Second Opinions for Spine Surgery: A Scoping Review

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Abstract

**Background:** Second opinions have the goal of clarifying uncertainties around diagnosis or management, particularly when healthcare decisions are complex, unpleasant, and carry considerable risks. Second opinions might be particularly useful for people recommended surgery for their back pain as surgery has at best a limited role in the management of back pain. No studies have attempted to summarise the available evidence for second opinion services designed for people with back pain that have been recommended to have surgery.

**Methods:** We conducted a scoping review. Two independent researchers screened PubMed, EMBASE and Cochrane CENTRAL from their inception to May 6th, 2021. Studies of any design were eligible provided that they described a second opinion intervention for people with spinal pain (low back or neck pain with or without radicular pain) either considering surgery or to whom surgery had been recommended. We assessed the methodological quality of studies with the Downs & Black scale. Outcomes were: i) characteristics of second opinion services for people considering or who have been recommended spinal surgery, ii) agreement between first and second opinions in terms of diagnoses, need for surgery and type of surgery, iii) their effectiveness in reducing surgery rates and improving patient-reported outcomes; and iv) the costs and healthcare use associated with these services. Outcomes were presented descriptively.

**Results:** We included 12 studies (11 had poor methodological quality; one had fair). Studies described patient, doctor, and insurance-initiated second opinion services. Diagnostic agreement between first and second opinions varied from 53% to 96% across studies. Agreement for need for surgery between first and second opinions ranged from 0% to 83%. There is some very-low quality evidence that second opinion services may reduce surgery rates in the short-term, but it is unclear whether these reductions are sustained in the long-term or if patients only delay surgery. Second opinion services may reduce costs and some healthcare use (e.g. imaging), but might increase others (e.g. injections, prescription drugs).

**Conclusions:** There is a need for high-quality studies to determine the value of second opinion services for reducing spinal surgery.

**Background**

Second opinions have the goal of clarifying uncertainties around diagnosis or management, particularly when healthcare decisions are complex, unpleasant, and carry considerable risks. Second opinions are not uncommon and often patient-initiated: about 1 in 5 persons who visited a doctor end up seeking a second opinion. Second opinions can also be initiated by other parties, such as doctors and health insurers. Those initiated by doctors and health insurers may have different drivers; they may be related to reducing the provision of low-value care (i.e., care that provides little or no benefit, may cause harm, or yields marginal benefits at a disproportionately high cost). In Australia, some private health insurers currently have second opinion services, typically offered by third-parties separate to the insurer.

Musculoskeletal conditions are amongst the most common reasons why people seek a second opinion. In an American study, requests for second opinions in orthopaedic surgery were the most common reason, representing 18% of all patient-initiated requests. Similar figures were described in an Israeli study: most second opinions were sought from orthopaedic surgeons, representing 17% of all requests. In a German study, 27% of all second opinions were for spinal conditions.
Second opinions might be particularly useful for people recommended surgery for their back pain as surgery has at best a limited role in the management of back pain. Reasons to consider a second opinion might include substantial variability in diagnoses given to people with back pain\(^9\), indications for surgery, and risks associated with some surgical procedures that have unclear benefits (e.g. spinal fusion).\(^{10}\) Some studies have reported outcomes of second opinions for people with back pain, but there has not been any attempts to summarise the evidence available for a range of outcomes of second opinion services designed for people with back pain that have been recommended to have surgery.

The aims of this scoping review are to describe:

1. The characteristics of second opinion services for spinal surgery
2. Diagnostic agreement between first and second opinions
3. Agreement in treatment recommendations between first and second opinions
4. The results of second opinion services for (i) reducing rates of surgery, and (ii) improving patient-reported outcomes
5. The costs and healthcare use associated with second opinion services

**Methods**

**Study design and registration**

Given the broad range of questions we were interested in, a scoping review was the most appropriate study design. Scoping reviews are useful for mapping the concepts underpinning a research area and the main sources and types of evidence available.\(^{11,12}\) We reported this scoping review per the recommendations from the PRISMA extension for Scoping Reviews (PRISMA-ScR).\(^{13}\)

**Searches**

We searched PubMed, EMBASE and Cochrane CENTRAL from their inception to May 6\(^{th}\), 2021. The search terms for each database are described in Appendix 1. Two researchers (GF, JZ) independently screened studies first by reading title and abstract and then their full text. We conducted backward and forward citation tracking by examining the reference list of included studies and citations to the included studies. Disagreements were resolved by discussion and consensus. If no consensus was reached a third researcher (CM) arbitrated.

**Eligibility criteria**

Any study design was eligible, provided it described a second opinion intervention for people with spinal pain (low back or neck pain with or without radicular pain) either considering surgery or to whom surgery had been recommended. Second opinions could be initiated by the patient, doctor, or health insurance company. Second opinions could have been provided by an individual health professional (e.g., spine surgeon, rheumatologist), or conducted by a review board or conference. Studies describing changes in care pathways to reduce referrals to surgeons were not eligible as these do not constitute a second opinion for spinal surgery.\(^{14}\)

**Data charting process and outcomes**
Two independent researchers used a piloted spreadsheet to extract data from eligible studies. Data extracted included bibliographic data (year and country published), study design, characteristics of the included sample (e.g., age, sex, diagnoses), sample size, setting (e.g., tertiary outpatient specialist services), eligibility, details of the second opinion services (e.g., independence of the first and second opinions), outcomes, and results.

We extracted data for the following outcomes:

1. The characteristics of second opinion services for spinal surgery. Format could describe who initiated the service (e.g. doctor, patient, or insurer) and characteristics of the service (e.g. health professionals involved in providing the second opinion)
2. The diagnostic agreement between those providing the first and second opinions.
3. The agreement in treatment recommendations between those providing the first and second opinions. This consisted of agreement on the need for surgery and type of surgery.
4. The outcomes of second opinion services on (i) reducing rates of surgery, and (ii) improving patient-reported outcomes. For the assessment of effectiveness, studies had to report data on actual surgical rates as opposed to treatment recommendations and have data for at least one year since the second opinion.
5. The costs and healthcare use associated with second opinion services.

**Methodological quality**

We used the Downs and Black tool to appraise the methodological quality of the included studies. The Downs and Black Scale has 27 items relating to quality of reporting (ten questions), external validity (three questions), internal validity (bias and confounding) (13 questions), and statistical power (one question). The scale has been shown to have high levels of agreement. Included studies were classified as “excellent” (24–28 points), “good” (19–23 points), “fair” (14–18 points) or “poor” (<14 points).

**Analyses**

We summarised data using descriptive statistics when applicable. We used means and standard deviations (SD) or medians and minimum and maximum for continuous outcomes, and frequency and proportions for categorical data when appropriate.

**Results**

We retrieved 6330 records from the electronic databases. After excluding 613 duplicates, we screened 5717 titles and abstracts. Of these, 27 studies had their full text assessed for eligibility and 9 were deemed eligible. We identified a further 3 studies upon conducting backward and forward citation tracking. We therefore included 12 studies in this review. (Fig. 1).

**Study characteristics**

We identified no randomised controlled trials. All studies were observational – 8 were prospective, 3 were retrospective, and one was cross-sectional. One study was a conference abstract. Eight studies did not have a comparator; patients enrolled into these studies had been recommended surgery by another surgeon prior to entering the study. Three studies had a comparator. In two, the comparator was the period
prior to the implementation of the second opinion service.\textsuperscript{19,21} In one, matched controls who did not seek a second opinion were used.\textsuperscript{26}

Eleven studies were classified as poor\textsuperscript{17,19–21,23–29} and one was classified as fair in relation to methodological quality.\textsuperscript{22} Across the included studies, several elements in the Downs & Black scale were poorly reported. For example, no study had a randomised design, allocation concealment, blinded study participants or personnel, adequately described the characteristics of patients lost to follow-up and conducted an a priori power analysis. Only one study collected adverse event data, described the compliance with the intervention and attempted to adjust analyses for confounding.\textsuperscript{22} Characteristics of the included studies including their methodological quality are presented in Table 1.
Table 1
Characteristics of the included studies.

| Study, year | Sample size and setting | Eligibility | Intervention | Downs & Black score | Outcomes |
|-------------|-------------------------|-------------|--------------|---------------------|----------|
| Country: US | 155 patients; Neurosurgery outpatient practice | No information | Consecutive patients seeking a surgical opinion for a spine problem. | 4 (poor) | Format of the service • Agreement (need for surgery) |

**Citation:** Gamache, 2012

**Design:** Prospective observational study

**Type of second opinion:** Patient-initiated

| Citation: | Lenza, 2017 | Country: Brazil | Design: Prospective observational study | Type of second opinion: Doctor-initiated | Inclusion | Exclusion |
|-----------|-------------|-----------------|--------------------------------------|----------------------------------------|-----------|----------|
| Referred for second opinion: 544 | Completed stage 1: 485 | Completed the full protocol: 425 | Tertiary outpatient service in Brazil within a large private hospital | Inclusion | Exclusion |
| All patients aged 18 + referred to the outpatient centre recommended for surgery | Spinal fractures, major scoliosis, congenital spinal deformity, spinal tumours, spondyloarthropathies, or infection* | Each patient attended two appointments with a physiatrist and an orthopaedic surgeon who did not perform spine surgery. When consensus was not reached or consensus in favour of surgery was reached, patients were seen by a spinal review board (9 senior spine surgeons and 6 neurosurgeons). The board made the final recommendation. Participants who were recommended conservative management were offered treatment at the physiotherapy outpatient service. | 18 (fair) | Format of the service • Agreement (diagnosis) • Agreement (need for surgery) • Agreement (type of surgery) • Patient-reported outcomes |

PROMs, patient-reported outcome measures; N/A, not applicable
| Study, year | Country | Design | Type | Citation | Sample size and setting | Eligibility | Intervention | Downs & Black score | Outcomes |
|-------------|---------|--------|------|----------|------------------------|------------|-------------|---------------------|----------|
|             |         |        |      | Marnitz, 2019 | 243 | No information | No information | 10 (poor) | Surgery rates |
|             | Germany | Retrospective observational study | Setting unclear | Patient-initiated | | | | |
|             |         |        |      | Namiranian, 2018 | 11 (reviewed by the spine board) | 291 (pre and post spine board implementation period but not reviewed by board) | Veteran Affairs Maryland Health Care System | Inclusion: Patients considered for elective lumbar spine surgery and considered at high risk of poor outcome | Exclusion: Red flags (e.g., progressive lower extremity weakness, bladder disorders, fever, malignancy, intractable pain, or significant lumbar spine trauma) | A multidisciplinary spine board including orthopaedic spine surgeons, neurosurgeons, pain psychologists, physical therapists, radiologists, pain pharmacists, primary care clinicians, pain management clinicians, anaesthetists, and veteran advocacy was created. After a board discussion, a formal recommendation for the treatment plan was made. | 14 (poor) | Format of the service | Agreement (need for surgery) |

PROMs, patient-reported outcome measures; N/A, not applicable
| Study, year | Sample size and setting | Eligibility | Intervention | Downs & Black score | Outcomes |
|-------------|-------------------------|-------------|--------------|---------------------|----------|
| Country:    | Brazil                  | Patients aged 18–82 years who required a second opinion due to disagreement with the pre-established protocol for surgical indication | Opinions from two surgeons were compared and classified as: | 10 (poor) | • Format of the service  
| Design:     | Prospective observational study | • Complete agreement: both surgical options were similar | • Partial disagreement: minor difference in surgical indication (eg extension of procedure or number of implants). A third opinion was not needed. | | Agreement (need for surgery) |
| Type        | Orthopaedic surgery practice | • Complete disagreement: there was a significant difference in surgical indication, diagnosis, need for surgery or type of procedure. Required a third opinion by another spine surgeon. | | | |

**Citation:** Vialle, 2015

**PROMs, patient-reported outcome measures; N/A, not applicable**
| Study, year | Sample size and setting | Eligibility | Intervention | Downs & Black score | Outcomes |
|-------------|-------------------------|-------------|--------------|---------------------|----------|
| Country: US | Design: Retrospective observational study | Type of second opinion: Doctor-initiated | 100 Medical Centre | Inclusion | Patients scheduled to undergo spine surgery involving up to three levels of fusion or unusual spinal pathology that required a multidisciplinary approach for diagnosis of treatment planning. | A spine multidisciplinary conference with at least one member of the following areas: physical medicine and rehabilitation, anaesthesia pain service, neurosurgery, orthopaedic spine surgery, nursing, physical therapy, and social work. | 11 (poor) | - Format of the service - Agreement (diagnosis) - Agreement (need for surgery) |
| Country: US | Design: Prospective observational study | Type of second opinion: Patient-initiated | 274 Neurosurgery outpatient practice | No information | Patients who had been referred for surgery by another spine surgeon and wanted a second opinion were assessed by a neurosurgeon who classified the surgical recommendations as “necessary” or “unnecessary”. There were two criteria for classifying surgeries as “unnecessary”: • No focal neurological deficits • No significant abnormal surgical pathology on imaging | | 3 (poor) | - Format of the service - Agreement (need for surgery) |

PROMs, patient-reported outcome measures; N/A, not applicable
| Study, year | Sample size and setting | Eligibility | Intervention | Downs & Black score | Outcomes |
|-------------|-------------------------|-------------|--------------|---------------------|----------|
| Country     | Elitability             | Intervention | Patients receiving a second opinion and for whom surgery had been recommended by another surgeon had their initial surgery recommendation classified as: |
| Design      | Type                    |                          | • Unnecessary: surgeries recommended for pain alone, without neurological deficits, or significant radiographic abnormalities. |
| Type        |                         |                          | • Wrong: Overly extensive surgeries (eg too many levels anterior, posterior, or circumferential) or performed from the wrong access route (eg anterior vs posterior vs circumferential) |
| Type of second opinion: |                         |                          | • Right: The neurosurgeon providing the second opinion agreed with the surgical recommendation from the previous surgeon (necessity, extent, and approach) |
| Country: US | Neurosurgery outpatient practice | No information | 7 (poor) |
| Design:    | Prospective observational study | 183 | | | |
| Type of second opinion: | Patient-initiated | | | |

PROMs, patient-reported outcome measures; N/A, not applicable
| Study, year | Sample size and setting | Eligibility | Intervention | Downs & Black score | Outcomes |
|-------------|-------------------------|-------------|--------------|---------------------|----------|
| **Country**: US | Online survey with 30 hospitals | N/A | N/A | 8 (poor) | - Format of the service - Costs |
| **Design**: Cross-sectional study | **Type of second opinion**: patient-initiated | | | | |
| Citation: Lien, 2020 | | | | | |
| **Country**: Brazil | 419 | Patients recommended surgery were referred by their health insurer for a second opinion at the tertiary outpatient service | Each patient attended two appointments with a physiatrist and an orthopaedic surgeon who did not perform spine surgery. When there was no consensus or consensus that surgery was required, patients were seen by a spinal review board (9 senior spine surgeons and 6 neurosurgeons). The board made the final recommendation. Participants who were recommended conservative management were offered treatment at the physiotherapy outpatient service. | 12 (poor) | - Costs |
| **Design**: Prospective observational study | **Type of second opinion**: Doctor-initiated | | | | |
| Citation: Viola, 2013 | Tertiary outpatient service in Brazil within a large private hospital | | | | |

PROMs, patient-reported outcome measures; N/A, not applicable
| Study, year | Sample size and setting | Eligibility | Intervention | Downs & Black score | Outcomes |
|-------------|-------------------------|-------------|--------------|---------------------|----------|
| Country: US | 54 physiatrists from 33 practices providing consultations in Spine Centres of Excellence approved by the health insurer | Inclusion | A health insurer formed a multidisciplinary advisory group to define criteria required for physiatrists to be eligible to obtain the designation of a Spine Centre of Excellence. Every patient was required to be seen by a physiatrist prior to evaluation by a spine surgeon (except if patient had any of the exclusion criteria). Surgeons were not reimbursed unless services were approved by the health insurer. After the consultation with the physiatrist, the patient could choose what care to receive (e.g., continue care with physiatrist, see a surgeon) without any other limitations. | 10 (poor) | • Format of the service  
• Surgery rates  
• Costs  
• Healthcare use |
| Design: Prospective observational study | Exclusion | Patients that had evidence of trauma, tumour, infection, progressive bilateral neurological findings, cauda equina syndrome, follow-up to an inpatient or emergency department evaluation by a spine surgeon | | |
| Type of second opinion: Insurance-initiated | | | | |

PROMs, patient-reported outcome measures; N/A, not applicable
| Study, year | Sample size and setting | Eligibility | Intervention | Downs & Black score | Outcomes |
|-------------|-------------------------|-------------|--------------|--------------------|----------|
| Country     |                         |             |              |                    |          |
| Design      |                         |             |              |                    |          |
| Type        |                         |             |              |                    |          |
| Citation: Goodman, 2016 | 501 | Inclusion | People aged 18–65 with a membership with the health insurer with an episode of back pain | 9 (poor) | • Format of the service  
• Surgery rates  
• Costs  
• Healthcare use |
| Country: US |                         | Exclusion   | Serious clinical presentations or other reasons (eg surgical follow-up) |                    |          |
| Design: Prospective observational study |                  |              |              |                    |          |
| Type of second opinion: Insurance-initiated |                  |              | In order for a surgical consultation to be authorised by the health plan, patients were required to see a physiatrist (any) within the previous 6 months of the surgical appointment. |                    |          |

**Characteristics of second opinion services**

Second opinion services were either patient-initiated (n = 5), 17,20,23,26,28,29 doctor-initiated (n = 4), 22,24,25,27 or insurance-initiated (n = 2). 19,21 In four studies describing a patient-initiated second opinion service, second opinions were given by a single surgeon. 17,20,28,29 In one study it was not clear who provided the second opinion. 26 Only one study described the format by which second opinion services were delivered. 28 In a survey study with 30 neurosurgery medical centres in the US, most patient-initiated (29, 97%) second opinion services offered in-person appointments, and a small proportion (11, 37%) offered a tele-health option. 28

In the four studies describing doctor-initiated second opinion services, the final treatment recommendation typically considered the opinion of more than one health professional and did not always only involve spine surgeons in the decision (e.g., a multidisciplinary conference). 25,27 In two studies describing the same second opinion service, patients referred to that service were first seen by an orthopaedic surgeon (not a spine surgeon) and a physiatrist who made an independent treatment recommendation. 22,24 When there was consensus that surgery was not required, patients were offered physiotherapy treatment. If there was consensus that surgery was required, or opinions were discordant, patients were then referred to a board of nine spine surgeons who reviewed the case and made a final recommendation. In two other studies, doctor-initiated second opinions consisted of a multidisciplinary team who made the final treatment recommendation. 25,27

In the two studies describing insurance-initiated services, insurers adopted a mandatory consultation with a physiatrist for every patient requiring surgical evaluation with a spine surgeon. 19,21 In one study, the service was provided by a trained physiatrist within specialised centres, 19 whereas in the other study any physiatrist was eligible to provide the service. 21

**Diagnostic agreement between first and second opinions**
Two studies had data on the diagnostic agreement between first and second opinions. In the study by Lenza et al., diagnoses were concordant between first and second opinions for 53% of patients. Examples of diagnoses that had low concordance include cervical radiculopathy (36% agreement), lumbar radiculopathy (50% agreement), and lumbar stenosis (58% agreement) (Table 2). In contrast, Yanamadala et al. had a much better agreement (96%).
| Study, year       | Agreement between first and second opinions, second opinion/second opinion (%) | Diagnosis                                                                 | Need for surgery                                                                 | Type of surgery                                                                 |
|-------------------|--------------------------------------------------------------------------------|------------------------------------------------------------------------------|----------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| Lenza, 2017       |                                                                                 | Overall agreement: 53%                                                        | Overall agreement: 143/425 (34%)                                                | Agreement with the same surgical procedure recommended by the first opinion: 66/425 (16%)  |
|                   |                                                                                 | Agreement by diagnosis:                                                       |                                                                                  |                                                                                 |
|                   |                                                                                 | - Non-specific neck pain: 4/13 (24%)                                          |                                                                                  |                                                                                 |
|                   |                                                                                 | - Radiculopathy (cervical): 36/99 (36%)                                       |                                                                                  |                                                                                 |
|                   |                                                                                 | - Radiculopathy (lumbar): 116/234 (50%)                                       |                                                                                  |                                                                                 |
|                   |                                                                                 | - Lumbar stenosis: 7/12 (58%)                                                 |                                                                                  |                                                                                 |
|                   |                                                                                 | - Failed back surgery: 26/37 (70%)                                            |                                                                                  |                                                                                 |
|                   |                                                                                 | - Non-specific low back pain: 66/83 (80%)                                     |                                                                                  |                                                                                 |
|                   |                                                                                 | - Cervical myelopathy: 2/2 (100%)                                             |                                                                                  |                                                                                 |
|                   |                                                                                 | - Non-spinal condition: 87/0                                                   |                                                                                  |                                                                                 |
| Gamache, 2012     |                                                                                 | 55%                                                                          |                                                                                  |                                                                                 |
| Namiranian, 2018  |                                                                                 | Overall agreement: 0/11 (0%)                                                  |                                                                                  |                                                                                 |
| Yanamadala, 2017  |                                                                                 | Overall agreement: 96/100 (96%)                                               | Overall agreement: 42/100 (42%)                                                 |                                                                                 |
|                   |                                                                                 | Agreement by diagnosis                                                         |                                                                                  |                                                                                 |
|                   |                                                                                 | - Non-spinal condition: 4/0                                                   |                                                                                  |                                                                                 |
### Agreement in treatment recommendations between first and second opinions

Eight studies reported data on agreement in treatment recommendations (need for surgery and type) between first and second opinions. Agreement for need for surgery (yes/no) ranged from 0% to 83% (Table 2). Three one studies provided data on the agreement between first and second opinions on the type of surgery, and showed very low agreement for commonly recommended surgeries such as lumbar fusion (15%), cervical fusion (15%), and cervical or lumbar decompression (25%).

### Outcomes

Three studies, two insurance-initiated and one patient-initiated, had data on the outcomes of second opinion services. In Marnitz & Wagner, 44% patients who received a second opinion had surgery compared to 75% of patients who did not after one year (between-group difference: 32%; 95% CI 19–43%).

The two studies describing an insurance-initiated service found conflicting results. Fox et al found a 29% reduction in surgery rates comparing a 2-year pre and 2-year post-implementation period (2.7 vs 1.9 surgeries per 1000 plan members), whereas Goodman et al found increased surgery rates by 9% from 2008 to 2013 (68 vs 74 per 100,000 population) when implementing a similar service.

Only one study reported patient-reported outcomes from patients who had received surgery or conservative care following the second opinion recommendation. One year after receiving the final recommendation from the second opinion service, those who were recommended conservative care had similar pain, disability and quality of life than those who had surgery (Table 3). These results however need to be interpreted with caution, as 72–78% of participants who initiated the study (n = 485) did not provide patient-reported outcomes. No studies compared patient-reported outcomes of people who received a second opinion versus those who did not.
| Study, year | Surgery rates | Patient-reported outcomes | Costs | Healthcare use |
|-------------|---------------|---------------------------|-------|----------------|
| **Lenza, 2017** | Between-group MD (95% CI) | Pain (0–10): 0.5 (-0.5 to 1.6) | RMDQ (0–24): 1.5 (-1.6 to 4.7) | ODI (0–100): 27.4 (-7.1 to 7.3) |
| **Marnitz, 2019** | Patients receiving surgery within 12 months, n/N (%) | Second opinion: 47/108 (44%) No second opinion: 81/108 (75%) | Between group difference (95% CI): 32% (19–43%) |
| **Viola, 2013** | Estimated cost (USD) of treatment after second opinion versus cost initially proposed (difference): - Surgery: $1,002,826 vs $1,228,117 (difference: $225,291; -18%) - Conservative: $184,304 vs $1,840,976 (difference: $1,656,672; -90%) - Total: $1,187,294 vs 3,069,094 (difference: $1,881,800; -61%) |
| Study, year | Surgery rates | Patient-reported outcomes | Costs | Healthcare use |
|-------------|---------------|--------------------------|-------|----------------|
| Fox, 2013   | Surgery rates per 1000 plan members pre/post program implementation (2006-2007 vs 2008-2010): 2.7 vs 1.9 (-29%) | | Costs pre (2006-07) versus post-implementation (2007-08) (USD, % change): | Healthcare use pre (2006-07) versus post-implementation (2007-08) (% change): |
|             |               |                          | Surgical costs per member per month: $9.75 vs $7.29 (-25%) | - Physiatrist consultations per 1000 members: 5 vs 8.5 (+69.5%) |
|             |               |                          | Total spinal-related costs per member per month: $19.7 vs $17.4 (-12%) | - New surgical consultations per 1000 members: 7.2 vs 3.7 (-48%) |
|             |               |                          | Average reimbursement for surgery: $21,250 vs $22,853 | - Advanced imaging (CT or MRI) per 1000 members: 14 vs 11.6 (-17.7%) |
|             |               |                          |                                               | - Electrodiagnostic testing, % of cases: 21% vs 24% (+14%) |
|             |               |                          |                                               | - Spinal injections, % of cases: 42% vs 44% (+4%) |
Study, year | Surgery rates | Patient-reported outcomes | Costs | Healthcare use
--- | --- | --- | --- | ---
Goodman, 2016 | Surgery rates per 100,000 population pre-post program implementation (2008–2013): 68 vs 74 (+ 8%) | Costs pre (versus post-implementation (USD, % change): $4,338 vs $7,940 (+ 83%) | Percentage of incremental costs with non-surgical care per type of service considering an average increase in cost post-implementation of $3,602 per member:  
- Emergency: $326 (9%)  
- Urgent care: $1 (0%)  
- Observation stays: $209 (6%)  
- Inpatient admissions: $666 (19%)  
- Office visits: $379 (11%)  
- Physiotherapy visits: $290 (8%)  
- Radiology: $437 (12%)  
- Chiropractic: $1 (0%)  
- Prescription drugs: $460 (13%)  
- Lumbar injections: $835 (23%) |
Lien, 2020 | Mean (SD; range) cost of second opinion services across 30 hospitals in the US: $493 ($343; $90-$1300) | Average cost of second opinion services provided online: $643 ($259; $100-$850) |

**Costs and healthcare use associated with second opinion services**

Four studies had data on costs or healthcare use, or both (Table 3). Lien described the costs of patient-initiated second opinion services in 30 hospitals in the US. The mean (SD) cost of these services across the 30 hospitals was $US 493 per second opinion consultation (range $90-$1300). None of the services were covered by insurers. Amongst hospitals that offered online services, the mean cost was higher – $643 ($259; range $100-$850).

In Fox et al., the total monthly spinal-related costs per member reduced 12% after the implementation of an insurer-initiated second opinion service. The net decrease in costs for the insurer in one year was more than $14 million. The cost reduction was driven by a decrease in surgical rates (29% reduction), surgical consultations
and advanced imaging such as MRI or CT scans (18% reduction). There were increased costs with physiatrist services (69% increase), electrodiagnostic testing (14% increase), and spinal injections (4% increase). The average reimbursement per surgery increased 8% (from $21,250 to $22,853). Goodman et al. only reported data on pre-surgical costs before and after the implementation of the insurance initiated second opinion service and noted an 83% increase in those costs.21 The main drivers of the observed increase in costs were lumbar injections (23% of incremental costs), inpatient admissions (19%), prescription drugs (13%) and radiology (12%).

Viola et al.24 reported estimated cost data. In their study, all patients had been initially referred to surgery. They estimated that there was an overall estimated reduction of 61% in costs with the second opinion service. An 18% reduction was estimated amongst those treated surgically (n = 54), and a 90% reduction was estimated amongst those treated conservatively (n = 112) (Table 3).

Discussion

Summary of main findings

This scoping review identified 12 observational studies describing i) characteristics of second opinion services for people considering or who have been recommended spinal surgery, ii) agreement between first and second opinions in terms of diagnoses, need for surgery and type of surgery, iii) their effectiveness in reducing surgery rates and improving patient—reported outcomes; and iv) the costs and healthcare use associated with these services. Studies described patient, doctor, and insurance-initiated second opinion services. These were typically offered by single surgeons in studies describing a patient-initiated service, by multidisciplinary teams in studies of doctor-initiated services, and by non-surgeons in insurance-initiated services.

Agreement in diagnoses and treatment recommendations (need for and type of surgery) were variable across studies. Diagnostic agreement varied from 53%22 to 96%,27; agreement on the need for surgery ranged from 0%25 to 83%.17 Second opinion services may reduce surgical rates, reduce costs and use of some healthcare resources such as advanced imaging. There might be an increase in use of other aspects of healthcare, such as expenses related to non-surgical care (e.g. injections). However the evidence is uncertain with one study having fair methodological quality and the other 11 having poor methodological quality.

Comparison with previous studies

To the best of our knowledge ours is the first study to summarise outcomes related to second opinion services for spinal surgery. Our findings indicate that second opinions may reduce surgery rates and healthcare costs, however data are limited by the poor design and methodological quality of studies. This is in line with the literature on second opinions in other areas of healthcare. In a systematic review of patient-initiated second opinions for a range of health conditions, second opinions led to change in diagnosis, treatment, or prognosis in 10%-62% of cases.1 In a review of second opinion services for patients with cancer, substantial variability was found in the proportion of cases where changes in diagnosis, treatment recommendations or prognosis occurred: 12%-69%.30

Meaning of the study
In our review, spinal fusion was the surgery more often considered to be unnecessary after a second opinion. 

Second opinion services may be a promising intervention to curb the rise in rates of spinal fusion, a costly surgery with questionable benefits compared to structured non-surgical care for people with spinal pain due to degenerative conditions. These services may reduce the use of spinal fusion by mainly two mechanisms: improving the uptake of conservative care and reducing the complexity of surgical procedures. Zadro et al. found that 1 in 6 patients did not receive any course of physiotherapy, and 1 in 6 patients had between 1 and 8 sessions prior to undergoing lumbar fusion. Försth et al. found that lumbar fusion added to decompression in patients with lumbar stenosis (with or without degenerative spondylolisthesis) had negligible effects on pain or disability, but increased hospital length of stay by an average of 3 days, and more than doubled costs ($5,400 vs $12,200).

We found conflicting evidence of effectiveness of insurance-initiated second opinion services for reducing surgery rates. In Fox et al, which reported a reduction in surgery rates, physiatrists who saw patients prior to a surgery consultation were part of specialised centres to treat spinal problems, whereas any physiatrist could provide the service in Goodman et al, which reported an 9% increase in surgical rates. This indicates that specific training of clinicians providing these services may be an important component to ensure services are successful. The length of follow-up in both studies also offer potentially interesting insights on why findings from both studies differ. Goodman had 6 years of data and did report a 9.2% decrease in surgery rates in 2011. However, by 2013 surgery rates had already gone up again and were 9% higher than when the study began in 2008. One hypothesis suggested by Goodman et al. is that the service only delayed patients getting surgery - hence the transitory reductions in surgery rates. This transitory change was also associated with increased costs with healthcare services that may also have questionable value for back pain (e.g. spinal injections, imaging). The study also showed a 13% increase in the use of prescription drugs, some of which are known to be ineffective for back pain and increase the risk of adverse events, such as opioids and antidepressants. Whether delaying surgery is a good outcome for patients and health systems remains an unanswered question which should be answered by future studies.

Strengths and limitations

Strengths of our study include a comprehensive literature search across various electronic databases, study screening and data extraction processes that were conducted in duplicate by independent reviewers in accordance with best practices, and assessment of methodological quality (also conducted in duplicate by two independent reviewers).

Most studies included in this review (n = 11) had poor methodological quality, and we could not find any randomised controlled trials investigating the effectiveness of second opinion services for reducing surgery rates and improving patient-reported outcomes. This limitation is particularly relevant for the outcomes we studied: surgery rates, patient-reported outcomes, costs and healthcare use. The lack of a randomised trial assessing the effectiveness of second opinion services is a major gap in the literature that needs to be addressed.

Very few studies provided actual data on surgical rates after a second opinion, which could be considered a limitation of the literature. Most studies had a cross-sectional design and focused on describing the agreement between first and second opinions. A disagreement between the two opinions, and a second opinion not recommending surgery might not be enough for patients to avoid surgery as patients might have sought
additional opinions and had surgery with a different surgeon. For example, 58% of patients who received a final recommendation of conservative care were lost to follow-up and no information about whether they had surgery or not was available in the study by Lenza et al.\textsuperscript{22} Better documentation of decisions made by first and second opinion services and adequate follow-up strategies of patients to ascertain whether or not they had surgery are important aspects that need to be addressed by future studies.

**Conclusion**

Different formats of second opinion services for reducing spinal surgery have been reported. Second opinion services typically recommend less surgical treatments compared to first opinions, particularly for spinal fusion. There is some very-low quality evidence that second opinion services may reduce surgery rates in the short-term, but it is unclear whether these reductions are sustained in the long-term or if patients only delay surgery. There are no studies comparing health outcomes between those who received versus did not receive a second opinion. There is a need for high-quality studies to determine the value of second opinion services for reducing spinal surgery.

**Declarations**

*Ethics approval and consent to participate:* Not applicable

*Consent for publication:* Not applicable

*Availability of data and materials:* All data generated or analysed during this study are included in this published article.

*Competing interests:* The authors declare that they have no competing interests.

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*Authors’ contributions:* All authors conceived and design the study; GF, JZ, and CL acquired, interpreted, and analysed data. GF drafted the work. JZ, CL, IA and CM revised it critically for important intellectual content. All authors approved the final version to be published and are accountable for all aspects of the work.

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**References**

1. Payne VL, Singh H, Meyer AN, Levy L, Harrison D, Graber ML. Patient-initiated second opinions: systematic review of characteristics and impact on diagnosis, treatment, and satisfaction. *Mayo Clin Proc.* 2014;89(5):687–696.

2. Wagner TH, Wagner LS. Who gets second opinions? *Health Aff (Millwood).* 1999;18(5):137–145.

3. Shmueli L, Shmueli E, Pliskin JS, et al. Second Medical Opinion: Utilization Rates and Characteristics of Seekers in a General Population. *Med Care.* 2016;54(10):921–928.

4. Könsgen N, Prediger B, Bora A-M, et al. Analysis of second opinion programs provided by German statutory and private health insurance – a survey of statutory and private health insurers. *BMC Health Services*
Research. 2021;21(1):209.

5. HCF. Second opinion service. https://www.hcf.com.au/members/access-medical-resources/second-opinion-services. Accessed: 08/06/2021.

6. BUPA. Best Doctors. https://www.bupa.com.au/health-insurance/best-doctors. Published 2021. Accessed: 08/06/2021.

7. Meyer AN, Singh H, Graber ML. Evaluation of outcomes from a national patient-initiated second-opinion program. *Am J Med*. 2015;128(10):1138 e1125-1133.

8. Weyerstraß J, Prediger B, Neugebauer E, Pieper D. Results of a patient-oriented second opinion program in Germany shows a high discrepancy between initial therapy recommendation and second opinion. *BMC Health Services Research*. 2020;20(1):237.

9. Herzog R, Elgort DR, Flanders AE, Moley PJ. Variability in diagnostic error rates of 10 MRI centers performing lumbar spine MRI examinations on the same patient within a 3-week period. *Spine J*. 2017;17(4):554–561.

10. Chou R, Baisden J, Carragee EJ, Resnick DK, Shaffer WO, Loeser JD. Surgery for low back pain: a review of the evidence for an American Pain Society Clinical Practice Guideline. *Spine (Phila Pa 1976)*. 2009;34(10):1094–1109.

11. Tricco AC, Zarin W, Ghassemi M, et al. Same family, different species: methodological conduct and quality varies according to purpose for five types of knowledge synthesis. *J Clin Epidemiol*. 2018;96:133–142.

12. Ferreira GE, Traeger AC, Maher CG. Review article: A scoping review of physiotherapists in the adult emergency department. *Emerg Med Australas*. 2019;31(1):43–57.

13. Tricco AC, Lillie E, Zarin W, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med*. 2018;169(7):467–473.

14. Fourney DR, Dettori JR, Hall H, Härtl R, McGirt MJ, Daubs MD. A systematic review of clinical pathways for lower back pain and introduction of the Saskatchewan Spine Pathway. *Spine (Phila Pa 1976)*. 2011;36(21 Suppl):S164-171.

15. Downs SH, Black N. The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non-randomised studies of health care interventions. *J Epidemiol Community Health*. 1998;52(6):377–384.

16. O'Connor SR, Tully MA, Ryan B, Bradley JM, Baxter GD, McDonough SM. Failure of a numerical quality assessment scale to identify potential risk of bias in a systematic review: a comparison study. *BMC Res Notes*. 2015;8:224–224.

17. Epstein NE, Hood DC. "Unnecessary" spinal surgery: A prospective 1-year study of one surgeon's experience. *Surg Neurol Int*. 2011;2:83.

18. Ferreira GE, McLachlan AJ, Lin CC, et al. Efficacy and safety of antidepressants for the treatment of back pain and osteoarthritis: systematic review and meta-analysis. *Bmj*. 2021;372:m4825.

19. Fox J, Haig AJ, Todey B, Challa S. The effect of required physiatrist consultation on surgery rates for back pain. *Spine (Phila Pa 1976)*. 2013;38(3):E178-184.

20. Gamache FW. The value of "another" opinion for spinal surgery: A prospective 14-month study of one surgeon's experience. *Surgical neurology international*. 2012;3(Suppl 5):S350-S354.

21. Goodman RM, Powell CC, Park P. The Impact of Commercial Health Plan Prior Authorization Programs on the Utilization of Services for Low Back Pain. *Spine (Phila Pa 1976)*. 2016;41(9):810–815.
22. Lenza M, Buchbinder R, Staples MP, et al. Second opinion for degenerative spinal conditions: an option or a necessity? A prospective observational study. *BMC Musculoskeletal Disorders.* 2017;18(1):354.

23. Vialle E. Second opinion in spine surgery: a Brazilian perspective. *Eur J Orthop Surg Traumatol.* 2015;25 Suppl 1:S3-6.

24. Viola DC, Lenza M, Almeida SL, et al. Spine surgery cost reduction at a specialized treatment center. *Einstein (Sao Paulo).* 2013;11(1):102–107.

25. Namiranian K, Norris EJ, Jolissaint JG, Patel JB, Lombardi CM. Impact of Multidisciplinary Spine Conferences on Surgical Planning and Perioperative Care in Elective Lumbar Spine Surgeries. *Asian Spine J.* 2018;12(5):854–861.

26. U M, C W. V48 - Evaluation of a second opinion procedure for planned spinal surgery - a controlled non-randomized intervention study. *European Spine Journal.* 2019;28(11):2660–2758.

27. Yanamadala V, Kim Y, Buchlak QD, et al. Multidisciplinary Evaluation Leads to the Decreased Utilization of Lumbar Spine Fusion: An Observational Cohort Pilot Study. *Spine (Phila Pa 1976).* 2017;42(17):E1016-E1023.

28. Lien BV, Brown NJ, Gattas S, et al. The market landscape of online second opinion services for spine surgery. *Surgical neurology international.* 2020;11:365–365.

29. Epstein NE. Are recommended spine operations either unnecessary or too complex? Evidence from second opinions. *Surgical neurology international.* 2013;4(Suppl 5):S353-S358.

30. Ruetters D, Keinki C, Schroth S, Liebl P, Huebner J. Is there evidence for a better health care for cancer patients after a second opinion? A systematic review. *J Cancer Res Clin Oncol.* 2016;142(7):1521–1528.

31. Martin BI, Mirza SK, Spina N, Spiker WR, Lawrence B, Brodke DS. Trends in Lumbar Fusion Procedure Rates and Associated Hospital Costs for Degenerative Spinal Diseases in the United States, 2004 to 2015. *Spine (Phila Pa 1976).* 2019;44(5):369–376.

32. Harris IA, Dao AT. Trends of spinal fusion surgery in Australia: 1997 to 2006. *ANZ J Surg.* 2009;79(11):783–788.

33. Grotle M, Smastuen MC, Fjeld O, et al. Lumbar spine surgery across 15 years: trends, complications and reoperations in a longitudinal observational study from Norway. *BMJ Open.* 2019;9(8):e028743.

34. Harris IA, Traeger A, Stanford R, Maher CG, Buchbinder R. Lumbar spine fusion: what is the evidence? *Intern Med J.* 2018;48(12):1430–1434.

35. Zadro JR, Lewin AM, Kharel P, Naylor J, Maher CG, Harris IA. Physiotherapy utilisation and costs before lumbar spine surgery: a retrospective analysis of workers compensation claims in Australia. *BMC Musculoskeletal Disorders.* 2021;22(1):248.

36. Forsth P, Olafsson G, Carlsson T, et al. A Randomized, Controlled Trial of Fusion Surgery for Lumbar Spinal Stenosis. *N Engl J Med.* 2016;374(15):1413–1423.

37. Foster NE, Anema JR, Cherkin D, et al. Prevention and treatment of low back pain: evidence, challenges, and promising directions. *Lancet.* 2018;391(10137):2368–2383.

38. Abdel Shaheed C, Maher CG, Williams KA, Day R, McLachlan AJ. Efficacy, Tolerability, and Dose-Dependent Effects of Opioid Analgesics for Low Back Pain: A Systematic Review and Meta-analysis. *JAMA Intern Med.* 2016;176(7):958–968.

**Figures**
Figure 1

PRISMA Flow diagram

Supplementary Files

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- Appendix1.docx