

# Spinal metastases and metastatic spinal cord compression

## Supplement 2: Health economics

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# Search strategy

## Health economics global search

One global search was conducted for economic evidence.

Database: Medline – OVID interface

#	Searches
1	exp Spinal Cord Neoplasms/ or Spinal Neoplasms/
2	((spine or spinal or vertebr*) adj2 (adeno* or cancer* or carcinoma* or intraepithelial* or intra epithelial* or malignan* or neoplas* or tumo?r*)).tw.
3	((spine or spinal or vertebr*) and (metast* or oligometast*)).tw.
4	or/1-3
5	Spinal Cord Compression/
6	((cauda equina or cervical* or cervicothoracic or cord* or coccyx or duralsac* or dural sac* or intervertebr* or lumbar or lumbosac* or lumbo sac* or medulla* or orthothoracic or sacral or sacrum or spinal or spine* or thecal sac* or thoracic or vertebr* or epidural or extradural or extra dural or ((axon* or neuron* or nerve*) adj2 root)) and (collaps* or compress* or pinch* or press*) and (adeno* or cancer* or carcinoma* or chordoma* or intraepithelial* or intra epithelial* or malignan* or metast* or neoplas* or oligometast* or tumo?r*)).tw.
7	(myelopath* or myeloradiculopath* or radiculopath*).tw,hw. or (radicular adj2 (disorder* or syndrome*)).tw.
8	(mescc or msc).tw.
9	or/5-8
10	((adeno* or cancer* or carcinoma* or intraepithelial* or intra epithelial* or malignan* or metast* or neoplas* or tumo?r*) adj3 (escap* or infiltrat* or invasiv* or metast* or spread*) adj5 (cauda equina or cervical* or cervicothoracic or cord* or coccyx or duralsac* or dural sac* or intervertebr* or lumbar or lumbosac* or lumbo sac* or medulla* or orthothoracic or sacral or sacrum or spinal or spine* or thecal sac* or thoracic or vertebr* or epidural or extradural or extra dural or ((axon* or neuron* or nerve*) adj2 root))).tw.
11	or/4,9-10
12	Economics/ or Value of life/ or exp "Costs and Cost Analysis"/ or exp Economics, Hospital/ or exp Economics, Medical/ or Economics, Nursing/ or Economics, Pharmaceutical/ or exp "Fees and Charges"/ or exp Budgets/
13	(cost* or economic* or pharmacoeconomic*).ti.
14	(budget* or financ* or fee or fees or price* or pricing* or (value adj2 (money or monetary))).ti,ab.
15	(cost* adj2 (effective* or utilit* or benefit* or minimi* or unit* or estimat* or variable*)).ab.
16	or/12-15
17	11 and 16
18	limit 17 to english language
19	limit 18 to yr="2005 -Current"

# Economic evidence study selection

## Health economics global search

Figure 1: Flow diagram of economic article selection for global health economic search

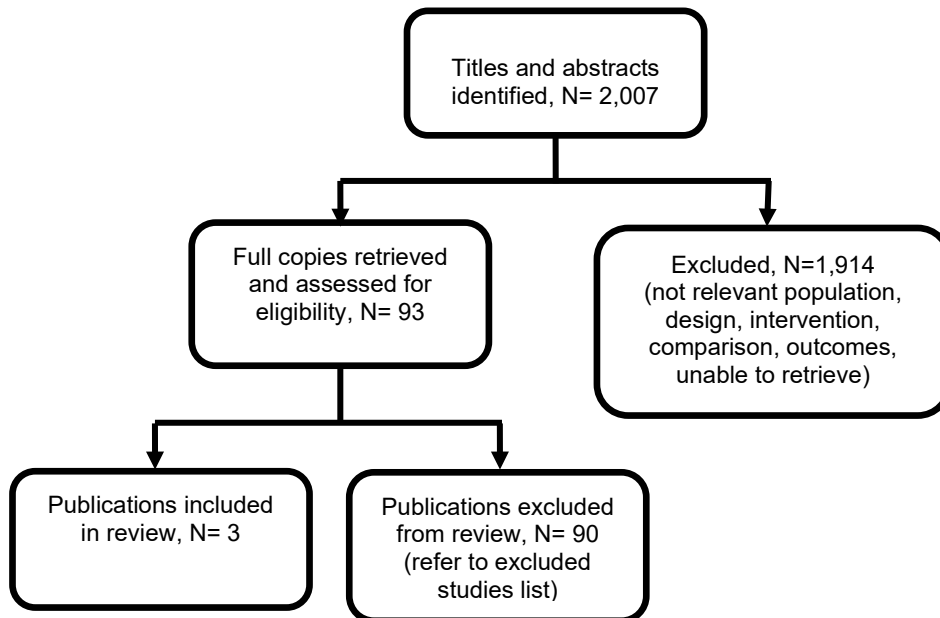


Table 1: Number of economic studies identified by review topic

Review topic	Number of economic studies included in the review
<b>Topic M: How effective is radiotherapy, including both fractionated and unfractionated radiotherapy, for the management of spinal metastases, direct malignant infiltration of the spine or associated spinal cord compression?</b>	1
<b>Topic N: What is the effectiveness of invasive interventions, such as vertebroplasty, kyphoplasty, ablation and surgery, in managing spinal metastases, direct malignant infiltration of the spine or associated spinal cord compression?</b>	2

## Excluded studies

### Excluded studies following full text review

Author and Year	Title and Journal	Reason for exclusion
Adeleke 2020	Reversing the trend of Friday peak for metastatic spinal cord compression referrals <i>Annals of Oncology</i>	Not an economic evaluation
Atkinson 2017	Management and cost of surgical site infection in patients undergoing surgery for spinal metastasis <i>Journal of Hospital Infection</i>	Not relevant to any review question
Azad 2019	Laminectomy Versus Corpectomy for Spinal Metastatic Disease-Complications, Costs, and Quality Outcomes <i>World Neurosurgery</i>	Not relevant to any review question
Barlev 2010	Payer costs for inpatient treatment of pathologic fracture, surgery to bone, and spinal cord compression among patients with multiple myeloma or bone metastasis secondary to prostate or breast cancer <i>Journal of Managed Care Pharmacy</i>	Costing analysis
Braam 2016	Stereotactic versus conventional radiotherapy for pain reduction and quality of life in spinal metastases: Study protocol for a randomized controlled trial <i>Trials</i>	Study protocol
Cacicedo 2022	Evaluation of results and costs of high precision radiotherapy (VMAT) compared with conventional radiotherapy (3D) in the treatment of cancer patients with spinal cord compression of metastatic origin <i>Reports of Practical Oncology and Radiotherapy</i>	Costing analysis
Chaudhry 2016	The surgical management of metastatic spinal cord compression: A proposed cost-utility analysis <i>International Journal of Surgery</i>	Study protocol
Chaudhry 2016	A cost-utility analysis of surgical intervention in metastatic spinal cord compression (MSCC) <i>Spine Journal</i>	Conference abstract
Chew 2013	Health service cost associated with percutaneous vertebroplasty in patients with spinal metastases <i>Clinical Radiology</i>	Costing analysis
Choi 2013	Assessment of quality of life after surgery for spinal metastases: position statement of the Global Spine Tumour Study Group <i>World Neurosurgery</i>	Not an economic evaluation
Clinicaltrials.org 2005	VERTOS-II. Percutaneous Vertebroplasty Versus Conservative Therapy <a href="https://clinicaltrials.gov/show/NCT00232466">https://clinicaltrials.gov/show/NCT00232466</a>	Study protocol
Clinicaltrials.org 2019	Multicentre Medical-economic Study Evaluating the Efficacy of Adding Zolédronique Acid to STERéotaxique Radiotherapy in the Treatment of Vertebral Metastases <a href="https://clinicaltrials.gov/show/NCT03951493">https://clinicaltrials.gov/show/NCT03951493</a>	Study protocol

Depreitere 2019	Cost-Utility Analysis of Surgery and Radiotherapy for Symptomatic Spinal Metastases in a Belgian Specialist Center World Neurosurgery	This study was identical to one included in the evidence review but used Belgian costs. Given the more relevant study was reviewed this study was excluded.
Elmalky 2017	The safety, efficacy, and cost-effectiveness of intraoperative cell salvage in metastatic spine tumor surgery Spine Journal: Official Journal of the North American Spine Society	Not relevant to any review question
Eseonu 2022	Systematic Review of Cost-Effectiveness Analyses Comparing Open and Minimally Invasive Lumbar Spinal Surgery. International journal of spine surgery	Not an economic evaluation
Euctr 2019	Multicentre, randomized, controlled, open-label, multi-centre medico-economic study evaluating the efficacy of adding zoledronic acid to Stereotaxic radiotherapy in the treatment of vertebral metastases <a href="http://www.who.int/trialsearch/Trial2.aspx?TrialID=EUCTR2019-001209-26-FR">http://www.who.int/trialsearch/Trial2.aspx?TrialID=EUCTR2019-001209-26-FR</a>	Trial protocol
Fassler 2011	Utility weights for skeletal related events in castration resistant prostate cancer Value in Health	Not an economic evaluation
Fehlings 2012	The effect of surgery on health-related quality of life and functional outcome in patients with metastatic epidural spinal cord compression: The aospine north america prospective multicenter study Spine Journal	Not an economic evaluation
Fehlings 2012	Is surgery for cervical spondylotic myelopathy cost-effective? A cost-utility analysis based on data from the AOSpine North America prospective CSM study Journal of neurosurgery	Not relevant to any review question
Fehlings 2014	Cost-effectiveness of surgery in the management of metastatic epidural spinal cord compression: a systematic review Spine	Systematic review. References checked
Fischer 2014	The financial cost for the surgical treatment of metastatic spinal cord compression European Spine Journal	Costing study
Fontes 2016	Perioperative Cost Analysis of Minimally Invasive vs Open Resection of Intradural Extramedullary Spinal Cord Tumors Neurosurgery	Not relevant to any



		review question
Fried 2019	Design and implementation of outpatient-based rapid MRI protocols to rule out metastatic spinal cord compression and brain metastases Journal of Clinical Oncology. Conference	Conference abstract
Furlan 2011	An Ontario-based cost-utility analysis comparing the standard of care with direct decompressive surgical resection followed by radiotherapy in the palliative care of patients with metastatic spinal cord cancer Canadian journal of neurological sciences. [conference abstract]	Not relevant to any review question
Furlan 2012	The combined use of surgery and radiotherapy to treat patients with epidural cord compression due to metastatic disease: a cost-utility analysis Neuro-Oncology	Not relevant to any review question
Furlan 2012	Palliative care of patients with metastatic spinal cord cancer: A cost-utility analysis comparing the standard of care with direct decompressive surgical resection followed by radiotherapy Neurology. Conference: 64th American Academy of Neurology Annual Meeting. New Orleans, LA United States. Conference Publication:	Conference abstract
Ghogawala 2011	Comparative effectiveness of ventral vs dorsal surgery for cervical spondylotic myelopathy Neurosurgery	Not relevant to any review question
Groom 2019	Evaluation of patients presenting to secondary-care with back pain and history of cancer: retrospective analysis of NICE-CG75 and service delivery Physiotherapy (United Kingdom)	Not relevant to any review question
Guddati 2016	Outcomes in metastatic cancer patients who develop spinal cord compression Journal of Clinical Oncology. Conference	Not an economic evaluation
Guddati 2017	Early intervention results in lower mortality in patients with cancer hospitalized for metastatic spinal cord compression Journal of Investigative Medicine	Not an economic evaluation
Gunther 2011	Health resource utilisation (HRU) associated with skeletal related events (SRES) in patients with bone metastases (BMS): Results from a retrospective, multinational european study Value in Health	Not an economic evaluation
Gunther 2012	Cost of skeletal complications from bone metastases (BM): Results from a retrospective European study Supportive Care in Cancer	Costing analysis
Haley 2011	Efficacy and cost-effectiveness analysis of external beam and stereotactic body radiation therapy in the treatment of spine metastases: a matched-pair analysis Journal of Neurosurgery Spine	Not relevant to any review question
Haley 2011	Efficacy and cost-effectiveness analysis of external beam and stereotactic body radiation therapy in the	Not relevant to any

	treatment of spine metastases: A matched-pair analysis - Clinical article Journal of Neurosurgery: Spine	review question
Hecht 2011	Is intraoperative CT of posterior cervical spine instrumentation cost-effective and does it reduce complications? Clinical Orthopaedics and Related Research	Not relevant to any review question
Hershkovich 2020	Cost-Benefit Analysis of Routine Bone Biopsy During Augmentation of Osteoporotic Vertebral Compression Fractures Spine	Not relevant to any review question
Hodges 2013	Cost-effectiveness analysis of stereotactic ablative radiation therapy versus single-fraction external beam radiation in painful vertebral body metastases International Journal of Radiation Oncology Biology Physics	Not relevant to any review question
Jordan 2019	Outcomes and cost-minimization analysis of cement spacers versus expandable cages for posterior-only reconstruction of metastatic spine corpectomies Annals of Translational Medicine	Not relevant to any review question
Katzir 2020	Cost Analysis With Use of Expandable Cage or Cement in Single level Thoracic Vertebrectomy in Metastasis Global Spine Journal.	Costing analysis
Kim 2014	Cost-effectiveness analysis of single fraction of stereotactic body radiotherapy compared to single fraction of external beam radiotherapy for palliation of vertebral bone metastases Journal of Clinical Oncology. Conference: ASCO's Quality Care Symposium	Not relevant to any review question
Kim 2015	Cost-effectiveness analysis of single fraction of stereotactic body radiation therapy compared with single fraction of external beam radiation therapy for palliation of vertebral bone metastases International Journal of Radiation Oncology, Biology, Physics	US health care payer perspective taken
Kowalchuk 2022	Cost-Effectiveness of Treatment Strategies for Spinal Metastases. Practical radiation oncology	Did not reported a quality adjusted outcome measure
Kudithipudi 2015	Cost-effectiveness and toxicity of radiation therapy technique in the palliative treatment of spine metastases International Journal of Radiation Oncology Biology Physics	Not an economic evaluation
Lee 2007	Metastatic spinal cord compression as an oncology emergency: getting our act together International Journal for Quality in Health Care	Not an economic evaluation
Lewandrowski 2019	Incidence, management, and cost of complications after transforaminal endoscopic decompression surgery for lumbar foraminal and lateral recess stenosis: A value	Not relevant to any review question

	proposition for outpatient ambulatory surgery International Journal of Spine Surgery	
Li 2014	The value of routine biopsy during percutaneous kyphoplasty for vertebral compression fractures PLoS ONE [Electronic Resource]	Not relevant to any review question
Liu 2012	Comparison between anterior and posterior decompression for cervical spondylotic myelopathy: subjective evaluation and cost analysis Orthopaedic Audio-Synopsis Continuing Medical Education [Sound Recording]	Not relevant to any review question
Lothgren 2013	Cost per patient and potential budget implications of denosumab compared with zoledronic acid in adults with bone metastases from solid tumours who are at risk of skeletal-related events: An analysis for Austria, Sweden and Switzerland European Journal of Hospital Pharmacy	Not relevant to any review question
Lu 2014	Cost-effective studies in spine surgeries: A narrative review Spine Journal	Systematic review. References checked.
Malik 2020	P55. What is the value of undergoing surgery for spinal metastases at dedicated cancer centers? Spine Journal	Conference abstract
Matza 2011	Health state utilities for skeletal-related events associated with bone metastases Journal of Clinical Oncology. Conference: ASCO Annual Meeting	Not relevant to any review question
Matza 2014	Health state utilities for skeletal-related events secondary to bone metastases European Journal of Health Economics	Not relevant to any review question
McAnany 2015	Decision analytic modeling in spinal surgery: A methodologic overview with review of current published literature Spine Journal	Systematic review. References checked.
Merikli 2019	Immediate Reconstruction of Oncologic Spinal Wounds Is Cost-Effective Compared with Conventional Primary Wound Closure Plastic & Reconstructive Surgery	Not relevant to any review question
Moiyadi 2011	Objective assessment of utility of intraoperative ultrasound in resection of central nervous system tumors: A cost-effective tool for intraoperative navigation in neurosurgery Journal of Neurosciences in Rural Practice	Not relevant to any review question
Monsky 2014	Quality of life assessment in interventional radiology Academic Radiology	Not relevant to any review question

Narmadha 2016	Comparing single fraction (8 Gy) versus multifractionated (30 Gy) radiotherapy schedules in the treatment of spine metastasis Journal of Cancer Research and Therapeutics	Not an economic evaluation
Oduoza 2021	Open vs mis lumbar surgery: A systematic review of cost effectiveness British Journal of Surgery	Not relevant to any review question
Olafsson 2012	Balloon kyphoplasty increases quality of life in cancer patients with vertebral compression fractures Value in Health	Not relevant to any review question
Ong 2012	Comparative cost between vertebroplasty and kyphoplasty for the treatment of vertebral compression fractures Value in Health	Costing analysis
Ong 2013	Two-year cost comparison of vertebroplasty and kyphoplasty for the treatment of vertebral compression fractures: are initial surgical costs misleading? Osteoporosis International	Costing analysis
Pahuta 2021	Calculating Utilities From the Spine Oncology Study Group Outcomes Questionnaire: A Necessity for Economic and Decision Analysis Spine	Not relevant to any review question
Papatheofanis 2009	Cost-utility analysis of the CyberKnife system for metastatic spinal tumors Neurosurgery	US health care payer perspective taken
Rades 2007	Functional outcome and survival after radiotherapy of metastatic spinal cord compression in patients with cancer of unknown primary International Journal of Radiation Oncology, Biology, Physics	Not an economic evaluation
Richards 2017	Innovative development in the uk: The manchester metastatic spinal cord compression (mscc) service Cancer Nursing	Not an economic evaluation
Richards 2017	Metastatic spinal cord compression (MSCC)-collaborative work between the tertiary cancer centre and the specialist spinal centre since the introduction of the mscc coordinator service has seen a marked increase in surgical rates, with 20% of patients who presented with MSCC in the first 24 months having spinal surgery. This has resulted in improved survival rates for MSCC patients in Greater Manchester and Cheshire Spine Journal	Not an economic evaluation
Richards 2017	Improved surgery rates in metastatic spinal cord compression, collaborative work between two centres Cancer Nursing	Not an economic evaluation
Saad 2006	Impact of bone metastases on patient's quality of life and importance of treatment European Urology, Supplements	Not an economic evaluation

Saba 2005	The role of bisphosphonates in the management of advanced cancer with a focus on non-small-cell lung cancer. Part 2: Clinical studies and economic analyses Oncology	Not relevant to any review question
Sadeghi-Naini 2018	Vertebroplasty and kyphoplasty for metastatic spinal lesions Clinical Spine Surgery	Not an economic evaluation
Sahgal 2020	CCTG SC.24/TROG 17.06: A Randomized Phase II/III Study Comparing 24Gy in 2 Stereotactic Body Radiotherapy (SBRT) Fractions Versus 20Gy in 5 Conventional Palliative Radiotherapy (CRT) Fractions for Patients with Painful Spinal Metastases International Journal of Radiation Oncology Biology Physics	Not an economic evaluation
Sande 2009	Long-term follow-up of cancer patients receiving radiotherapy for bone metastases: Results from a randomised multicentre trial Radiotherapy and Oncology	Not an economic evaluation
Schairer 2014	Hospital readmission rates after surgical treatment of primary and metastatic tumors of the spine Spine	Not an economic evaluation
Schoenfeld 2021	The Cost-Effectiveness of Surgical Intervention for Spinal Metastases: A Model-Based Evaluation The Journal of bone and joint surgery. American	US health care payer perspective taken
Shah 2014	Cost-effectiveness analysis of stereotactic body radiation therapy, conventional single-fraction radiation therapy, and medical management alone for a painful localized spine metastasis International Journal of Radiation Oncology Biology Physics	US health care payer perspective taken
Shakokani 2016	Cost implications of routine bone biopsy in percutaneous vertebroplasty/kyphoplasty Spine Journal	Not relevant to any review question
Sweeney 2011	The smart route to a NICE future; introducing a smartcard for patients at risk of metastatic spinal cord compression has the potential to improve quality of life and save up to 17.5 million nationally European Journal of Cancer	Not an economic evaluation
Taechalertpaisarn 2022	Cost-Utility Analysis Compared Between Radiotherapy Alone and Combined Surgery and Radiotherapy for Symptomatic Spinal Metastases in Thailand. Neurospine	Health care payer perspective from country outside the OECD
Thomas 2006	Cost-effectiveness of surgery plus radiotherapy versus radiotherapy alone for metastatic epidural spinal cord compression International Journal of Radiation Oncology, Biology, Physics	Not relevant to any review question

Tipsmark 2015	Healthcare costs attributable to the treatment of patients with spinal metastases: a cohort study with up to 8 years follow-up BMC Cancer	Not an economic evaluation
Tomecek 2011	Commentary: Surgery for nonambulatory patients with epidural spinal metastasis: is it evidence based and cost effective? Spine Journal: Official Journal of the North American Spine Society	Not an economic evaluation
Turner 2015	Cost of Surgery for Symptomatic Spinal Metastases in the United Kingdom World Neurosurgery	Costing analysis
Turner 2016	Surgery for spinal metastases is cost-effective: Calculation of cost per quality-adjusted life years (QALY) in UK patients Spine Journal	Non-comparative
van Tol 2021	Costs Associated With Timely and Delayed Surgical Treatment of Spinal Metastases Global Spine Journal.	Costing analysis
Voidey 2014	Economic evaluation of kyphoplasty Pharmacie Hospitalier et Clinicien	Did not reported a quality adjusted outcome measure
Weber 2015	Clinical long-term outcome, technical success, and cost analysis of radiofrequency ablation for the treatment of osteoblastomas and spinal osteoid osteomas in comparison to open surgical resection Skeletal Radiology	Not an economic evaluation
Witiw 2017	Surgery for degenerative cervical myelopathy: a patient-centered quality of life and health economic evaluation Spine Journal	Not relevant to any review question
Xie 2012	Cost-effectiveness of denosumab compared with zoledronic acid in patients with breast cancer and bone metastases Clinical Breast Cancer	Not relevant to any review question
Zhu 2018	Efficacy, safety, and economics of bracing after spine surgery: a systematic review of the literature Spine Journal	Not relevant to any review question