

AO Spine Curriculum Second Edition





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Contributors

Emre Acaroglu	Turkey
AlaaEldin Ahmad	Palestine
Bryan Ashman	Australia
Evan Davies	United Kingdom
John DeVine	USA
Juan Emmerich	Argentina
Asdrubal Falavigna	Brazil
Harry Gebhard	Switzerland
Michael Grevitt	United Kingdom
Jose Manuel Ignacio	Philippines
Bradley Jacobs	Canada
Yoshiharu Kawaguchi	Japan
KV Menon	India
Shanmuganathan Rajasekaran	India
Luiz Gustavo Dal Olivo da Rocha	Brazil
Satish Rudrappa	India
Alpaslan Senkoylu	Turkey
Klaus Schnake	Germany
Mohammad El-Sharkawi	Egypt
Nestor Taboada	Colombia
Muzahem Taha	Iraq
Steve Theiss	USA
Claudius Thomé	Austria
Patrick Tropicano	France
Karsten Wiechert	Germany
Atiq Uz Zaman	Pakistan

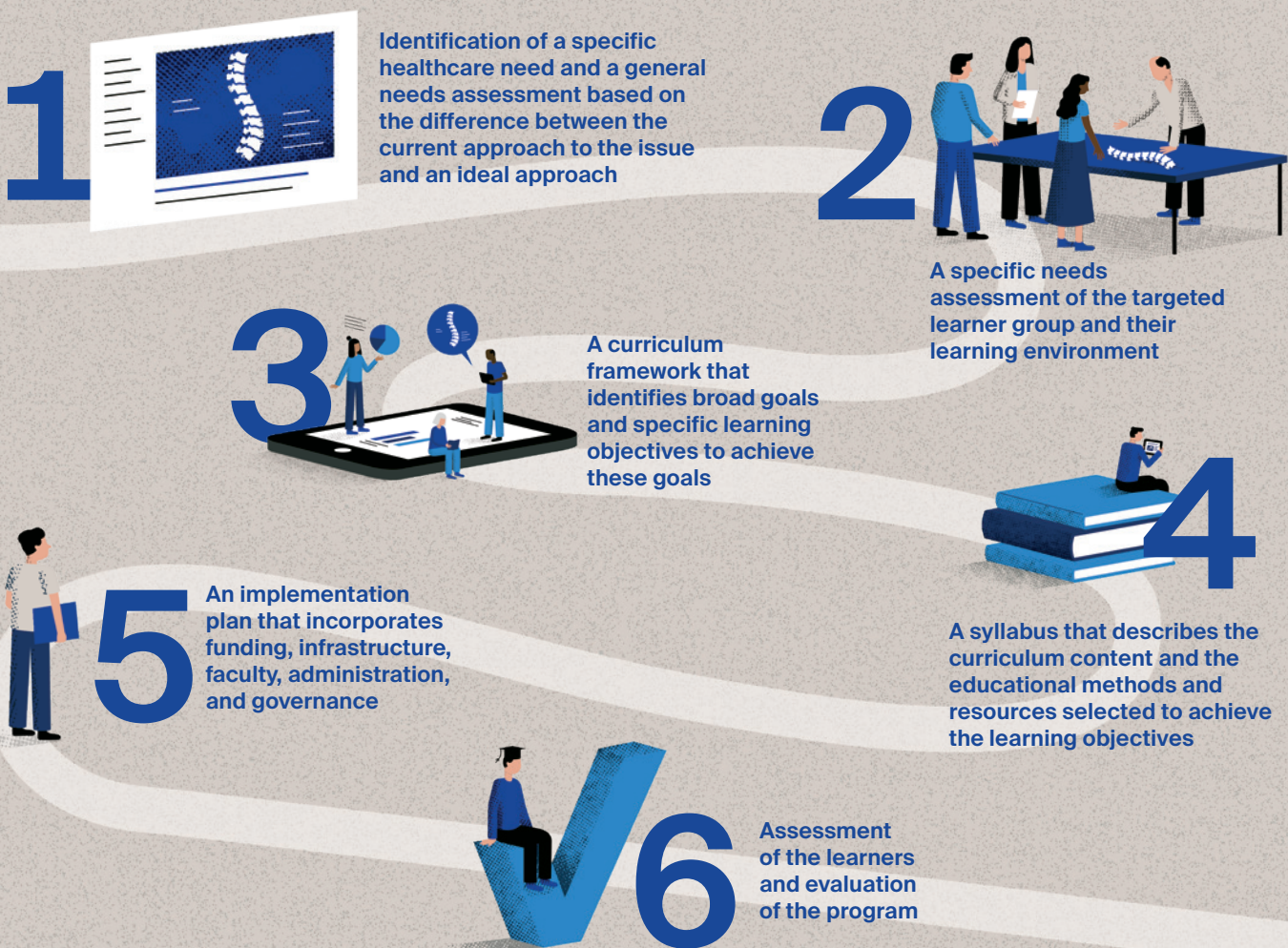
Introduction

Since the first AO Spine Curriculum was published in 2010, many new concepts have emerged in both spine surgery and medical education. This second edition of the curriculum incorporates some of these changes to remain fit for purpose as a framework for continuing professional development (CPD) in the surgical management of spinal disorders.

Curriculum planning

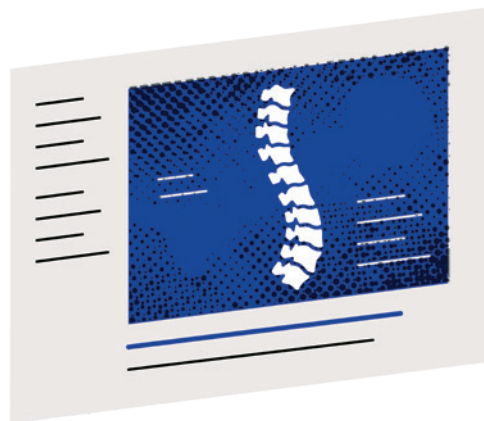
The review and revision of the existing curriculum was conducted by the contributors using a modified Delphi process involving online and face-to-face collaboration.

The approach to this curriculum revision was based on the method published by the Faculty Development Program at Johns Hopkins University School of Medicine¹.



The healthcare need: spinal disorders and spine surgery

Spinal disorders, particularly chronic spinal pain, are leading causes of disability and healthcare expenditure worldwide². Surgical treatment of spinal disorders is well established but the evidence base for recommending specific interventions for individual patients is constantly being updated, along with CPD programs for spine surgery that reflect changes in technology, education, and healthcare.



The target learners' need: spine surgery training

Spine surgeons begin their careers either as orthopedic or neuro- surgeons. Most training programs in spine surgery around the world are based on surgical apprenticeships through fellowships at hospitals specializing in spine surgery and are supplemented by continuing medical education activities. Very few of these fellowships have a curriculum or formal training program. A survey of AO Spine members in 2013 indicated that an online training program based on the AO Spine Curriculum would be of high value.



The framework: EPAs (entrustable professional activities)

Competence versus competency

Ten Cate and colleagues suggest that **competence** is more than the sum of separate items of knowledge, skills, and attitudes (**competencies**): it is the interaction between an individual's abilities and the healthcare environment in which they use them³. Or, to use Miller's paradigm, what a clinician **does** is more important than what he or she knows, knows how or shows how⁴.

The EPA framework

The starting point for a curriculum planning process using EPAs begins with analyzing the professional work of the specialist medical practitioner⁵. This analysis identifies the essential activities that can be **entrusted** only to those who have acquired the requisite abilities to work independently in a healthcare context to achieve a desired outcome. To put it succinctly, how the right person does the right thing to get the right result.

In a training program, EPAs can be subdivided into **entrustment milestones** where trainees move from high levels of supervision to more autonomous levels as they are deemed to have gained the necessary competencies⁶.

This curriculum focusses on the final level of autonomy, namely, independent practice. This is the level at which spine surgeons perform their clinical activities.

The following table of EPAs represents the activities of a typical working week for spine surgeons. They are not exhaustive or exclusive but serve as examples of the units of work of professional spine surgery practice.

	EPA	EPA	EPA	EPA	EPA	EPA	EPA
Spine surgery	Assessment of and consent from the preoperative patient	Position the patient	Perform a preoperative team briefing	Perform the procedure safely	Document the procedure	Transfer the patient to the recovery area	Check the patient post-operatively
Inpatient care	Visit the patient	Discuss treatment plans with medical and nursing teams	Review laboratory results	Counsel the patient and family about progress and prognosis	Document changes in patient condition or plan	Manage or prevent complications	Plan discharge and rehabilitation
Outpatient clinic	Interview and examine the patient	Order and interpret imaging and investigations	Make a diagnosis and formulate a treatment plan	Counsel patients about treatment options	Document the consultation	Write prescriptions and letters to referring practitioners	Arrange review of progress or outcomes
Private practice	Select and manage private clinic staff	Oversee the billing	Market the practice	Maintain a practice management system	Establish a medical record system	Purchase medical indemnity insurance	Establish a risk management system
Emergency on-call	Take phone calls from residents/fellows	Assess the need for urgent intervention	Liaise with operating room personnel	Prioritize the emergency operating room schedule	Attend the operating room when required	Arrange roster swaps and leave cover	Cover other colleagues' patients
Collaboration with multidisciplinary teams (MDTs)	Allied health practitioners	Radiologists	Anesthetists	Physicians	Trauma teams	Research teams	Operating room teams
Teaching	Lectures and tutorials	Supervise and advise trainees	Run journal clubs	Lead case-based discussions	Give feedback	Be a role model	Reflect on teaching practice
Administration	Meet with health administrators	Plan budgets	Select and manage junior medical staff	Manage rosters	Attend committee meetings	Manage waiting lists and theater schedules	Perform team appraisals
Quality improvement	Morbidity and mortality reviews	Patient case reviews	Patient and team safety protocols	Treatment protocols	Contribute to spine registries	Clinical research	Reflect on clinical practice

EPAs should describe the breadth and depth of professional clinical practice, and to make the concept more easily understood, broad **core** activities are described by specific **key competencies**.

The AO Spine Curriculum is based on the following seven core EPAs:

1. Make a diagnosis
2. Formulate a treatment plan
3. Explain treatment options to patients
4. Collaborate with multidisciplinary teams
5. Perform an appropriate procedure when indicated
6. Review patient progress and prevent or manage complications
7. Participate in quality improvement activities

The curriculum outline is presented as tables of core EPAs and competencies as they relate to the **pathology domains** of spinal disorders.

Trauma



EPA	Key competencies
Make a diagnosis	Examine the patient for a possible spinal cord injury and reexamine serially if a neurological deficit is found
	Suspect a spinal injury in the unconscious polytrauma patient
	Maintain spinal immobilization until spinal trauma is excluded
	Arrange appropriate imaging
	Recognize the radiographic features of instability and cord injury
Formulate a treatment plan	Classify the spinal injury using the AO Spine classification systems
	Use evidence-based decision-making for treatment of the spinal injury, including spinal cord injury management
Explain treatment options to patients	Describe the risks and benefits of surgical versus conservative management and consider the patient's preferences and expectations
Collaborate with MDTs	Be involved in rehabilitation planning
Perform appropriate procedures	Reduction/stabilization/decompression/fusion when indicated
	Use safety protocols to protect the patient and team members
	Preserve function at uninjured levels where possible
Manage or prevent complications	Postinjury, intraoperative, and postoperative
Participate in quality improvement	Perform surgical audit on outcomes and complications
	Enroll patients in a trauma registry/database

Degeneration



EPA	Key competencies
Make a diagnosis	Analyze the patient history, comorbidities, disability, and quality of life
	Examine the patient, including neurological assessment, to exclude myelopathy/radiculopathy
	Select the appropriate diagnostic tests and exclude non-spinal conditions
	Measure and interpret spinal alignment and spinopelvic parameters
	Correlate clinical and imaging findings, distinguishing between aging changes and pathology
Formulate a treatment plan	Critically review the best available evidence when considering operative and nonoperative interventions
	Describe the bio-psycho-social model of pain and recognize the risks for chronification
Explain treatment options to patients	Consider the patient's preferences and expectations
	Recognize the indications for, and limitations of, surgical intervention
Collaborate with MDTs	Recognize the importance of a multidisciplinary approach in nonoperative treatment, including pain management
	Describe the importance of postoperative activity and rehabilitation
Perform appropriate procedures	Reduction/stabilization/decompression/fusion when indicated
	Use safety protocols to protect the patient and team members
	Describe the biological agents and other techniques available to increase fusion rate
Manage or prevent complications	Intraoperative and postoperative
Participate in quality improvement	Use validated outcome measures to assess effectiveness of interventions
	Enroll patients in a surgical registry/database

Adult deformity



EPA	Key competencies
Make a diagnosis	Analyze the patient history, comorbidities, disability, and quality of life Examine the patient for spinal imbalance and neurological deficit Order appropriate imaging, including bone density Measure and interpret spinal alignment and spinopelvic parameters Describe the classifications of adult deformities
Formulate a treatment plan	Critically review the best available evidence to support surgical intervention Assess the need for medical optimization of the patient before surgery, including osteoporosis treatment Plan for augmentation of instrumentation and dealing with the proximal junction Discriminate between deformity with and without stenosis and the different management required
Explain treatment options to patients	Discuss with patients the risks and benefits of surgery compared with conservative treatment Consider the patient's preferences and expectations
Collaborate with MDTs	Involve medical colleagues in preoperative optimization and postoperative care
Perform appropriate procedures	Address spinal balance and consider osteotomies, stabilization, augmentation, distal fixation, proximal junction, posterior and/or anterior fusion Use safety protocols to protect the patient and team members
Manage or prevent complications	Be prepared for the challenges of revision surgery
Participate in quality improvement	Use validated outcome measures to assess effectiveness of interventions Enroll patients in a surgical registry/database

Pediatric deformity



EPA	Key competencies
Make a diagnosis	<p>Analyze the patient history and understand the conditions associated with childhood spinal deformity</p> <hr/> <p>Examine the child with spinal deformity, including neurology, abdominal reflexes, and syndromic features</p> <hr/> <p>Order and interpret appropriate imaging to assess spinal alignment</p> <hr/> <p>Describe the classifications of pediatric deformities: scoliosis, kyphosis, spondylolisthesis</p>
Formulate a treatment plan	<p>Critically review the best available evidence to support surgical intervention for severe or progressive deformity</p> <hr/> <p>Monitor mild to moderate deformities and identify factors that indicate the possibility of progression</p> <hr/> <p>Understand the natural history of untreated deformity and future disability</p>
Explain treatment options to patients	<p>Discuss with patients/parents the risks and benefits of surgery compared with conservative treatment</p> <hr/> <p>Consider the patient's/parents' concerns and expectations</p>
Collaborate with MDTs	<p>Involve medical colleagues in preoperative assessment and postoperative care</p>
Perform appropriate procedures	<p>Consider the need for reduction, osteotomies, instrumentation, distal fixation, posterior and/or anterior fusion</p> <hr/> <p>Use safety protocols to protect the patient and team members</p>
Manage or prevent complications	<p>Monitor spinal cord function intraoperatively</p> <hr/> <p>Identify postoperative complications early and treat promptly</p>
Participate in quality improvement	<p>Use validated outcome measures to monitor safety and quality</p> <hr/> <p>Enroll patients in a surgical registry/database</p>

Oncology



EPA	Key competencies
Make a diagnosis	<p>Clinically assess and stage patients with spinal neoplasm</p> <hr/> <p>Classify spinal column neoplasms</p> <hr/> <p>Describe the pathology of tumors of the spinal column and spinal cord</p> <hr/> <p>List diagnostic imaging appropriate for tumors of the spine</p> <hr/> <p>Describe mechanical instability as it relates to spinal column tumors</p> <hr/> <p>Establish a diagnosis based on histological verification (biopsy)</p>
Formulate a treatment plan	<p>Critically review the evidence supporting surgical versus nonsurgical treatment of spinal tumors</p> <hr/> <p>For primary tumors, discuss the balance between cure and morbidity</p> <hr/> <p>For metastatic tumors, discuss the balance between prognosis and quality of life</p>
Explain treatment options to patients	<p>List the options for radiotherapy and chemotherapy for primary and secondary tumors</p> <hr/> <p>Discuss with patients and family the surgical and nonsurgical options in view of expected prognosis, risks, outcomes, and quality of life</p> <hr/> <p>Review the unique considerations in the management of pediatric spinal column tumors</p>
Collaborate with MDTs	<p>Discuss the importance of a multidisciplinary team approach to the management of spinal column tumors</p>
Perform appropriate procedures	<p>Discuss the surgical principles of resection of primary vertebral tumors</p> <hr/> <p>Describe the principles of surgical tumor resection for metastatic tumors</p> <hr/> <p>Review the role of minimally invasive surgical techniques/separation surgery for treatment of spinal metastases</p> <hr/> <p>Discuss reconstruction options for resected spinal tumors</p> <hr/> <p>Use safety protocols to protect the patient and team members</p>
Manage or prevent complications and review patient progress	<p>Recognize the increased risk of wound problems in patients with debility, prior surgery, or radiation</p> <hr/> <p>Anticipate intraoperative complications</p> <hr/> <p>Recognize recurrent disease postoperatively</p>
Participate in quality improvement	<p>Use validated outcome measures to monitor safety and quality</p> <hr/> <p>Enroll patients in a tumor registry/database</p>

Infection



EPA

Key competencies

Make a diagnosis	Describe the clinical features of and differences between pyogenic spondylodiscitis, epidural abscess, and spinal tuberculosis
	Describe the general risk factors for spine infections
	Order and interpret hematological, microbiological, and imaging tests to confirm spinal infection
	Isolate and identify the causative organism by aspiration or biopsy, if possible
Formulate a treatment plan	Identify preoperative risk factors for developing surgical-site infections after spine surgery and discuss the preventive strategies to minimize risks
	Consider surgical intervention for neurological compression, spinal instability, and debridement
Explain treatment options to patients	Discuss with patients the indications for surgical intervention in spinal infection and the potential risks and benefits
Collaborate with MDTs	Collaborate with the infectious diseases team to prescribe appropriate antimicrobial therapy according to the sensitivities of the isolated organism and evidence-based guidelines
Perform appropriate procedures	Debridement, decompression, reconstruction, fusion
	Use safety protocols to protect the patient and team members
	Describe the place of instrumentation in spinal infection
Manage or prevent complications and review patient progress and outcomes	Manage post-infective complications, including deformity, loss of fixation, pseudarthrosis
	Emphasize and review patient compliance with frequency and duration of treatment
	Perform regular clinical and hematological review until resolution of the infection
Participate in quality improvement	Regularly review the incidence and outcomes of spinal infections in the local healthcare setting

Inflammatory spondyloarthropathy



EPA	Key competencies
Make a diagnosis	Assess the patient history, physical findings, disability, and quality of life Describe the classification of inflammatory spondyloarthropathy List diagnostic tests and imaging modalities Recognize the radiographic features of spinal instability or ankylosis
Formulate a treatment plan	Describe the principles of medical management of inflammatory arthritis List indications for surgical intervention in spondyloarthropathy Describe surgical strategies in ankylosing spondylitis for kyphosis correction, fracture fixation Describe surgical strategies in rheumatoid arthritis for occipitocervical decompression/stabilization
Explain treatment options to patients	Discuss with patients the indications for surgical intervention in spondyloarthropathy and the potential risks and benefits Consider the patient's preferences and expectations
Collaborate with MDTs	Involve rheumatology colleagues in preoperative optimization and postoperative care
Perform appropriate procedures	Reduction/stabilization/decompression/osteotomies/fusion Use safety protocols to protect the patient and team members Preserve function at unaffected levels where possible
Manage or prevent complications	Intraoperative and postoperative
Participate in quality improvement	Perform surgical audit on outcomes and complications Enroll patients in a registry/database

Spinal fragility fractures



EPA

Key competencies

Make a diagnosis	Recognize that acute vertebral and sacral fragility fractures may be associated with significant morbidity in the elderly
	List diagnostic tests and imaging modalities for assessing bone density
	Recognize the radiographic features of spinal fragility fractures
	Classify osteoporotic fractures of the spine and sacrum
Formulate a treatment plan	Describe the medical management of osteoporosis
	Critically review the best evidence for surgical management of acute spinal fragility fractures
Explain treatment options to patients	Discuss the relative risks and benefits of medical versus surgical treatment of acute vertebral fragility fractures
	Consider the patient's preferences and expectations
Collaborate with MDTs	Participate in joint care with an orthogeriatric service
Perform appropriate procedures	Vertebroplasty/kyphoplasty/sacroplasty
	Use safety protocols to protect the patient and team members
	Consider prophylactic treatment at unaffected levels where indicated
Manage or prevent complications	Intraoperative (cement leakage) and postoperative (neuro deficit)
	Describe strategies for preventing future fractures
Participate in quality improvement	Perform surgical audit on outcomes and complications
	Enroll patients in a registry/database

Implementation of the curriculum

AO Spine educational events

All AO Spine educational events are linked to the curriculum. Event planning starts with an assessment of the learners' needs for a specific topic. The curricular competencies to be covered are specified before the event so that learners can provide input into their current and their desired level of experience'. This informs the pre-event preparations and reinforces the link between the event content and the AO Spine curriculum. Each event is aimed at a specific domain or competency within the curriculum, and the event content relates directly to the learning objectives, learning methods, and resources of that particular educational experience.



References

- 1. Kern DE, Thomas PA, Hughes MT (eds).** *Curriculum Development for Medical Education: a Six-step Approach*. 2nd ed. Baltimore, Maryland: Johns Hopkins University Press; 2009.
- 2. Ashman B, Chen JLT.** Quality spine care in Australasia. In: Ratliff J, Albert TJ, Cheng J et al (eds). *Quality Spine Care*. Switzerland: Springer; 2019: 200–201.
- 3. Ten Cate O, Snell L, and Carraccio C.** Medical competence: the interplay between individual ability and the health care environment. *Medical Teacher*. 2010; 32, 669–675.
- 4. Miller GE.** The assessment of clinical skills/competence/performance. *Academic Medicine*. 1990; 65:63–67.
- 5. Ten Cate O.** Entrustability of professional activities and competency-based training. *Medical Education*. 2005; 39:1176–1177.
- 6. Ten Cate O, Chen HC, Hoff RG, et al.** Curriculum development for the workplace using Entrustable Professional Activities (EPAs): AMEE Guide No. 99, *Medical Teacher*. 2015; 37: 983–1002.
- 7. Moore DE, Green JS, Gallus HA.** Achieving desired results and improved outcomes: integrating planning and assessment throughout learning activities. *Journal of Continuing Education in the Health Professions*. 2009; 29:1–15.



AO Foundation, AO Spine
Clavadelerstrasse 8
7072 Davos
Switzerland

T +41 44 200 24 20
F +41 44 200 24 21
education@aospine.org
www.aospine.org