B 3%, C 43.6%, D 31.7%, E 18.8%. Preoperative analgesic consumption was as follows: 85.6% morphine analgesics, 11.5% non-morphine analgesics and 2.9% no analgesic consumption.

Surgical procedures included posterior and anterior decompression as well as possible fusion. In all, 93.7% had posterior decompression, at the following levels: cervical, thoracic and lumbar levels, while 6.1% had anterior decompression at the following levels: cervical, thoracic and lumbar. Fusion was carried out in 44.9% of cases.

Resection of tumor was carried out in 85.5% of cases; in 5.4% of cases as wide excision, 13.6% marginal excision, 81% intralesional excision and in 0% RF ablation.

IX. Number of registered operations and follow-up rate

The number of patients entered in the surgery register for degenerative lumbar disorders has steadily increased in recent years, as illustrated in Figure 75.

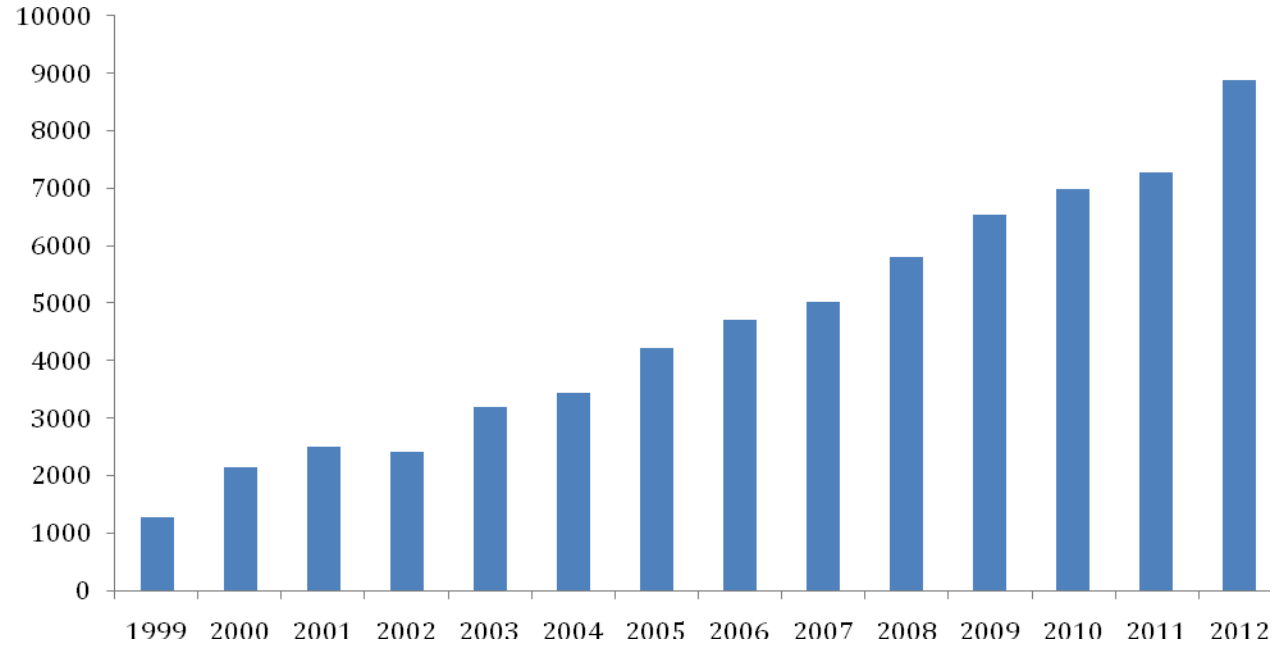

Fig 75. Number of patients entered in the register for degenerative disorders of the lumbar spine 1999-2012.

Figure 76 below shows the follow-up rate at 1 and 2 years for patients operated in 2010, figure 76.

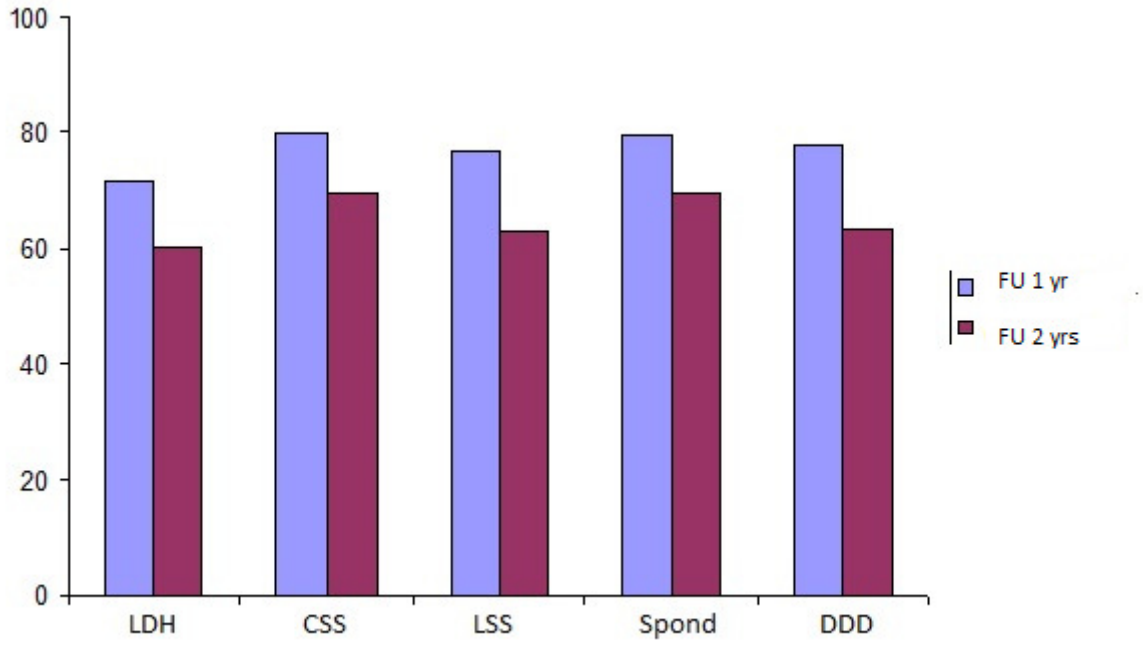

Fig 76. Current follow-up rate.

X. Conclusion

We hope that our readers have been able to appreciate this report from Swespine, the Swedish spine surgery register, despite the occasionally technical nature of the language. As was mentioned in the introductory chapter, the registry data are being used on a broader level in numerous initiatives, both nationally and internationally, as well as in a clinical care improvement project developed in cooperation with Registercentrum Sydost, Indikator and Qulturum. Another example is the model for quality-based reimbursement for spine surgery described in the analysis chapter of the report.

We are happy to promote Swespine as the leading spine register worldwide in terms of both design and content. The structure used in the current project to develop a worldwide registry platform for spine surgery will most likely be quite similar to Swespine.

Once again, the number of registered surgeries this year was higher than previously, while the follow-up rate remains essentially unchanged. We hope to improve the latter using the Register Center.

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XI. References

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