BACKGROUND

- Complications in instrumental spinal surgeries (ISS) pose a considerable burden on patients.
- ISS is indicated when sudden events such as injuries, fractures, or emerging events like infection or tumors causing spinal weakness and instability occur. Furthermore, spine-related diseases like spondylolisthesis, scoliosis, kyphosis, or spinal stenosis are possible indications for ISS.
- The use of a pedicle screw for the fixation of vertebrae in the spine is the generally accepted ISS approach; however, accurate placement of pedicle screws remains difficult.1
- Dependable data on the frequency of reoperations and associated costs are lacking for Germany.

OBJECTIVES

- The aim of this study was to estimate the incidence of ISS and consecutive reoperations and to calculate related costs.

METHODS

- We conducted a retrospective claims data analysis using the Health Risk Institute research database, which contains anonymized claims data and covers approximately 5.42% of the German population.
- The study period comprised January 1, 2009 to December 31, 2011.
- An algorithm of operation and procedure codes (OPS) identified primary ISS and following reoperations.
- ISS was defined with 1 of the following OPS codes: – S-831.4*: Open reduction with internal fixation of the spine (osteosynthesis) – S-835.9: Osteosynthesis and bone substitutes at the spine – S-836.3*: Spondylosis (dorsal) – S-836.4*: Spondylosis (dorsal and ventral combined, inter-corporal)
- Patients were defined as incident patients if they had an ISS in 2010 (index date) and no ISS in the 12 months before the index date.
- The development of the algorithms to identify primary ISS and following reoperations was guided by 2 clinical experts (Jörg Frank, Michael Winking).
- Patients with an OPS code S-835.9 (revision of a spinal surgery) or S-953 (revision surgery) were considered to have had a reoperation.
- Patients with a sequence of the same access OPS codes S-830.* (patient access cervical) or S-932.5* (patient access lumbar) at their primary surgery and that following secondary surgery were also included in the study.
- Reoperation rates were calculated for an individual period of 12 months after the primary ISS in 2010.
- Costs for occurring reoperations were calculated by group comparison.
- All costs were calculated by an annual scale of 12 months before and 12 months after the primary ISS for each patient in the study population.
- Annual incremental cost for a reoperation was calculated by comparing patients with a reoperation with a control group composed of patients without a reoperation after their primary ISS.
- The mean cost difference between both groups was attributed to the reoperation.
- Existing differences in cost levels in the year before the primary ISS were adjusted by the difference in differences approach.

RESULTS

- A total of 3,316 individuals had a primary ISS in 2010; of these, 54.3% were female and the mean age was 61 years.
- 331 patients underwent a reoperation within 12 months after their primary ISS resulting in an annual reoperation rate of 10.0% (95% confidence interval [CI]: 9.0%, 11.0%.
- Patients with reoperations were comparable to those without a following reoperation in terms of age and gender. The standardized difference was 7.0% for age and 4.6% for gender.
- Reoperations were also more frequent for female patients (55.9%) (Table 1).

Table 1. Gender Proportion of the Study Population

<table>
<thead>
<tr>
<th>Total ISS Population</th>
<th>Patients Not Undergoing Reoperation</th>
<th>Patients Undergoing Reoperation</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>%</td>
<td>N %</td>
</tr>
<tr>
<td>Female</td>
<td>1,803</td>
<td>54.37%</td>
</tr>
<tr>
<td>Male</td>
<td>1,513</td>
<td>45.63%</td>
</tr>
<tr>
<td>Total</td>
<td>3,316</td>
<td>100%</td>
</tr>
</tbody>
</table>

COST OF ISS AND FOLLOWING REOPERATIONS

- The mean cost per ISS was €11,331 for all patients (€13,358, reoperation group; €11,106, control group).
- The difference was driven by 42.6% of reoperations occurring within the same hospital stay as the primary ISS.
- Together with the costs of the primary ISS, patients with a reoperation incurred a mean total cost of €31,220 in the 12 months after their primary ISS. In contrast, the mean annual total cost of patients without a reoperation was €18,928, a difference of €12,291 (P<0.0001).
- The mean adjusted annual cost for a reoperation was €11,370, with €8,432 directly attributed to the reoperation procedure and €2,938 to excess costs in the first year after the primary ISS.
- After controlling for unobserved variables, there was a significant difference in mean total costs of €921 between the 2 groups (Figure 1).

DISCUSSION

- The present study is the first scientifically published study for the German setting that analyzes the incidence and costs of ISS and consecutive reoperations from the perspective of the statutory health insurance (SHI) system.
- Reoperations have a considerable impact on health insurance budgets. Based on the SHI population in 2010 (Federal Statistical Office, DESTATIS, Federal Ministry of Health), a total of approximately 5,214 patients underwent an ISS revision surgery, resulting in approximately €59.3m costs for the German SHI system.
- The natural frequency of reoperations in this study was estimated to be 9.88%, which is in line with reoperation rates given in the literature. Green et al. (2005) reported reoperation rates from 10% to 42% for studies using traditional techniques to insert pedicle screws and reoperation rates ranging from 0% to 9% for studies where an imaging technique was used to guide screw surgery.2,3
- The broader approach of identifying reoperations was chosen here because of the hypothesis that current coding practice might be incomplete and not every reoperation is classified as such by the appropriate OPS code.

LIMITATIONS

- This study is limited by the nature of the data source. Claims data are recorded for accounting purposes and not for clinical research. As a result, it is not possible to characterize patients by clinical parameters such as disease severity or to see the physician's intervention for each reoperation. It is therefore difficult to investigate plausible causes of reoperations based on claims data.

CONCLUSION

- Necessary reoperations occur and are associated with significant resource utilization and cost from the perspective of the German SHI.
- With 10% of primary ISS patients requiring a reoperation in Germany, their associated annual costs are relevant from the SHI perspective.
- On average, these costs exceed the direct cost for the initial surgery.
- Clearly, these costs are driven by the need for inpatient care. Nevertheless, costs for outpatient care also increase significantly in the year after the primary surgery.

ACKNOWLEDGEMENT

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REFERENCES