



CURRICULUM VITAE

Akhil Jay Khanna, MD

DEMOGRAPHIC AND PERSONAL INFORMATION

Academic Appointments

Professor

Department of Orthopaedic Surgery, Johns Hopkins University

Professor

Department of Neurosurgery, Johns Hopkins University

Professor

Department of Biomedical Engineering, Johns Hopkins University

Administrative Appointments

Vice Chair

Department of Orthopaedic Surgery
Johns Hopkins University
Baltimore, MD

Office Address

Johns Hopkins Orthopaedic and Spine
Surgery—National Capital Region
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Bethesda, MD 20817
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EDUCATION AND TRAINING

8/04-5/08 Masters of Business Administration
Johns Hopkins University
Carey School of Business
Baltimore, MD

- 8/03-7/04 Spine Surgery Fellow, Cleveland Clinic Spine Institute,
Departments of Orthopaedic Surgery and Neurosurgery
The Cleveland Clinic Foundation
Cleveland, OH
- 7/99-6/03 Resident and Chief Resident, Department of Orthopaedic Surgery
Johns Hopkins University Hospital and School of Medicine
Baltimore, MD
- 7/98-6/99 Intern, Departments of General Surgery and Orthopaedic Surgery
Johns Hopkins University Hospital and School of Medicine
Baltimore, MD
- 7/96-6/98 Resident, Department of Radiology
Johns Hopkins University Hospital and School of Medicine
Baltimore, MD
- 6/95-6/96 Intern, Department of Medicine, and Clinical Fellow,
Harvard Medical School
Beth Israel Hospital
Boston, MA
- 8/91-5/95 Doctor of Medicine
Georgetown University School of Medicine
Washington, DC
- 8/89-6/92 Bachelor of Science in Chemistry
Georgetown University
Washington, DC
- 8/85-6/89 *Thomas Jefferson High School for Science and Technology*
Alexandria, VA

PROFESSIONAL EXPERIENCE

- 2014 - Present Professor
Departments of Orthopaedic Surgery, Neurosurgery and Biomedical Engineering
Johns Hopkins University
Baltimore, MD
- 2014 - Present Vice Chair of Professional Development
Department of Orthopaedic Surgery
Johns Hopkins University
Baltimore, MD
- 2011 - 2018 Division Chief
Johns Hopkins Orthopaedic Surgery—National Capital Region
Bethesda, MD
- 2014 - 2016 Vice Chair
Department of Orthopaedic Surgery
Suburban Hospital, *a Member of Johns Hopkins Medicine*
Baltimore, MD

- 2009 - 2014 Associate Professor
Departments of Orthopaedic Surgery and Biomedical Engineering
Johns Hopkins University
Baltimore, MD
- 2004 - 2009 Assistant Professor
Department of Orthopaedic Surgery
Johns Hopkins University
Baltimore, MD
- 2004 - 2011 Co-Director, Division of Spine Surgery
Johns Hopkins Orthopaedic Surgery at Good Samaritan Hospital
Baltimore, MD

RESEARCH ACTIVITIES

Peer-Reviewed Publications

1. Beall DP, **Khanna AJ**, Shaffrey JK. Extensive Pneumatosis Intestinalis and Portal Venous Air Developing after Bowel Infarction. *Maryland Medical Journal* 1997; 46: 139-140.
2. **Khanna AJ**. Pathophysiology and Treatment of Variceal Hemorrhage. *Radiology* 1997; 203: 784.
3. **Khanna AJ**, Yoon TR, Mont MA, Hungerford DS, Bluemke DA. Femoral Head Osteonecrosis: Detection and Grading Using a Rapid MR Imaging Protocol. *Radiology* 2000; 217(1): 188-192.
4. Frassica FJ, **Khanna AJ**, McCarthy EF. The Role of MR Imaging in Soft Tissue Tumor Evaluation: Perspective of the Orthopaedic Oncologist and Musculoskeletal Pathologist. *Magnetic Resonance Imaging Clinics of North America* 2000; 8(4): 915-927.
5. **Khanna AJ**, Braverman NE, Valle D, Sponseller PD. Cervical Stenosis Secondary to Rhizomelic Chondrodysplasia Punctata. *American Journal of Medical Genetics* 2001; 99(1): 63-66.
6. Ahn UM, Lemma MA, Ahn NA, **Khanna AJ**, Buchowski J, Kostuik JP. Occipitocervical Fusion: A Review of Indications, Techniques of Internal Fixation, and Results. *Neurosurgery Quarterly* 2001; 11(2): 77-85.
7. **Khanna AJ**, Cosgarea AJ, Mont MA, Andres BM, Domb BG, Evans PJ, Bluemke DA, Frassica FJ. Magnetic Resonance Imaging of the Knee: Current Techniques and Spectrum of Disease. *The Journal of Bone and Joint Surgery [American]*, 2001, 83 (Suppl. 2, Pt. 2): 128-141.
8. Shindle MK, **Khanna AJ**, Hoehner JC, O’Niell PJ, Sponseller PD. Colonic Perforation Complicating Postero-Anterior Fusion Using Fibular Strut Autograft for a High-Grade Spondylolisthesis. *Journal of Spinal Disorders & Techniques* 2002; 15(6): 546-549.
9. Shindle MK, **Khanna AJ**, McCarthy EF, O’Niell PJ, Sponseller PD. Desmoid Tumor of the Spinal Canal Causing Paralysis. *Spine* 2002; 27(12): E304-307.
10. **Khanna AJ**, Carbone JJ, Kebaish KM, Cohen DB, Riley LH III, Wasserman BA, Kostuik JP. Magnetic Resonance Imaging of the Cervical Spine: Current Techniques and Spectrum of Disease. *The Journal of Bone and Joint Surgery [American]*, 2002; 84(Suppl. 2, Pt. 2): 70-80.
11. **Khanna AJ**, Wasserman BA, Sponseller PD. Magnetic Resonance Imaging of the Pediatric Spine. *Journal of the American Academy of Orthopaedic Surgeons*, 2003; 11(4): 248-259.
12. Moshirfar A, Campbell JT, **Khanna AJ**, Byank RP, Bluemke DA, Wenz JF Sr. Magnetic Resonance Imaging of the Ankle: Current Techniques and Spectrum of Disease. *The Journal of Bone and Joint Surgery [American]*, 2003; 85(Suppl. 4): 7-19.
13. Ngu BB, **Khanna AJ**, Pak SS, McCarthy EF, Sponseller PD. Eosinophilic Granuloma of the Atlas Presenting as Torticollis in a Child. *Spine*, 2004; 29(5):E98-E100.

14. Domb BG, **Khanna AJ**, Mitchell SE, Frassica FJ. Toe-Walking Attributable to Malformation of the Calf Muscle. *Clinical Orthopaedics and Related Research*, 2004; 420:225-229.
15. Andres BA, **Khanna AJ**, Wenz JF Sr, Faust AF, Frassica FJ. A Comparison of Digital Cameras: Features Essential for the Orthopaedic Surgeon. *Clinical Orthopaedics and Related Research* 2004; 421: 10-16.
16. **Khanna AJ**, Domb BG, Moshirfar A, Wenz JF Sr. Rapidly Destructive Osteoarthropathy of the Hip. *The American Journal of Orthopedics*, 2004; 33(5): 243-247.
17. **Khanna AJ**, Kebaish KM, Ozdemir HM, Cohen DB, Gonzales RA, Kostuik JP. Sacral Insufficiency Fracture Surgically Treated by Fibular Allograft. *Journal of Spinal Disorders and Techniques*, 2004;17(3): 167-173.
18. **Khanna AJ**, Shindle MK, Wasserman BA, Gokaslan ZL, Gonzales RA, Buchowski JM, Riley LH III. Use of Magnetic Resonance Imaging in Differentiating Compartmental Location of Spinal Tumors. *The American Journal of Orthopedics*; 2005; 34(10): 472-476.
19. **Khanna AJ**, Neubauer P, Togawa D, Reinhardt MK, Lieberman IH. Kyphoplasty and Vertebroplasty for the Treatment of Spinal Metastases. *Supportive Cancer Therapy*, 2005; 3(1): 21-25.
20. Moshirfar A, Rand FF, Sponseller PD, Parazin SJ, **Khanna AJ**, Kebaish KM, Stinson JT, Riley LH III. Pelvic Fixation in Spine Surgery: Historical Overview, Indications, Biomechanical Relevance, and Current Techniques. *The Journal of Bone and Joint Surgery [American]*, 2005; 87(Suppl. 2): 89-106.
21. **Khanna AJ**, Reinhardt MK, Togawa D, Lieberman IH. Functional Outcomes of Kyphoplasty for the Treatment of Osteoporotic and Osteolytic Vertebral Compression Fractures. *Osteoporosis International*, 2006;17(6): 817-826.
22. Shindle MK, **Khanna AJ**, Bhatnager R, Sponseller PD. Adolescent Idiopathic Scoliosis: Modern Management Guidelines. *Journal of Surgical Orthopaedic Advances*, 2006; 15(1): 43-52.
23. Brunton LM, Anderson MW, Pannunzio ME, **Khanna AJ**, Chhabra AB. Magnetic Resonance Imaging of the Elbow: Update on Current Techniques and Indications. *The Journal of Hand Surgery [American]*, 2006; 31(6): 1001-1011.
24. Farber A, Fayad L, Johnson T, Cascio B, Shindle M, Neubauer P, **Khanna AJ**. Magnetic Resonance Imaging of the Shoulder: Techniques and Spectrum of Disease. *The Journal of Bone and Joint Surgery [American]*, 2006; 88(Suppl. 4): 64-79.
25. Shindle MK, Foo LF, Kelly BT, **Khanna AJ**, Domb BG, Farber A, Wanich T, Potter HG. Magnetic Resonance Imaging of Cartilage in the Athlete: Current Techniques and Spectrum of Disease. *The Journal of Bone and Joint Surgery [American]*, 2006; 88(Suppl. 4): 27-46.
26. Moshirfar A, **Khanna AJ**, Kebaish KM. Treatment of Symptomatic Spondyloptosis in an Adult Previously Treated with in Situ Fusion and Instrumentation by L5 Vertebrectomy and L4-S1 Instrumented Reduction. *The Spine Journal*, 2007; 7(1): 100-105.
27. Pateder DB, **Khanna AJ**, Lieberman IH. Vertebroplasty and Kyphoplasty for the Management of Osteoporotic Vertebral Compression Fractures. *Orthopedic Clinics of North America*. 2007; 38(3):409-418.
28. Shen FH, Samartzis D, **Khanna AJ**, Anderson DG. Minimally Invasive Techniques for Lumbar Interbody Fusions. *The Orthopedic Clinics of North America*, 2007; 38(3): 373-386.
29. Papp DF, **Khanna AJ**, McCarthy EF, Carrino JA, Farber AJ, Frassica FJ. Magnetic Resonance Imaging of Soft-Tissue Tumors: Determinate and Indeterminate Lesions. *The Journal of Bone and Joint Surgery [American]*, 2007; 89(Suppl. 3): 103-115.
30. **Khanna AJ**, Lee S, Villaraga M, Gimbel J, Steffey D, Shwardt J. Biomechanical Evaluation of Kyphoplasty with Calcium Phosphate Cement in a 2-Functional Spinal Unit Vertebral Compression Fracture Model. *The Spine Journal*, 2008; 8(5): 770-777.
31. Gebauer GP, Farjoodi P, Sciubba DM, Gokaslan ZL, Riley LH III, Wasserman BA, **Khanna AJ**. Magnetic Resonance Imaging of Spine Tumors: Classification, Differential Diagnosis, and

- Spectrum of Disease. *The Journal of Bone and Joint Surgery [American]*, 2008; 90(Suppl 4): 146-142.
32. Krabak BJ, Clotz CR, Gokaslan ZL, **Khanna AJ**. Spinal Capillary Hemangioma in a Patient with Chronic Hip Pain. *SpineLine*, 2008; 9(5): 33-36.
 33. Gebauer GP, **Khanna AJ**. Management of Osteoporotic Fractures of the Thoracolumbar Spine. *Seminars in Spine Surgery*, 2010; 22(2): 58-66.
 34. Farjoodi P, **Khanna AJ**, Marker DR, Frassica FJ. Evaluation of the Orthopaedic In-Training Examination: Spine Questions. *Journal of Surgical Education*, 2010; 67(3): 139-142.
 35. Farjoodi P, Mesfin A, Carrino JA, **Khanna AJ**. Magnetic Resonance Imaging of the Musculoskeletal System: Basic Science, Pulse Sequences, and a Systematic Approach to Image Interpretation. *The Journal of Bone and Joint Surgery*, 2010; 92(Suppl 2): 105-116.
 36. Ponnusamy KE, Iyer S, Gupta G, **Khanna AJ**. Instrumentation of the Osteoporotic Spine: Biomechanical and Clinical Considerations. *The Spine Journal*. 2011;11(1): 54-63.
 37. Archer KR, Wegener ST, Seebach C, Song Y, Skolasky RL, Thornton C, **Khanna AJ**, Riley LH III. The Effect of Fear-Avoidance Beliefs on Pain and Disability after Surgery for Lumbar and Cervical Degenerative Conditions. *Spine*, 2011; 36(19): 1554-1562.
 38. Schafer S, Nithananiathan S, Mirota DJ, Uneri A, Stayman JW, Zbijewski W, Schmidgunst C, Kleinszig G, **Khanna AJ** and Siewerdsen JH, Mobile C-Arm Cone-Beam CT for Guidance of Spine Surgery: Image Quality, Radiation Dose, and Integration with Interventional Guidance. *Medical Physics*, 2011;3(8):4563-74
 39. **Khanna AJ**. Introduction. *Seminars in Spine Surgery*, 2011; 23(2): 83.
 40. Dewan AK, Mirski MA, **Khanna AJ**. Perioperative Risk Assessment and Morbidity Associated with Lumbar Spine Surgery. *Seminars in Spine Surgery*, 2011; 23(2): 84-90.
 41. Chalian M, Soldatos T, Carrino JA, Belzberg AJ, Khanna AJ, Chhabra A. Prediction of Transitional Lumbosacral Anatomy on Magnetic Resonance Imaging of the Lumbar Spine. *World Journal of Radiology*. 2012 Mar 28;4(3):97-101.
 42. Thakkar RS, Malloy JP IV, Thakkar SC, Carrino JA, **Khanna AJ**. Imaging the Postoperative Spine. *Radiologic Clinics of North America*, 2012; 50(4): 731-47.
 43. Uneri A, Schafer S, Mirota DJ, Nithiananthan S, Otake Y, Taylor RH, Gallia GL, **Khanna AJ**, Lee S, Reh DD, Siewerdsen JH. TREK: An Integrated System Architecture for Intraoperative Cone-beam CT-Guided Surgery. *International Journal of Computer Assisted Radiology and Surgery*, 2012; 7(1): 159-173.
 44. Lee J, Stayman JW, Otake Y, Schafer S, Zbijewski W, **Khanna AJ**, Prince JL, Siewerdsen JH. Volume-of-Change Cone-Beam CT for Image-Guided Surgery. *Physics in Medicine and Biology*, 2012; 57: 4969-4989.
 45. Stayman JW, Otake Y, Prince JL, **Khanna AJ**, Siewerdsen JH. Model-Based Tomographic Reconstruction of Objects Containing Known Components. *IEEE Transactions on Medical Imaging*, 2012; (10):1837-48.
 46. Reaungamornrat S, Otake Y, Uneri A, Schafer S, Mirota DJ, Nithiananthan S, Stayman JW, Kleinszig G, **Khanna AJ**, Taylor RH, Siewerdsen JH. An On-Board Surgical Tracking and Video Augmentation System for C-Arm Image Guidance. *International Journal of Computer Assisted Radiology and Surgery*, 2012; 7(5):647-65.
 47. Yoo J, Schafer S, Uneri A, Otake Y, **Khanna AJ**, Siewerdsen JH. An Electromagnetic “Tracker-in-Table” Configuration for X-Ray Fluoroscopy and Cone-Beam CT-Guided Surgery. *International Journal of Computer Assisted Radiology and Surgery*, 2013; Jan;8(1):1-13.
 48. Otake Y, Schafer S, Stayman JW, Zbijewski W, Kleinszig G, Graumann R, **Khanna AJ**, and Siewerdsen JH. Automatic Localization of Vertebral Levels in X-Ray Fluoroscopy Using 3D-2D Registration: A Tool to Reduce Wrong-Site Surgery. *Physics in Medicine and Biology*, 2012; 57(17): 5485-5508.

49. Dewan AK, Chhabra AB, **Khanna AJ**, Anderson MW, Brunton LM. Magnetic resonance imaging of the hand and wrist: techniques and spectrum of disease. *J Bone Joint Surg Am*, 2013 May 15; 95(10):e68 (1-12).
50. Dewan AK, Chhabra AB, Anderson MW, Brunton LM, **Khanna AJ**. Magnetic resonance imaging of the elbow: techniques and spectrum of disease. *J Bone Joint Surg Am*. 2013 Jul 17;95(14):e99 1-13.
51. **Khanna AJ**. Commentary on the sedimentation sign: correlation with operative level in patients undergoing lumbar decompression for spinal stenosis. *The Spine Journal*. 2013; Aug;13(8):843-4.
52. Mesfin A, Komanski CB, **Khanna AJ**. Failure of cement-augmented pedicle screws in the osteoporotic spine: a case report. *Geriatr Orthop Surg Rehabil*. 2013; Sep;4(3):84-88.
53. Otake Y, Wang AS, Stayman JW, Uneri A, Kleinszig G, Vogt S, **Khanna AJ**, Gokaslan ZL, Siewerdsen JH. Robust 3D-2D image registration: Application to Spine Interventions and Vertebral Labeling in the Presence of Anatomical Deformation. *Physics in Medicine and Biology*, 2013; 58 (23): 8535-8553.
54. Uneri A, Otake Y, Wang AS, Kleinszig G, Vogt S, **Khanna AJ**, Siewerdsen JH. 3D-2D Registration for Surgical Guidance: Effect of Projection View Angles on Registration Accuracy. *Physics in Medicine and Biology*, 2013; Dec 19;59(2): 271-287.
55. Wang AS, Stayman JW, Otake Y, Kleinszig G, Vogt S, Gallia GL, **Khanna AJ**, and Siewerdsen JH. Soft-Tissue Imaging with C-Arm Cone-Beam CT Using Statistical Reconstruction. *Physics in Medicine and Biology*, 2014; 59(4): 1005-1026.
56. Wang AS, Stayman JW, Otake Y, Vogt S, Kleinszig G, **Khanna AJ**, Gallia GL, and Siewerdsen JH. Low-Dose Preview for Patient-Specific, Task-Specific Technique Selection in Cone-Beam CT. *Medical Physics*, 2014; *Medical Physics*. 2014 Jul; 41(7):071915.
57. Reangamornrat S, Wang AS, Uneri A, Otake Y, **Khanna AJ**, and Siewerdsen JH. Deformable Image Registration with Local Rigidity Constraints for Cone-Beam CT Guided Spine Surgery. *Physics in Medicine and Biology*, 2014; 59 (14) 3761-3787.
58. Uneri A, Wang AS, Otake Y, Kleinszig G, Vogt S, **Khanna AJ**, Gallia GL, Gokaslan ZL, Siewerdsen JH. Evaluation of low-dose limits in 3D-2D rigid registration for surgical guidance. *Physics in Medicine and Biology*, 2014;59(18): 5329-5345.
59. Uneri A, De Silva T, Stayman JW, Kleinszig G, Vogt S, **Khanna AJ**, Gokaslan ZL, Wolinsky J-P, Siewerdsen JH. Known-Component 3D-2D Registration for Quality Assurance in Spine Surgery Pedicle Screw Placement", *Physics in Medicine and Biology*, 2015; 60(20):8007-24.
60. Hassanzadeh H, Nandyala SV, **Khanna AJ**, An HS. Intraoperative Neurophysiologic Monitoring in Adult Spine Surgery. *Seminars in Spine Surgery*, 2015; 27(4): 209-213.
61. Louie PK, **Khanna AJ**, Hassanzadeh H, Kebaish KM. Intraoperative Neurophysiologic Monitoring in High-Grade Spondylolisthesis. *Seminars in Spine Surgery*, 2015; 27(4): 217-221.
62. Jain A, **Khanna AJ**, Hassanzadeh H. Management of Intraoperative Neuromonitoring Signal Loss. *Seminars in Spine Surgery*, 2015; 27(4): 229-232.
63. Reangamornrat S, De Silva T, Uneri A, Goerres J, Jacobson M, Ketcha M, Vogt S, Kleinszig G, **Khanna AJ**, Wolinsky JP, Prince JL, Siewerdsen JH. Performance Evaluation of MIND Demons Deformable Registration of MR and CT Images in Spinal Interventions, *Physics in Medicine and Biology*, 2016; 61: 8276–8297.
64. Uneri A, De Silva T, Goerres J, Jacobson MW, Ketcha MD, Reangamornrat S, Kleinszig G, Vogt S, **Khanna AJ**, Osgood GM, Wolinsky JP, Siewerdsen JH. Operating Room Quality Assurance (ORQA) for Spine Surgery Using Known-Component 3D-2D Image Registration. *Physics in Medicine and Biology*, 2016; 43(6): 3792-3792.
65. De Silva T, Uneri A, Ketcha MD, Reangamornrat S, Goerres J, Jacobson MW, Vogt S, Kleinszig G, **Khanna AJ**, Wolinsky JP, Siewerdsen JH. Registration of MRI to Intraoperative Radiographs for Target Localization in Spinal Interventions. *Physics in Medicine and Biology*, 2017; 62(2): 684-701.

66. Puvanesarajah V, Jain A, Kebaish K, Shaffrey CI, Sciubba DM, De la Garza-Ramos R, **Khanna AJ**, Hassanzadeh H. Poor Nutrition Status and Lumbar Spine Fusion Surgery in the Elderly: Readmissions, Complications, and Mortality. *Spine*, 2016 Nov 9. [Epub ahead of print]
67. De Silva T, Uneri A, Ketcha MD, Reangamornrat S, Goerres J, Jacobson MW, Vogt S, Kleinszig G, **Khanna AJ**, Wolinsky JP, and Siewerdsen JH. Registration of MRI to Intraoperative Radiographs for Target Localization in Spinal Interventions, *Physics in Medicine and Biology*, 2017; 62(2): 684-701
68. Xu S, Uneri A, **Khanna AJ**, Siewerdsen J, Stayman J. Polyenergetic known-component CT reconstruction with unknown material compositions and unknown x-ray spectra. *Physics in Medicine and Biology*, 2017 62(8): 3352-3374.
69. Uneri A, De Silva T, Goerres J, Jacobson MW, Ketcha MD, Reangamornrat S, Kleinszig G, Vogt S, **Khanna AJ**, Osgood GM, Wolinsky JP, Siewerdsen JH. Intraoperative evaluation of device placement in spine surgery using known-component 3D-2D image registration. *Physics in Medicine and Biology*, 2017; 21 62(8): 3330-3351.
70. Ishii L, Demski R, Ken Lee KH, Mustafa Z, Frank S Wolinsky JP, Cohen DB, **Khanna AJ**, Ammerman J, Khanuja HS, Unger AS, Gould L, Wachter PA, Stearns L, Werthman R, Pronovost P. Improving healthcare value through clinical community and supply chain collaborations. *Healthcare (Amst)*. 2017; 5(1-2):1-5.
71. De Silva T, Punnoose J, Uneri A, Mahesh M, Goerres J, Jacobson M, Ketcha MD, Manbachi A, Vogt S, Kleinszig G, **Khanna AJ**, Wolinsky JP, Siewerdsen JH, Osgood G. Virtual fluoroscopy for intraoperative C-arm positioning and radiation dose reduction. *Journal of Medical Imaging*. 2018; 5(1).

Proceedings Publications (Non-Peer-Reviewed)

1. Reangamornrat S, Otake Y, Uneri A, Schafer S, Stayman JW, Zbijewski W, Mirota DJ, Yoo J, Nithianathan S, **Khanna AJ**, Taylor RH, Siewerdsen JH. Tracker-on-C: A novel tracker configuration for image-guided therapy using a mobile C-arm. *Int J Comput Assist Radiol Surg*, 2011; 6(Suppl1): S134-S135.
2. Yoo J, Uneri A, Schafer S, Otake Y, Stayman JW, **Khanna AJ**, and Siewerdsen JH, Characterization and implementation of an x-ray compatible electromagnetic field generator in cone-beam CT-guided surgery. *Int J Comput Assist Radiol Surg*, 2011; 6(Suppl1): S254-S255.
3. Uneri A, Schafer S, Mirota D, Nithianathan S, Otake Y, Reangamornrat S, Yoo J, Stayman JW, Reh D, Gallia GL, **Khanna AJ**, Hager G, Taylor RH, Kleinszig G, Siewerdsen JH. Architecture of a high-performance surgical guidance system based on C-arm cone-beam CT: Software platform for technical integration and clinical translation. *SPIE Medical Imaging: Visualization, Image-Guided Procedures, and Display*, 2011; Volume 7964: 796422-29.
4. Otake Y, Schafer S, Stayman JW, Zbijewski W, Kleinszig G, Graumann R, **Khanna AJ**, Siewerdsen JH. Automatic Localization of target vertebrae in spine surgery using fast CT-to-fluoroscopy (3D-2D) image registration. *SPIE Medical Imaging: Image-Guided Procedures, Robotic Procedures, and Modeling*, 2012; Vol. 8316: 83160N.
5. Reangamornrat S, Otake Y, Uneri A, Schafer S, Mirota DJ, Nithianathan S, Stayman JW, **Khanna AJ**, Reh DD, Gallia GL, Taylor RH, Siewerdsen JH, Tracker-on-C for cone-beam CT-guided surgery: Evaluation of geometric accuracy and clinical applications. *SPIE Medical Imaging: Image-Guided Procedures, Robotic Procedures, and Modeling*, 2012; Vol. 8316: 831609.
6. Lee J, Stayman JW, Otake Y, Shafer S, Zbijewski W, **Khanna AJ**, Prince JL, Siewerdsen JH. Incorporation of prior knowledge for region-of-change imaging from sparse scan data in image-guided surgery. *SPIE Medical Imaging: Image-Guided Procedures, Robotic Procedures, and Modeling*, 2012; Vol. 8316: 831603.

7. Wang AS, Stayman JW, Otake Y, Kleinszig G, Vogt S, **Khanna AJ**, Gokaslan ZL, Siewerdsen JH. Statistical reconstruction for soft tissue imaging with low dose C-arm cone-beam CT. Proceedings of the 12th International Fully3D Meeting: Fully Three-Dimensional Image Reconstruction in Radiology and Nuclear Medicine, 2013; 201-204.
8. Wang AS, Otake Y, Stayman JW, Uneri A, Kleinszig G, Vogt S, **Khanna AJ**, Gokaslan ZL, Siewerdsen JH. Soft tissue visibility and dose reduction in mobile C-arm cone-beam CT using advanced 3D image reconstruction. *Int. J. Comput. Assist. Radiol. Surg.* CARS, 2013; In Press.
9. Otake Y, Wang AS, Stayman JW, Kleinszig G, Vogt S, **Khanna AJ**, Groves M, Gokaslan ZL, Siewerdsen JH. Automatic localization of vertebral levels in C-arm fluoroscopy: Evaluation of the LevelCheck algorithm in a preclinical cadaver study with realistic tissue deformation. *Int J Comput Assist Radiol Surg.* CARS, 2013; In Press.
10. Otake Y, Wang AS, Stayman JW, Kleinszig G, Vogt S, **Khanna AJ**, Wolinsky JP, Gokaslan ZL, Siewerdsen JH. Verification of surgical product and detection of retained foreign bodies using 3D-2D registration in intraoperative mobile radiographs. *Int J Comput Assist Radiol Surg.* CARS, 2013; In Press.
11. Nithiananthan S, Uneri A, Schafer S, Mirota DJ, Otake Y, Stayman JW, Zbijewski W, **Khanna AJ**, Reh DD, Gallia GL, Siewerdsen JH, Deformable image registration with content mismatch: A Demons variant to account for added material and surgical devices in the target image. SPIE Medical Imaging 2013: Image-Guided Procedures, Robotic Interventions, and Modeling, Feb. 2013; In Press.
12. Wang AS, Schafer S, Stayman JW, Otake Y, Sussman MS, **Khanna AJ**, Gallia GL, Siewerdsen JH. Soft-tissue imaging in low-dose, C-arm cone-beam CT using statistical image reconstruction. Proceedings of SPIE: Medical Imaging, 2013: Vol. 8668: 86681F.

Inventions, Patents, Copyrights

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| 3/16/06 | <i>Orthopaedic Screw System</i>
U.S. Provisional Patent Application No. 60/782,069 |
| 3/14/07 | <i>Orthopaedic Screw System</i>
Patent Pending, U.S. Patent Application No. 11684764 |
| 11/4/10 | <i>Universally Deployable and Expandable Bone Screw Anchor Assembly</i>
International Patent (PCT) Application No. 61/258,362 |
| 2/10/12 | <i>Minimally-Invasive Device, Kit, and Method for Bone Graft Harvesting</i>
International Patent (PCT) Application No. PCT/US2012/024761 |
| 5/7/12 | <i>Bone Harvesting Device</i>
U.S. Provisional Patent Application No.: 61/643,662 |
| 10/25/12 | <i>Universally Deployable and Expandable Bone Screw Anchor</i>
Publication Number US 2012/0271363 A1 |
| 1/1/13 | <i>Orthopaedic Screw System</i>
Patent Number US 8,343,200 B2 |
| 5/14/14 | <i>System and Method for Automatic Localization of Structures in Projection Images</i>
U.S. Provisional Patent Application No. 61/996,655 |
| 10/24/14 | <i>Bone Harvesting</i>
U.S. Provisional Patent Application No.: 14/523,252 |

Extramural Funding

- 1992 *Optimization of Techniques for Dynamic MR Imaging of the Breast*
Basic Science Research Grant
Georgetown University School of Medicine
\$2000
Role: Research Intern
- 1993 *CT and MRI Evaluation of Pulmonary Asbestosis and Mesothelioma*
Summer Research Fellowship
National Institutes of Health
\$2500
Role: Research Intern
- 2006 *Pull-Out Resistant Pedicle Screw for Osteoporotic Patients*
Grant #3423-06
National Collegiate Inventors and Innovators Alliance (NCIIA)
\$18,500
Role: PI and Advisor
- 2007 *Expandable Interbody Fusion Cage*
Grant #4671-07
National Collegiate Inventors and Innovators Alliance (NCIIA)
\$17,000
Role: PI and Advisor
- 2009-2012 *High-Performance 3D Imaging on a Mobile C-Arm*
Siemens Healthcare, Special Products (XP) Division, Industry Research Partnership
\$1,300,000 (plus \$200,000 for capital equipment)
PI: Jeffrey Siewerdsen, PhD, Johns Hopkins University
Role: Co-Investigator; 5% effort.
Preclinical implementation of flat-panel cone-beam CT on a mobile, isocentric C-arm in minimally invasive procedures; Systems integration and clinical trials in key applications, including spine, orthopaedics, and soft-tissue abdominal surgeries.
- 2010 *Corticon: Anchor for Fixation in Osteoporotic Bone*
Grant #7197-09
National Collegiate Inventors and Innovators Alliance (NCIIA)
\$20,000
Role: PI and Advisor
- 2011-2012 *Minimally Invasive Device for Harvesting of Iliac Crest Bone Graft*
Grant #8317-10
National Collegiate Inventors and Innovators Alliance (NCIIA)
\$20,000
Role: PI and Advisor
- 2011-2012 *Minimally Invasive Device for Harvesting of Iliac Crest Bone Graft*
Grant # 2011-UTDF-0361-00
Maryland Technology Development Corporation (TEDCO) University Technology Development Fund (UTDF)
\$50,000

Role: PI and Advisor

- 2011-2012 “Minimally Invasive Device for Harvesting of Iliac Crest Bone Graft
Technology Accelerator Fund
Department of Biomedical Engineering, Johns Hopkins University,
Grant for “Minimally Invasive Device for Harvesting of Iliac Crest Bone Graft”
\$45,000
Role: PI
- 2012 Minimally Invasive Device for Harvesting of Iliac Crest Bone Graft
Johns Hopkins-Coulter Translational Partnership Award
Department of Biomedical Engineering, Johns Hopkins University,
\$104,175
Role: Co-Principal Investigator
(Co-PIs: Khaled M. Kebaish, MD and Lee H. Riley, III, MD)
- 2013 Minimally Invasive Device for Harvesting of Iliac Crest Bone Graft; Boss Medical, LLC
Maryland Technology Development Corporation (TEDCO) and Maryland Innovation Initiative
\$99,960
Role: Co-Principal Investigator
(Co-PIs: Khaled M. Kebaish, MD and Lee H. Riley, III, MD)
- 2013 Minimally Invasive Device for Harvesting Autologous Bone Graft
Proposal #1315589
National Science Foundation Small Business Innovation Research (NSF SBIR) Phase I
Grant
\$150,000
Role: Senior Personnel
- 2014-2016 *Minimally Invasive Device for Harvesting Autologous Bone Graft*
National Science Foundation Small Business Innovation Research (NSF SBIR) Phase II
Grant
\$750,000
Role: Senior Personnel
- 2015 *Minimally Invasive Device for Harvesting Autologous Bone Graft*
National Science Foundation Technology Enhancement for Commercial Partnerships
\$150,000
Role: Senior Personnel

EDUCATIONAL ACTIVITIES

Educational Publications

Invited Review Articles

1. **Khanna AJ**, Neubauer P, Togawa D, Lieberman IH. Kyphoplasty and Vertebroplasty for the Treatment of Spinal Metastases. *Supportive Cancer Therapy*, 2005; 3(1): 21-25.
2. Pateder DB, **Khanna AJ**, Lieberman IH. Vertebroplasty and Kyphoplasty for the Management of Osteoporotic Vertebral Compression Fractures. *Orthopedic Clinics of North America*, 2007;38(3):409-418.

3. Shen FH, Samartzis D, **Khanna AJ**, Anderson DG. Minimally Invasive Techniques for Lumbar Interbody Fusions. *The Orthopedic Clinics of North America*, 2007; 38(3): 373-386.

Case Reports

1. Beall DP, **Khanna AJ**, Shaffrey JK. Extensive Pneumatosis Intestinalis and Portal Venous Air Developing after Bowel Infarction. *Maryland Medical Journal* 1997; 46: 139-140.
2. **Khanna AJ**, Braverman NE, Valle D, Sponseller PD. Cervical Stenosis Secondary to Rhizomelic Chondrodysplasia Punctata. *American Journal of Medical Genetics* 2001; 99(1): 63-66.
3. Shindle MK, **Khanna AJ**, Hoehner JC, O’Niell PJ, Sponseller PD. Colonic Perforation Complicating Postero-Anterior Fusion Using Fibular Strut Autograft for a High-Grade Spondylolisthesis. *Journal of Spinal Disorders & Techniques* 2002; 15(6): 546-549.
4. Shindle MK, **Khanna AJ**, McCarthy EF, O’Niell PJ, Sponseller PD. Desmoid Tumor of the Spinal Canal Causing Paralysis. *Spine* 2002; 27(12): E304-307.
5. Ngu BB, **Khanna AJ**, Pak SS, McCarthy EF, Sponseller PD. Eosinophilic Granuloma of the Atlas Presenting as Torticollis in a Child. *Spine*, 2004; 29(5):E98-E100.
6. Domb BG, **Khanna AJ**, Mitchell SE, Frassica FJ. Toe-Walking Attributable to Malformation of the Calf Muscle. *Clinical Orthopaedics and Related Research*, 2004; 420:225-229.
7. **Khanna AJ**, Domb BG, Moshirfar A, Wenz JF Sr. Rapidly Destructive Osteoarthropathy of the Hip. *The American Journal of Orthopedics*, 2004; 33(5): 243-247.
8. Krabak BJ, Clotz CR, Gokaslan ZL, **Khanna AJ**. Spinal Capillary Hemangioma in a Patient with Chronic Hip Pain. *SpineLine*, 2008; 9(5): 33-36.

Letters/Correspondence

1. **Khanna AJ**, Carbone JJ, Kebaish KM, Cohen DB, Riley III LH, Wasserman BA, Kostuik JP. Reply, Magnetic Resonance Imaging of the Rheumatic Cervical Spine. *Journal of Bone and Joint Surgery*, 2003; 85: 2482-2483.
2. Ponnusamy KE, Gupta G, Iyer S, **Khanna AJ**. Response to Letter to the Editor Regarding "Instrumentation of the Osteoporotic Spine: Biomechanical and Clinical Considerations." *The Spine Journal*, 2011; 11(5): 460-461.
3. **Khanna AJ**. Commentary on the sedimentation sign: correlation with operative level in patients undergoing lumbar decompression for spinal stenosis. *Spine J*, 2013; Aug13(8): 843-4.

Book Chapters

1. **Khanna AJ**, Shindle MK, Wasserman BA. Imaging of the Spine. In McLain RF (ed): Cancer in the Spine: Comprehensive Care. Totowa (NJ): Humana Press Inc, 2006; 73-81.
2. **Khanna AJ**, Lemma MA, Wasserman BA, McLain RF. Imaging: Screening for Spinal Disease. In McLain RF (ed): Cancer in the Spine: Comprehensive Care. Totowa (NJ): Humana Press Inc, 2006; 62-72.
3. Coumans JVCE, **Khanna AJ**, Lieberman IH. Minimally Invasive Approaches To Spinal Metastases: Endoscopic Surgery and Vertebral Augmentation. In McLain RF (ed): Cancer in the Spine: Comprehensive Care. Totowa (NJ): Humana Press Inc, 2006; 285-293.
4. Dhir RR, Doute D, **Khanna AJ**: Back Pain. In Frassica FJ, Sponseller PD, Wilckens JH (eds): 5-Minute Orthopaedic Consult, Ed 2. Philadelphia: Lippincott Williams & Wilkins, 2007; 34-35.
5. Soderlund KA, Cohen DB, **Khanna AJ**: Cervical Disc Herniation. In Frassica FJ, Sponseller PD,

- Wilckens JH (eds): 5-Minute Orthopaedic Consult, Ed 2. Philadelphia: Lippincott Williams & Wilkins, 2007; 62-63.
6. Glait SA, Mathur S, **Khanna AJ**: Cervical Spine Anatomy and Examination. In Frassica FJ, Sponseller PD, Wilckens JH (eds): 5-Minute Orthopaedic Consult, Ed 2. Philadelphia: Lippincott Williams & Wilkins, 2007; 64-65.
 7. Manista AP, Doute D, **Khanna AJ**: Kyphosis. In Frassica FJ, Sponseller PD, Wilckens JH (eds): 5-Minute Orthopaedic Consult, Ed 2. Philadelphia: Lippincott Williams & Wilkins, 2007; 226-227.
 8. Dhir RR, **Khanna AJ**: Lumbar Spine Anatomy and Examination. In Frassica FJ, Sponseller PD, Wilckens JH (eds): 5-Minute Orthopaedic Consult, Ed 2. Philadelphia: Lippincott Williams & Wilkins, 2007; 236-237.
 9. Soderlund KA, Mathur S, **Khanna AJ**: Neck Pain. In Frassica FJ, Sponseller PD, Wilckens JH (eds): 5-Minute Orthopaedic Consult, Ed 2. Philadelphia: Lippincott Williams & Wilkins, 2007; 270-271.
 10. Shindle MK, Cohen DB, **Khanna AJ**: Spondylolisthesis. In Frassica FJ, Sponseller PD, Wilckens JH (eds): 5-Minute Orthopaedic Consult, Ed 2. Philadelphia: Lippincott Williams & Wilkins, 2007; 416-417.
 11. Boateng H, Doute D, **Khanna AJ**: Vertebral Osteomyelitis. In Frassica FJ, Sponseller PD, Wilckens JH (eds): 5-Minute Orthopaedic Consult, Ed 2. Philadelphia: Lippincott Williams & Wilkins, 2007; 478-479
 12. Togawa D, Kayanja MM, Lieberman IH, **Khanna AJ**. Vertebral Body Augmentation for Bone Tumor. In Vaccaro AR, Bono CM (eds): Minimally Invasive Spine Surgery. Ossining (NY): Egerton Group, Ltd., 2007; 339-346.
 13. Srikumaran U, **Khanna AJ**. Imaging of the Spine. In: Shen FH, Shaffrey CI (eds): Arthritis & Arthroplasty: The Spine. Philadelphia: Saunders (Elsevier), 2010; 10-17.
 14. Srikumaran U, **Khanna AJ**. Overview of the Spine. In: Miller MD, Hart JA, MacKnight JM (eds): Essential Orthopaedics. Philadelphia: Saunders (Elsevier), 2010; 453-463.
 15. Dunleavy JD, **Khanna AJ**, Carrino JA. Normal MRI Anatomy of the Musculoskeletal System. In: **Khanna AJ** (ed): MRI for Orthopaedic Surgeons. New York: Thieme, 2010; 17-76.
 16. **Khanna AJ**. A Systematic Approach to the Review of Musculoskeletal MRI Studies. In: **Khanna AJ** (ed): MRI for Orthopaedic Surgeons. New York: Thieme, 2010; 77-93.
 17. Farber AJ, **Khanna AJ**, Fayad LM, Johnson TS, McFarland EG. The Shoulder. In: **Khanna AJ** (ed): MRI for Orthopaedic Surgeons. New York: Thieme, 2010; 97-117.
 18. Cascio BM, **Khanna AJ**, Glait SA, Cosgarea AJ, Johnson TS, Reeder JD. The Knee. In: **Khanna AJ** (ed): MRI for Orthopaedic Surgeons. New York: Thieme, 2010; 164-201.
 19. Zebala LP, Buchowski JM, Daftary AR, O'Brien JR, Carrino JA, **Khanna AJ**. The Cervical Spine. In: **Khanna AJ** (ed): MRI for Orthopaedic Surgeons. New York: Thieme, 2010; 229-268.
 20. Okubadejo GO, Daftary AR, Buchowski JM, Carrino JA, **Khanna AJ**. The Lumbar and Thoracic Spine. In: **Khanna AJ** (ed): MRI for Orthopaedic Surgeons. New York: Thieme, 2010; 269-315.
 21. **Khanna AJ**, Wasserman BA, Sponseller PD. The Pediatric Spine. In: **Khanna AJ** (ed): MRI for Orthopaedic Surgeons. New York: Thieme, 2010; 338-349.
 22. Papp DF, **Khanna AJ**, McCarthy EF, Fayad LM, Farber AJ, Frassica FJ. Soft-Tissue and Bone Tumors. In: **Khanna AJ** (ed): MRI for Orthopaedic Surgeons. New York: Thieme, 2010; 370-396.
 23. Srikumaran U, Fayad LM, **Khanna AJ**. Correlation of MRI With Other Imaging Studies. In: **Khanna AJ** (ed): MRI for Orthopaedic Surgeons. New York: Thieme, 2010; 414-424.
 24. Riley LH III, Pull ter Gunne AF, **Khanna AJ**. Occipitocervical Fusion. In: Wang JC (ed): Advanced Reconstruction: Spine. Rosemont (IL): American Academy Orthopaedic Surgeons, 2011; 175-181.

25. Gebauer G, **Khanna AJ**. Vascular complications. In: Bridwell KH, DeWald RL (eds): The Textbook of Spinal Surgery. Philadelphia: Lippincott Williams & Wilkins, 2011; 1598-1607.
26. **Khanna AJ**, Kwon BK. Subaxial Cervical Spine Injuries. In: Rao R, Smuck M (eds): Orthopaedic Knowledge Update: Spine, 4th Edition. Rosemont (IL): American Academy of Orthopaedic Surgeons, 2012; 221-233.
27. Dewan A, **Khanna AJ**. Penetrating Injuries to the Spine. In: Vaccaro A, Anderson G (eds). Decision Making in Spinal Care. New York: Thieme, 2012; 567 – 574.
28. Menga EN, Dewan AK, **Khanna AJ**. Imaging of the intervertebral disc. In: Sharan AD, Tang SY, Vaccaro AR (eds). Basic Science of Spinal Diseases. New Delhi (India): Jaypee Brothers Medical Publishers, 2013:35-43.
29. Malloy JP, Dewan A, **Khanna AJ**. Radiographic and Computed Tomography Evaluation of the Cervical Spine. In: Shen FH, Samartzis D, Fessler RG (eds): The Cervical Spine. Philadelphia: Elsevier, 2012; in press.
30. Dewan A, Malloy JP, **Khanna AJ**. MRI of the Cervical Spine. In: Shen FH, Samartzis D, Fessler RG (eds): The Cervical Spine. Philadelphia: Elsevier, 2012; in press.
31. Deshmukh S, Carrino JA, Dunleavy JD, **Khanna AJ**. Normal Spine MRI Anatomy. In: **Khanna AJ** (ed): MRI Essentials for the Spine Specialist. New York: Thieme, 2014: 19 – 44.
32. Paterno JM, Silverberg CM, **Khanna AJ**, Singla AK. Common Clinical and Correlative Pain Generators of the Cervical and Lumbosacral Spine. In: **Khanna AJ** (ed): MRI Essentials for the Spine Specialist. New York: Thieme, 2014: 45 – 67.
33. **Khanna AJ**. A Systematic Approach to the Review of Spine MRI Studies. In: **Khanna AJ** (ed): MRI Essentials for the Spine Specialist. New York: Thieme, 2014: 68 – 84.
34. Haines C, **Khanna AJ**, Carrino JA, Lin SC, O'Brien JR. The Occipitocervical Junction. In: **Khanna AJ** (ed): MRI Essentials for the Spine Specialist. New York: Thieme, 2014: 87 – 110.
35. Zebala LP, Buchowski JM, Daftary AR, O'Brien JR, Carrino JA, **Khanna AJ**. The Cervical Spine. In: **Khanna AJ** (ed): MRI Essentials for the Spine Specialist. New York: Thieme, 2014: 111 – 154.
36. Okubadejo GO, Daftary AR, Buchowski JM, Carrino JA, **Khanna AJ**. The Lumbar and Thoracic spine. In: **Khanna AJ** (ed): MRI Essentials for the Spine Specialist New York: Thieme, 2014: 155 – 210.
37. **Khanna AJ**, Wasserman BA, Sponseller PD. MRI of the Pediatric Spine. In: **Khanna AJ** (ed): MRI Essentials for the Spine Specialist. New York: Thieme, 2014: 237 – 250.
38. Ahlawat S, Srikumaran U, **Khanna AJ**, Fayad LM. Correlation of MRI with Other Imaging Modalities. In: **Khanna AJ** (ed): MRI Essentials for the Spine Specialist. New York: Thieme, 2014: 267 – 279.
39. Miele WR, Neuman BJ, **Khanna AJ**. The Cervical Spine. In: Miller MD (ed): Orthopaedic Knowledge Update: Sports, 5th Edition. Rosemont (IL): American Academy of Orthopaedic Surgeons, 2016; 433-449.
40. Nandyala SV, **Khanna AJ**, Hassanzadeh H. Pathophysiology, Natural History and Clinical Syndromes of the Cervical Spine. In: Garfin SR, Eismont FJ, Bell GR, Fischgrund G, Bono C. (eds) Herkowitz- Rothman and Simeone: The Spine, 7th Edition. Elsevier Publishing; 2016.
41. Reidler JS, Jain A, **Khanna AJ**. Cervical spine trauma. In: Desai M, O'Brien J (eds). The Spine Handbook. New York, NY: Oxford University Press, 2018:147-172.

Books/Textbooks/Monographs

1. **Khanna AJ** (Spine Section Editor): In Frassica FJ, Sponseller PD, Wilckens JH (eds): The 5-Minute Orthopaedic Consult, Ed 2. Philadelphia, Lippincott Williams & Wilkins, 2007.

2. **Khanna AJ.** Editor, MRI for Orthopaedic Surgeons. New York: Thieme, 2010.
3. **Khanna AJ.** Editor, Complications in Lumbar Spine Surgery in *Seminars in Spine Surgery*. New York: Elsevier, 2011.
4. **Khanna AJ.** Editor, MRI Essentials for the Spine Specialist. New York: Thieme, 2014.
5. Hassanzadeh H, **Khanna AJ.** Editors, Neuromonitoring in Spine Surgery in *Seminars in Spine Surgery*. New York: Elsevier, 2015.

National White Paper Publication

1. Douglas FL, Acharya S, Davis BL, Dhinojwala, Fenning SD, Gray M, Greenwald AS, Greenwald JFI, Hess M, **Khanna AJ**, Kumar UN, Yazdi Y. Value-driven Engineering for US Global Competitiveness: *A Call for a National Platform to Advance Value-driven Engineering*. Austen Bioinnovation Institute. June 14, 2011:1 -37.
<http://www.abiakron.org/Data/Sites/1/pdf/abiawhitepaper6-14-11.pdf>

Podium Presentations at National Meetings

1. **Khanna AJ**, Patt RH, Rajan SS, Swain S, et al. High Resolution 3D Dynamic Breast MR: Findings in 28 Suspicious Lesions. *Southern Medical Association 87th Annual Meeting*. Oct. 28-31, 1993, New Orleans, LA.
2. **Khanna AJ**, Bluemke DA, Yoon TR, Hungerford DS, Mont MA. Osteonecrosis of the Hip: Effectiveness of a Limited Screening Magnetic Resonance Imaging Protocol for Detection and Grading. *American Academy of Orthopaedic Surgeons (AAOS)*, 66th Annual Meeting. February 8, 1999; Anaheim, CA.
3. Buchowski JM, Kebaish KM, **Khanna AJ**, Sinkov VA, Sieber A, Kostuik JP. Role of Discography in Failed Back Surgery Syndrome: Analysis of Functional Outcome in 90 Patients. *Spine Across the Sea, North American Spine Society (NASS) Meeting*. July 28, 2003; Maui, HI
4. **Khanna AJ**, Reinhardt MK, Togawa D, Stefancin J, Holman P, Lieberman IH. Clinical and Functional Outcomes of Kyphoplasty for Vertebral Compression Fractures. *North American Spine Society (NASS)*. October 26-30, 2004; Chicago, IL.
5. **Khanna AJ**, Reinhardt MK, Togawa D, Stefancin J, Holman P, Lieberman IH. Clinical and Functional Outcomes of Kyphoplasty for Spinal Metastases. *American Academy of Orthopaedic Surgeons (AAOS)*. February 23-27, 2005; Washington DC.
6. Togawa D, **Khanna AJ**, Reinhardt MK, Stefancin J, Holman P, Lieberman IH. Kyphoplasty for Vertebral Compression Fractures: Clinical Results of Treatments for Osteoporosis, Multiple Myeloma, and Spinal Metastases. *The International Society for the Study of the Lumbar Spine*, Annual Meeting, May 10-14, 2005; New York, NY.
7. **Khanna AJ.** Epidemiology and Impact of Osteoporosis. *Spine Study Group*, 16th Annual Symposium: New Technology: Concepts and Controversies. June 8-12, 2005; West Palm Beach, FL.
8. **Khanna AJ.** Osteoporotic Vertebral Compression Fracture Management Debate: Kyphoplasty. *Spine Study Group*, 16th Annual Symposium. New Technology: Concepts and Controversies. June 8-12, 2005; West Palm Beach, FL.
9. **Khanna AJ.** AxiaLIF Procedure for L5-S1 Stabilization. *Spine Study Group*, 17th Annual Symposium. New Technology: Concepts and Controversies. May 18-21, 2006; West Palm Beach, FL.
10. **Khanna AJ.** Kyphoplasty. *Spine Study Group*, 17th Annual Symposium. New Technology: Concepts and Controversies. May 18 – 21, 2006; West Palm Beach, FL.

11. **Khanna AJ.** Spine Surgery Reimbursement Update. *Spine Study Group*, 17th Annual Symposium. New Technology: Concepts and Controversies. May 18-21, 2006; West Palm Beach, FL.
12. **Khanna AJ.** Occipitocervical Pathology and Imaging Symposium. *Cervical Spine Research Society*, 34th Annual Meeting. November 30 – December 2, 2006; West Palm Beach, FL.
13. **Khanna AJ,** Togawa D, Reinhardt MK, Liberman IH. Kyphoplasty for the Treatment of Vertebral Compression Fractures Due to Spinal Metastases and Multiple Myeloma. *Cancer and Bone Society*, 6th International Meeting on Cancer Induced Bone Disease. December 10-14, 2006; San Antonio, TX.
14. **Khanna AJ,** Lee S, Gimbel J, Villaraga M, Shwardt J. Biomechanical Evaluation of Kyphoplasty with Calcium Phosphate Cement in a 2FSU Vertebral Compression Fracture Model. *American Academy of Orthopaedic Surgeons*, 74th Annual Meeting. February 13-17, 2007; San Diego, CA.
15. **Khanna AJ.** Combined Anterior and Posterior Approaches for Cervical Myelopathy. *Spine Study Group*, 18th Annual Symposium. New Technology: Concepts and Controversies. May 2-6, 2007; West Palm Beach,
16. **Khanna AJ.** AxiaLIF Procedure for L5-S1 Isthmic Spondylolisthesis. *Spine Study Group*, 18th Annual Symposium. New Technology: Concepts and Controversies. May 2-6, 2007; West Palm Beach, FL.
17. **Khanna AJ.** Imaging of the Spine. An Introduction to Spine Care for Non-Physician Providers. *North American Spine Society*, 22nd Annual Meeting. October 23-27, 2007; San Antonio, TX.
18. **Khanna AJ.** Decompression and Fusion with Rigid Fixation for Degenerative Spondylolisthesis. *Spine Study Group*, 19th Annual Symposium. New Technology: Concepts and Controversies. May 1 - 4, 2008; West Palm Beach, FL.
19. **Khanna AJ.** Spinal Stenosis without Instability: More of the Same. *Spine Study Group*, 19th Annual Symposium. New Technology: Concepts and Controversies. May 1-4, 2008; West Palm Beach, FL.
20. **Khanna AJ.** Emerging Techniques in Minimally Invasive Spine Surgery. *Clinical Orthopaedic Society*, 96th Annual Meeting. September 26, 2008; Annapolis, MD.
21. **Khanna AJ.** Lumbar Disc Herniation: Technical Pearls. *Spine Study Group*, 20th Annual Symposium. Pearls and Best Practices to Enhance Your Practice. May 27-31, 2009; West Palm Beach, FL.
22. **Khanna AJ.** Lumbar Stenosis: Non-Operative Management. *Spine Study Group*, 20th Annual Symposium. Pearls and Best Practices to Enhance Your Practice. May 27-31, 2009; West Palm Beach, FL.
23. **Khanna AJ.** Spine Marketing Strategies: What Really Works? *Spine Study Group*, 21st Annual Symposium. Pearls and Best Practices to Enhance Your Practice. May 13-16, 2010; West Palm Beach, FL.
24. **Khanna AJ.** Is Foot Drop a Surgical Emergency/Urgency? *Spine Study Group*, 21st Annual Symposium. Pearls and Best Practices to Enhance Your Practice. May 13-16, 2010; West Palm Beach, FL.
25. Schafer S, Otake Y, Uneri A, Mirota D, Nithiananthan S, Zbijewski W, Stayman J, Schmidgunst C, Bulitta C, **Khanna AJ,** Siewerdsen JH. Cone-Beam CT for Guidance of Spine Surgery: Performance and Integration of a New High-Performance C-Arm Prototype. *American Association of Physicists in Medicine*, 52nd Annual Meeting, July 18-22, 2010; Philadelphia, PA.
26. **Khanna AJ.** Advanced Techniques in Image Guidance for Spine Surgery. *North American Spine Society (NASS)* 25th Annual Meeting. October 5-9, 2010; Orlando, FL.
27. **Khanna AJ.** Strategies for Fixation in the Osteoporotic Spine. *American Academy of Orthopaedic Surgeons. Federation of Spine Associations: NASS Section.* February 19, 2011; San Diego, CA.
28. Siewerdsen JH, Gallia G, Hager G, **Khanna AJ,** Irish JC, Mirota DJ, Reh D, Nithiananthan S,

- Otake Y, Schafer S, Stayman JW, Taylor R, Uneri A, Zbijewski W, and Bulitta C. Development and Translation of a Cone-Beam CT Guidance System. *American Academy of Otolaryngology – Head and Neck Surgery Foundation (AAO-HNSF)*. Annual meeting, September 26-29, 2010; Boston, MA.
29. **Khanna AJ.** Radiofrequency Ablations in the Cervical and Lumbar Spine: Wizards with Wands or Charlans? *Spine Study Group, 22nd Annual Symposium*. May 19-22, 2011; West Palm Beach, FL.
 30. **Khanna AJ.** Before You Get Too Excited About Minimally Invasive Spine Surgery – Read These “Glowing” Reviews: Radiation Exposure and the Spine Surgeon. *Spine Study Group, 22nd Annual Symposium*. May 19-22, 2011; West Palm Beach, FL.
 31. Hassanzadeh H, Jain A, El Dafrawy M, **Khanna AJ**, Mesfin A, Neubauer P, Skolasky R, Kebaish K. Clinical Results and Functional Outcome in Adult Patients Following Surgical Treatment for Spinal Deformity: Primary vs. Revision. *Scoliosis Research Society (SRS) 46th Annual Meeting & Course*. September 14-17, 2011; Louisville, Kentucky.
 32. **Khanna AJ.** A Systematic Approach to the Evaluation of MR Imaging Studies. *North American Spine Society, 26th Annual Meeting*. November 1-5, 2011; Chicago, IL.
 33. **Khanna AJ.** MRI of the Cervical Spine. *North American Spine Society, 26th Annual Meeting*. November 1-5, 2011; Chicago, IL.
 34. **Khanna AJ.** MRI of the Lumbar Spine. *North American Spine Society, 26th Annual Meeting*. November 1-5, 2011; Chicago, IL.
 35. **Khanna AJ.** A Systematic Approach to the Evaluation of MR Imaging Studies. *American Academy of Orthopaedic Surgeons, 78th Annual Meeting*. February 7-11, 2012; San Francisco, CA.
 36. **Khanna AJ.** MRI of the Cervical Spine. *American Academy of Orthopaedic Surgeons, 78th Annual Meeting*. February 7-11, 2012; San Francisco, CA.
 37. **Khanna AJ.** MRI of the Lumbar Spine. *American Academy of Orthopaedic Surgeons, 78th Annual Meeting*. February 7-11, 2012; San Francisco, CA.
 38. Zbijewski W, Stayman JW, Otake Y, **Khanna AJ**, Carrino JA, Siewerdsen JH. High-Quality CT Imaging in the Presence of Surgical Instrumentation using Spectral System Models and Knowledge of Implanted Devices. *American Association of Physicists in Medicine, 53rd Annual Meeting*, 2012; Charlotte, North Carolina.
 39. **Khanna AJ.** Driving Clinical Utility by Incentivizing Clinicians to Participate. *A National Conference on Value-Driven Engineering to Improve Medical Innovation for U.S. Global Competitiveness*. Akron, Ohio. April 22 - 24, 2012.
 40. **Khanna AJ.** Anterior Cervical Decompression and Fusion. *North American Spine Society: Diagnosis and Treatments in Cervical Spine Surgery Course*. May 18-19, 2012; Burr Ridge, IL.
 41. **Khanna AJ.** Occipitocervical Fixation and Fusion. *North American Spine Society: Diagnosis and Treatments in Cervical Spine Surgery Course*. May 18-19, 2012; Burr Ridge, IL.
 42. Wang AS, Schafer S, Stayman JW, Otake Y, Sussman MS, **Khanna AJ**, Gallia GL, and Siewerdsen JH. Soft-Tissue Imaging in Low-Dose, C-arm Cone-Beam CT Using Statistical Image Reconstruction. *SPIE Medical Imaging: Physics of Medical Imaging*. February 9 – 14, 2013; Orlando, FL.
 43. **Khanna AJ.** MRI of the Spine: Essentials for the Spine Specialist. Moderator and Speaker, Special Interest Group. *North American Spine Society, 27th Annual Meeting*. October 24 – 27, 2012; Dallas, TX.
 44. **Khanna AJ.** MRI of the Cervical Spine: Focus on Trauma. *North American Spine Society, 27th Annual Meeting*. October 24 – 27, 2012; Dallas, TX.
 45. Nithiananthan S, Uneri A, Schafer S, Mirota DJ, Otake Y, Stayman JW, Zbijewski W, **Khanna AJ**, Reh DD, Gallia GL, and Siewerdsen JH. Deformable Image Registration with Content Mismatch: A Demons Variant to Account for Added Material and Surgical Devices in the Target

- Image. Image-guided Procedures, Robotic Interventions, and Modeling. *SPIE Medical Imaging: Physics of Medical Imaging*. February 9 – 14, 2013; Orlando, FL.
46. **Khanna AJ.** Sacroiliac Joint Fusion: Evidence-Based Analysis. *Spine Study Group and Association for Collaborative Spine Research (ACSR) Meeting*. February 15 – 16, 2013; San Diego, CA.
 47. **Khanna AJ.** Will We See Cost-Effectiveness Used in the United States? *Spine Study Group and Association for Collaborative Spine Research (ACSR) Meeting*. February 15 – 16, 2013; San Diego, CA.
 48. **Khanna AJ.** A Systematic Approach to the Evaluation of MR Imaging Studies. *American Academy of Orthopaedic Surgeons, 79th Annual Meeting*. March 20 – 24, 2013; Chicago, IL.
 49. **Khanna AJ.** MRI of the Cervical Spine. *American Academy of Orthopaedic Surgeons, 79th Annual Meeting*. March 20 – 24, 2013; Chicago, IL.
 50. **Khanna AJ.** MRI of the Lumbar Spine. *American Academy of Orthopaedic Surgeons, 79th Annual Meeting*. March 20 – 24, 2013; Chicago, IL.
 51. **Khanna AJ.** MRI of the Cervical Spine at Imaging of the Spine Course: Spectrum of Disease and Illustrative and Interactive Case Reviews. *North American Spine Society 28th Annual Meeting*. October 9, 2013.
 52. **Khanna AJ.** A Systematic Approach to the Evaluation of Spine MR Imaging Studies. Controversies in Spine Imaging Course. *North American Spine Society 28th Annual Meeting*. October 11, 2013.
 53. **Khanna AJ.** Macroeconomic Trends in Spine Care. *Spine Study Group and Association for Collaborative Spine Research (ACSR) Meeting*. January 29-31, 2014; San Diego, CA.
 54. **Khanna AJ.** A Systematic Approach to the Evaluation of MR Imaging Studies. *American Academy of Orthopaedic Surgeons, 80th Annual Meeting*. March 11 – 15, 2013; New Orleans, LA.
 55. **Khanna AJ.** MRI of the Cervical Spine. *American Academy of Orthopaedic Surgeons, 80th Annual Meeting*. March 11 – 15, 2014; New Orleans, LA.
 56. **Khanna AJ.** MRI of the Lumbar Spine. *American Academy of Orthopaedic Surgeons, 80th Annual Meeting*. March 11 – 15, 2014; New Orleans, LA.
 57. **Khanna AJ.** Complications and Failures of Lumbar Spine Surgery: Why Does the Failed Back Fail? Key Note Address, *American Society of Spine Radiology Annual Meeting*. February 7, 2015; Las Vegas, NV.
 58. **Khanna AJ.** Radiation Safety in Spine Surgery: Tips for Avoiding Exposure. *Spine Study Group and Association for Collaborative Spine Research (ACSR) Meeting*. May 13 -17, 2015; Aventura, FL.
 59. **Khanna AJ.** Image Guidance in Spine Surgery: Review of Currently Available Systems and Cost-Effectiveness of Image Guidance. *Spine Study Group and Association for Collaborative Spine Research (ACSR) Meeting*. May 13 -17, 2015; Aventura, FL.
 60. **Khanna AJ.** Radiation Safety in Spine Surgery: Tips for Avoiding Exposure. *North American Spine Society (NASS) Complication Avoidance and Management in Minimally Invasive Spine Surgery Meeting*. May 29 – 30, 2015. Burr Ridge, IL.
 61. **Khanna AJ.** Radiation Safety and Tips for Avoidance for Spine Surgeons and Specialists. *North American Spine Society 30th Annual Meeting*. October 14 - 17, 2015; Chicago, IL.
 62. **Khanna AJ.** MR Imaging of Complications and Failures in Thoracolumbar Spine Surgery. *North American Spine Society 30th Annual Meeting*. October 14 - 17, 2015; Chicago, IL.
 63. Reangamornrat S, De Silva T, Uneri A, Vogt S, Kleinsz G, **Khanna AJ**, Wolinsky JP, Prince JL, and Siewerdsen JH. MIND Demons: Symmetric Diffeomorphic Deformable Registration of MR and CT Images, *SIAM Conference on Imaging Science*, May 26, 2016; Albuquerque, NM.
 64. **Khanna AJ.** The Utility and Effectiveness of Formal Leadership Training Programs: Are They

- Necessary To Become a Good Leader? *American Orthopaedic Association (AOA) Annual Meeting*. June 20 – 25, 2016; Seattle, WA.
65. **Khanna AJ.** Radiation Safety and Tips for Avoidance for Spine Surgeons and Specialists. *North American Spine Society 31st Annual Meeting*. October 26 - 29, 2016; Boston, MA.
 66. **Khanna AJ.** Systematic Review of MR Imaging Studies: A Surgeon's Checklist. *North American Spine Society 31st Annual Meeting*. October 26 - 29, 2016; Boston, MA.
 67. **Khanna AJ.** Radiation Safety and Tips for Avoidance for Spine Surgeons and Specialists. *North American Spine Society 32nd Annual Meeting*. October 25 - 28, 2016; Orlando, FL.

Podium Presentations at International Meetings

1. **Khanna AJ,** Togawa D, Stefancin J, Holman P, Reinhardt MK, Lieberman IH. Clinical and Functional Outcomes of Kyphoplasty for Vertebral Compression Fractures. *International Meeting on Advanced Spine Technologies (IMAST)*. July 1-3, 2004; Southampton, Bermuda.
2. **Khanna AJ,** Reinhardt MK, Togawa D, Stefancin J, Holman P, Lieberman IH. Functional Outcomes of Kyphoplasty for the Treatment of Spinal Metastases. *International Meeting on Advanced Spine Technologies (IMAST)*. July 1-3, 2004; Southampton, Bermuda.
3. **Khanna AJ,** Reinhardt MK, Togawa D, Stefancin J, Holman P, Lieberman IH. Clinical and Functional Outcomes of Kyphoplasty for Vertebral Compression Fractures. *New Delhi Orthopaedic Association*. November 17-21, 2004; New Delhi, India.
4. Togawa D, **Khanna AJ,** Reinhardt MK, Stefancin J, Holman P, Lieberman IH. Clinical Results of Kyphoplasty for Osteoporotic and Osteolytic Vertebral Compression Fractures. *World Spine III*. July 31-August 3; Rio De Janeiro, Brazil.
5. **Khanna AJ.** Adolescent Idiopathic Scoliosis: Update 2007. Current Concepts in Spine Surgery. *New Delhi and Chandigarh Spine Society, Annual Meeting*. March 17-18, 2007; Chandigarh, India.
6. **Khanna AJ,** Lieberman IH. Thoracoscopic Spine Surgery. Podium Presentation, Current Concepts in Spine Surgery. *New Delhi and Chandigarh Spine Society, Annual Meeting*. March 17-18, 2007; Chandigarh, India.
7. **Khanna AJ.** Emerging Techniques in Minimally Invasive Spine Surgery. Podium Presentation, Current Concepts in Spine Surgery. *New Delhi and Chandigarh Spine Society, Annual Meeting*. March 17-18, 2007; Chandigarh, India.
8. **Khanna AJ.** Facet Screw Fixation and Other Minimally Invasive Fixation Techniques for the Lumbosacral Spine. *Japanese Society of Spine Surgery, 16th Annual Meeting*. June 13-16, 2007; Ohmiya, Japan.
9. **Khanna AJ.** Kyphoplasty for the Treatment of Osteoporotic and Osteolytic Vertebral Compression Fractures. Annual Meeting, *Japanese Society of Spine Surgery, 16th Annual Meeting*. June 13-16, 2007; Ohmiya, Japan.
10. **Khanna AJ.** Minimally Invasive Transforaminal Interbody Fusion. *Atlas Forum*. June 30 – July 1, 2010; Salzburg, Austria.
11. **Khanna AJ.** Minimally Invasive Spine Surgery: Rationale, Techniques and Patient Selection. *Atlas Forum*. June 30 – July 1, 2010; Salzburg, Austria.
12. Reaungamornrat S, Otake Y, Uneri A, Schafer S, Stayman W, Zbijewski W, Mirota D, Yoo J, Nithianathan S, **Khanna AJ,** Taylor R, Siewerdsen JH. Tracker-On-C: A Novel Tracker Configuration for Image-Guided Therapy Using a Mobile C-Arm. *25th International Congress and Exhibition of the Computer Assisted Radiology and Surgery Society*. June 22 – 25, 2011; Berlin, Germany.

13. **Khanna AJ.** Image Guidance in Spine Surgery. Atlas Forum. March 16 – 17, 2012; Lucerne, Switzerland.
14. **Khanna AJ,** Dewan AK. Perioperative Risk Assessment and Morbidity in Lumbar Spine Surgery. 19th Annual Brussels International Spine Symposium. November 9 – 10, 2012; Brussels, Belgium.
15. **Khanna AJ.** Strategies for Fixation in the Osteoporotic Spine. 19th Annual Brussels International Spine Symposium. November 9 – 10, 2012; Brussels, Belgium.
16. Otake Y, Wang A, Stayman JW, Kleinszig G, Vogt S, **Khanna AJ,** Wolinsky JP, Gokaslan ZL, Siewerdsen JH. Verification of surgical product and detection of retained foreign bodies using 3D-2D registration in intraoperative mobile radiographs. *26th International Congress and Exhibition of the Computer Assisted Radiology and Surgery Society.* June 26-29, 2013; Heidelberg, Germany.
17. Otake Y, Wang A, Stayman JW, Kleinszig G, Vogt S, **Khanna AJ,** Groves M, Gokaslan ZL, Siewerdsen JH. Automatic localization of vertebral levels in C-arm fluoroscopy: Evaluation of the LevelCheck algorithm in a preclinical cadaver study with realistic tissue deformation. *26th International Congress and Exhibition of the Computer Assisted Radiology and Surgery Society.* June 26-29, 2013; Heidelberg, Germany.
18. Siewerdsen JH, Wang A, Otake Y, Stayman JW, Uneri A, Kleinszig G, Vogt S, **Khanna AJ,** Gokaslan ZL. Soft tissue visibility and dose reduction in mobile C-arm cone-beam CT using advanced 3D image reconstruction. *26th International Congress and Exhibition of the Computer Assisted Radiology and Surgery Society.* June 26-29, 2013; Heidelberg, Germany.
19. **Khanna AJ.** Cervical Spinal Trauma (Presented in Spanish). *Primer Curso Intensivo de Ortopedia y Traumatología: Conceptos fundamentales presentado por AAOS y AAOT* (First Intensive Course of Orthopaedic Surgery and Traumatology: Fundamental Concepts Presented by the American Academy of Orthopaedic Surgeons and the Argentinian Association of Orthopaedic Surgery and Traumatology). December 7 – 10, 2014; Buenos Aires, Argentina.
20. **Khanna AJ.** Cervical Spine Degenerative Pathologies and Rheumatoid Arthritis (Presented in Spanish). *Primer Curso Intensivo de Ortopedia y Traumatología: Conceptos fundamentales presentado por AAOS y AAOT* (First Intensive Course of Orthopaedic Surgery and Traumatology: Fundamental Concepts Presented by the American Academy of Orthopaedic Surgeons and the Argentinian Association of Orthopaedic Surgery and Traumatology). December 7 – 10, 2014; Buenos Aires, Argentina.
21. **Khanna AJ.** Cervical Spinal Stenosis (Presented in Spanish). *Primer Curso Intensivo de Ortopedia y Traumatología: Conceptos fundamentales presentado por AAOS y AAOT* (First Intensive Course of Orthopaedic Surgery and Traumatology: Fundamental Concepts Presented by the American Academy of Orthopaedic Surgeons and the Argentinian Association of Orthopaedic Surgery and Traumatology). December 7 – 10, 2014; Buenos Aires, Argentina.
22. **Khanna AJ.** Surgical Anatomy and Imaging of the Occipitocervical Junction and Spectrum of Occipitocervical Anomalies and Pathologies. *International Symposium of Spinal Deformity and Minimally Invasive Spine Surgery.* Shanghai Changzheng Hospital. September 12 – 13, 2015; Shanghai, China.
23. **Khanna AJ.** Strategies for Fixation in the Osteoporotic Spine. *22nd Annual Japanese Society of Techniques and Surgery of the Spine.* September 18 – 19, 2015; Tokyo, Japan.
24. **Khanna AJ.** Minimally Invasive Spine Surgery: Rationale, Techniques and Outcomes. *22nd Annual Japanese Society of Techniques and Surgery of the Spine.* September 18 – 19, 2015; Tokyo, Japan.
25. **Khanna AJ.** Failures and Complications of Thoracolumbar Spine Surgery. *22nd Annual Japanese Society of Techniques and Surgery of the Spine.* September 18 – 19, 2015; Tokyo, Japan.

Poster and Exhibit Presentations at National and International Meetings

1. Patt RH, Rajan SS, Ascher SM, **Khanna AJ**. Optimization of Techniques for Dynamic MR Imaging of the Breast. Scientific Exhibit. *Radiologic Society of North America*, Annual Meeting. November 27- December 3, 1993; Chicago, IL.
2. **Khanna AJ**, Bluemke DA, Yoon TR, Hungerford DS, Mont MA. Osteonecrosis of the Hip: Effectiveness of a Limited Screening Magnetic Resonance Imaging Protocol for Detection and Grading. Poster Presentation, *American Academy of Orthopaedic Surgeons*, 66th Annual Meeting. February 8, 1999; Anaheim, CA.
3. **Khanna AJ**, Frassica FJ, Bawa M, Bluemke DA, Andres BM, Mont MA. Magnetic Resonance Imaging of the Hip: Current Techniques and Spectrum of Disease. Scientific Exhibit, *American Academy of Orthopaedic Surgeons*, 67th Annual Meeting. March 15-19, 2000; Orlando, FL.
4. Andres BM, **Khanna AJ**, Wenz JF, Frassica FJ. Digital Imaging for the Orthopaedic Surgeon: Current Applications and Equipment for Optimal Results. Poster Presentation, *American Academy of Orthopaedic Surgeons*, 68th Annual Meeting. February 28- March 3, 2001; San Francisco, CA.
5. **Khanna AJ**, Mont MA, Andres BM, Domb BG, Evans PJ, Cosgarea AJ, Bluemke DA, Frassica FJ. Magnetic Resonance Imaging of the Knee: Current Techniques and Spectrum of Disease. Scientific Exhibit, *American Academy of Orthopaedic Surgeons*, 68th Annual Meeting. February 28- March 3, 2001; San Francisco, CA.
6. **Khanna AJ**, Evans PJ, McFarland EG, Andres BM, Morshirfar A, Bluemke DA, Frassica FJ. Magnetic Resonance Imaging of the Shoulder: Current Techniques and Spectrum of Disease. Poster Presentation, *Arthroscopy Association of North America*, 20th Annual Meeting. April 19-21, 2001; Seattle, WA.
7. **Khanna AJ**, Wasserman BA, Gonzales RA, Riley LH III. Magnetic Resonance Imaging Characteristics of Tumors of the Lumbar Spine. Poster Presentation, *Scoliosis Research Society*, 36th Annual Meeting. September 18-22, 2001; Cleveland, OH.
8. **Khanna AJ**, Carbone JJ, Cohen DB, Kebaish KM, Riley III LH, Wasserman BA, Kostuik JP. Magnetic Resonance Imaging of the Cervical Spine: Current Techniques and Spectrum of Disease. Scientific Exhibit, *American Academy of Orthopaedic Surgeons* 69th Annual Meeting. February 13-17, 2002; Dallas, TX.
9. **Khanna AJ**, Kebaish KM, Ozdemir HM, Gonzales R, Cohen DB, Sinkov V, Kostuik JP. Sacral Insufficiency Fracture Treated with Allograft Fibula: A New Surgical Technique. Poster Presentation, *Spine, Science and Management Resident and Fellow Meeting*. November 21-24, 2002; New Orleans, LA.
10. Moshirfar A, Campbell J, **Khanna AJ**, Byank R, Wenz JF. Magnetic Resonance Imaging of the Foot and Ankle: Current Techniques and Spectrum of Disease. Scientific Exhibit, *American Academy of Orthopaedic Surgeons*, 70th Annual Meeting, February 6-9, 2003; New Orleans, LA.
11. **Khanna AJ**, Carbone JJ, Kebaish KM, Riley III LH, Cohen DB, Wasserman BA, Kostuik JP. Magnetic Resonance Imaging of the Lumbar Spine: Current Techniques and Spectrum of Disease. Scientific Exhibit, *American Academy of Orthopaedic Surgeons*, 70th Annual Meeting. February 6-9, 2003; New Orleans, LA.
12. **Khanna AJ**, Kebaish KM, Sinkov V, Buchowski JM, Kaspar S, Ozdemir HM, Sieber A, Kostuik JP. Failed Back Surgery Syndrome: Analysis of Functional Outcomes in 137 Patients. Poster Presentation, *Scoliosis Research Society*, 38th Annual Meeting. September 11-13, 2003; Quebec, Canada.
13. **Khanna AJ**, Wasserman BA, Moshirfar A, Sponseller PD. Magnetic Resonance Imaging of the Pediatric Spine: Current Techniques and Spectrum of Disease. Scientific Exhibit, *American Academy of Orthopaedic Surgeons*, 71st Annual Meeting. March 10-14, 2004; San Francisco, CA.
14. **Khanna AJ**, Lieberman IH, Reinhardt MK. Clinical and Functional Outcome of Kyphoplasty for Osteoporotic Vertebral Compression Fractures. Poster Presentation, *Spine Society of Europe*,

- SpineWeek 2004. May 30-June 5, 2004; Porto, Portugal.
15. Thomas RJ, Anderson MW, Pannunzio ME, Degnan GG, **Khanna AJ**, Chhabra AB. Magnetic Resonance Imaging of the Hand and Wrist: Current Techniques and Spectrum of Disease. Scientific Exhibit, *American Society of Surgery of the Hand*, Annual Meeting. September 9-12, 2004; New York, NY.
 16. **Khanna AJ**, Reinhardt MK, Togawa D, Stefancin J, Holman P, Lieberman IH. Clinical and Functional Outcome of Kyphoplasty for Spinal Metastases. Poster Presentation, *Scoliosis Research Society*. September 6-9, 2004; Buenos Aires, Argentina.
 17. Moshirfar A, Rand FF, Sponseller PD, Parazin SJ, **Khanna AJ**, Kebaish KM, Stinson JT, Riley LH, III. Pelvic Fixation in Spine Surgery: Historical Overview, Indications, Biomechanical Relevance, and Current Techniques. Scientific Exhibit, *American Academy of Orthopaedic Surgeons*, 72nd Annual Meeting. February 23-27, 2005; Washington, DC.
 18. Thomas R, Anderson M, Pannunzio M, Brunton L, **Khanna AJ**, Chhabra, AB. Magnetic Resonance Imaging of the Elbow: Current Techniques and Spectrum of Disease: Poster Presentation, *Virginia Orthopaedic Society*, 58th Annual Meeting. 2005; Hot Springs, VA.
 19. Thomas R, Anderson M, Pannunzio M, Brunton L, **Khanna AJ**, Chhabra AB. Magnetic Resonance Imaging of the Elbow: Current Techniques and Spectrum of Disease: Scientific Exhibit, *American Society for Surgery of the Hand*, 60th Annual Meeting. September 22-24, 2005; San Antonio, TX.
 20. Farber A, Fayad L, Johnson T, Cascio B, Shindle MK, Neubauer P, **Khanna AJ**. Magnetic Resonance Imaging of the Shoulder: Techniques and Spectrum of Disease. Scientific Exhibit, *American Academy of Orthopaedic Surgeons*, 73rd Annual Meeting. March 22-26, 2006; Chicago, IL.
 21. Shindle MK, Domb BG, Kelly BT, Hungerford MW, Wanich T, Potter HG, Farber A, **Khanna AJ**. Magnetic Resonance Imaging of Cartilage in the Athlete: Current Techniques and Spectrum of Disease. Scientific Exhibit, *American Academy of Orthopaedic Surgeons*, 73rd Annual Meeting. March 22-26, 2006; Chicago, IL.
 22. Papp DF, **Khanna AJ**, McCarthy E, Carrino JA, Fayad L, Farber A, Frassica FJ. Magnetic Resonance Imaging of the Soft Tissue Tumors: Techniques and Spectrum of Disease. Scientific Exhibit, *American Academy of Orthopaedic Surgeons*, 74th Annual Meeting. February 13-17, 2007; San Diego, CA.
 23. Lieberman IH, Hardenbrook M, Wang J, Guyer R, Mroz T, **Khanna AJ**. Radiation Exposure Using Miniature Robotic Guidance for Spinal Surgery. Poster Presentation, *North American Spine Society*, 22nd Annual Meeting. October 23-27, 2007; San Antonio, TX.
 24. Ponnusamy K, Iyer S, Gupta G, Hui A, Trehan K, Yu C, **Khanna AJ**. A Pull-out Resistant Pedicle Screw for the Osteoporotic Spine. Poster Presentation at 2007 ASME Frontiers in Biomedical Devices Conference, Irvine, CA.
 25. Ponnusamy K, Iyer S, Gupta G, Hui A, Trehan K, Yu C, **Khanna AJ**. A Pull-out Resistant Pedicle Screw for the Osteoporotic Spine. March Madness for the Mind Showcase, 2007 NCIIA 11th Annual Meeting, Tampa, FL.
 26. Gebauer GP, Farjoodi P, Sciubba B, Gokaslan Z, Riley III LH, Wasserman BA, **Khanna AJ**. MRI of Spine Tumors: Compartmental Classification, Differential Diagnoses and Spectrum of Disease. Scientific Exhibit, *American Academy of Orthopaedic Surgeons*, 75th Annual Meeting. March 5 – 9, 2008; San Francisco, CA.
 27. Farjoodi P, Mesfin A, Carrino JA, O Bray RW, **Khanna AJ**. Magnetic Resonance Imaging of Musculoskeletal Tissues: Basic Science, Pulse Sequences and a Systemic Approach to Interpretation. Scientific Exhibit, *American Academy of Orthopaedic Surgeons*, 76th Annual Meeting. March 9 – 13, 2010; New Orleans, LA.
 28. Yoo J, Uneri A, Schafer S, Otake Y, Stayman W, **Khanna AJ**, Siewerdsen JH. Characterization and implementation of an X-ray compatible electromagnetic field generator in cone-beam CT-guided surgery. Poster Presentation, 25th International Congress and Exhibition of the Computer

- Assisted Radiology and Surgery Society.* June 22 – 25, 2011; Berlin, Germany.
29. Uneri A, Schafer S, Mirota D, Nithiananthan S, Otake Y, Reaungamornrat S, Yoo J, Stayman W, Reh DD, Gallia GL, **Khanna AJ**, Hager GD, Taylor RH, Kleinszig G, Siewerdsen JH. *Architecture of a high-performance surgical guidance system based on C-arm cone-beam CT: software platform for technical integration and clinical translation.* *SPIE Medical Imaging: Visualization, Image-Guided Procedures, and Modeling.* February 12 – 17, 2011; Orlando, FL.
 30. Dewan AK, Chhabra AB, **Khanna AJ**, Anderson MW, Brunton LM. Magnetic Resonance Imaging of the Hand and Wrist: Techniques and Spectrum of Disease. Scientific Exhibit, *American Academy of Orthopaedic Surgeons, 77th Annual Meeting.* February 15 - 19, 2011; San Diego, CA.
 31. Farjoodi P, Salari N, Freehill MT, Wilckens JH, **Khanna AJ.** Evaluation and Management of the Cervical Spine in the Contact Athlete. Scientific Exhibit, *American Academy of Orthopaedic Surgeons, 77th Annual Meeting.* February 15 - 19, 2011; San Diego, CA.
 32. Hassanzadeh H, Jain A, El Dafrawy M, **Khanna AJ**, Mesfin A, Neubauer P, Skolasky R, Kebaish K. Clinical results and Functional outcome in Adult Patients Following Surgical Treatment of Spinal Deformity: Primary vs. Revision Surgery. North American Spine Society (NASS) 26th Annual Meeting. November 2-5, 2011; Chicago, IL. *Best Poster Presentation.*
 33. Hassanzadeh H, El Dafrawy MH, **Khanna AJ**, Neubauer PN, Mesfin A, Skolasky RL, Kebaish KM. Clinical Results and Functional Outcomes in Adult Patients Following Spinal Deformity Surgery: Primary vs. Revision. Poster Presentation, *American Academy of Orthopaedic Surgeons, 78th Annual Meeting.* February 7 – 11, 2012; San Francisco, CA.
 34. Dewan AK, Chhabra AB, **Khanna AJ**, Anderson MW, Brunton LM. Magnetic Resonance Imaging of the Elbow: Techniques and Spectrum of Disease. Scientific Exhibit, *American Academy of Orthopaedic Surgeons, 78th Annual Meeting.* February 7 – 11, 2012; San Francisco, CA.
 35. Nithiananthan S, Uneri A, Schafer S, Mirota DJ, Otake Y, Stayman JW, Zbijewski W, **Khanna AJ**, Reh DD, Gallia GL, and Siewerdsen JH. Deformable Image Registration with Content Mismatch: A Demons Variant to Account for Added Material and Surgical Devices in the Target Image. *SPIE Medical Imaging: Image-Guided Procedures, Robotic Interventions, and Modeling.* February 9 – 14, 2013; Orlando, FL.
 36. Thakkar RS, Suh KJ, **Khanna AJ**, Belzberg AJ, Carrino JA, Chhabra A. Magnetic Resonance Imaging of Benign Osseous Lesions of the Spine. Educational Exhibit, Radiologic Society of North America (RSNA), 98th Scientific Assembly and Annual Meeting. November 25 – 30, 2012; Chicago, IL.
 37. Dewan AK, Shindle MK, Kelly BT, Cosgarea AJ, Carrino JA, **Khanna AJ.** Magnetic Resonance Imaging of the Hip: Techniques and Spectrum of Disease. Scientific Exhibit, *American Academy of Orthopaedic Surgeons, 79th Annual Meeting.* March 20 – 24, 2013; Chicago, IL.
 38. De Silva T, Punnoose J, Uneri A, Goerres J, Jacobson M, Ketcha MD, Manbachi A, Vogt S, Kleinszig G, Khanna AJ, Wolinsky JP, Osgood G, Siewerdsen JH. C-arm Positioning Using Virtual Fluoroscopy for Image-Guided Surgery, *SPIE Medical Imaging,* February 11 – 16, 2017; Orlando, Florida (Accepted).

Presentations at Local and Regional Meetings

1. **Khanna AJ**, Patt RH, Rajan SS, Swain S, et al. High Resolution 3D Dynamic Breast MR: Findings in 28 Suspicious Lesions. Podium Presentation, *Southern Medical Association, 87th Annual Meeting.* October 28-31, 1993; New Orleans, LA.
2. **Khanna AJ.** Femoral Head Osteonecrosis: Diagnostic Evaluation. Grand Rounds, Department of Radiology and Radiological Science, *Johns Hopkins Hospital.* March, 1998; Baltimore, MD.
3. **Khanna AJ**, Cosgarea AJ, Ryan A. Repair of a Torn Complete Bucket Handle Discoid Lateral

- Meniscus Incarcerated in the Posterolateral Compartment. Podium Presentation, 32nd Annual Peter H. Mack Conference. *Johns Hopkins Hospital*. November 5, 1999; Baltimore, MD.
4. **Khanna AJ.** Thoracolumbar Burst Fractures. Podium Presentation, John J. Fahey Memorial AOA North American Traveling Fellow Meeting, *Johns Hopkins Hospital*. November 5, 2001; Baltimore, MD.
 5. **Khanna AJ.** Adolescent Idiopathic Scoliosis: Management and Surgical Techniques. Grand Rounds. Department of Orthopaedic Surgery, *Johns Hopkins Hospital*. February, 20, 2003; Baltimore, MD.
 6. **Khanna AJ,** Reinhardt MK, Togawa D, Stefancin J, Holman P, Lieberman IH. Kyphoplasty for the Treatment of Vertebral Compression Fractures: Functional Outcomes in 329 Patients. Research Symposium, Department of Orthopaedic Surgery, *The Cleveland Clinic Foundation*. May 20, 2004; Cleveland, OH.
 7. **Khanna AJ.** Pediatric Spine MRI: Current Techniques and Spectrum of Disease. Grand Rounds. Department Orthopaedic Surgery and Neurosurgery, *The Cleveland Clinic Foundation*. July 9, 2004, Cleveland, OH.
 8. **Khanna AJ.** Surgical Approaches to the Spine. *AO ASIF Spine Course: Team Approach to the Operative Management of the Spinal Surgery Patient*. October 2-3, 2004; Columbus, OH.
 9. **Khanna AJ.** Section Moderator: Lumbar Degenerative Disease. *AO ASIF Spine Course: Team Approach to the Operative Management of the Spinal Surgery Patient*. October 2-3, 2004; Columbus, OH.
 10. **Khanna AJ.** Minimally Invasive Spine Surgery. Grand Rounds. Department of Orthopaedic Surgery, *Johns Hopkins Hospital*. January 6, 2005; Baltimore, MD.
 11. **Khanna AJ.** Radiographic Imaging of the Spine. *AO ASIF Spine Course: Team Approach to the Operative Management of the Spinal Surgery Patient*. February 19-20, 2005; Baltimore, MD.
 12. **Khanna AJ.** Interbody Fusion: Anterior Versus Posterior. *AO ASIF Spine Course: Team Approach to the Operative Management of the Spinal Surgery Patient*. February 19 -20, 2005; Baltimore, MD.
 13. Thomas R, Anderson M, Pannunzio M, Brunton L, **Khanna AJ,** Chhabra AB. Magnetic Resonance Imaging of the Elbow: Current Techniques and Spectrum of Disease. Poster and Podium Presentation, *Virginia Orthopaedic Society, 58th Annual Meeting*. May 13-15, 2005; Hot Springs, VA.
 14. **Khanna AJ.** Kyphoplasty for the Treatment of Osteoporotic and Osteolytic Vertebral Compression Fractures. *Baltimore Bone Club*. November 15, 2005; Baltimore, MD.
 15. **Khanna AJ.** Kyphoplasty for the Treatment of Osteoporotic and Osteolytic Vertebral Compression Fractures. Grand Rounds. Department of Orthopaedic Surgery, *Johns Hopkins Hospital*. November 17, 2005; Baltimore, MD.
 16. Soderlund KA, Glait SA, Hungerford MW, Khanuja H, **Khanna AJ.** The Use of a Novel Teaching Module Approach to Supplement Orthopaedic Surgery Resident Education. Johns Hopkins Research in Medical Education Symposium. *Johns Hopkins Hospital*. September 15, 2006; Baltimore, MD.
 17. **Khanna AJ.** Non-operative and Operative Treatment Options for Patients with Spinal Stenosis. *National Association of Orthopaedic Nurses Meeting*. March 27, 2009. Baltimore, MD.
 18. **Khanna AJ.** Multiple Myeloma: Spinal Manifestations and Treatment Options. *Johns Hopkins International Advanced Myeloma Course*. October 12-14, 2010. Baltimore, MD.
 19. **Khanna AJ.** Cervical Spinal Stenosis, Radiculopathy and Myelopathy: Treatment Options and Case Reviews. Grand Rounds, *Suburban Hospital*. November 11, 2011. Bethesda, MD.
 20. **Khanna AJ.** Minimally Invasive Spine Surgery: Rationale, Treatment Options and Outcomes. Grand Rounds, *Suburban Hospital*. November 22, 2013. Bethesda, MD.

Electronic Publications

1. Manista AP, **Khanna AJ**. Pain Relief After a Vertebral Compression Fracture: Kyphoplasty Case Review. Spine-Health.com. (<http://www.spine-health.com/topics/case/kyphcase/kyph01.html>). December, 2005.
2. Manista AP, **Khanna AJ**. Gunshot Wounds to the Spine. Orthopaedic Hyperguide. (<http://www.ortho.hyperguides.com>). February, 2006.
3. Manista AP, **Khanna AJ**. Kyphoplasty. Orthopaedic Hyperguide. (<http://www.ortho.hyperguides.com>). March, 2006.
4. Glait SA, Manista AP, **Khanna AJ**. Schmorl's Nodes. Orthopaedic Hyperguide. (<http://www.ortho.hyperguides.com>). February, 2007.
5. Glait SA, Manista AP, **Khanna AJ**. Torticollis. Orthopaedic Hyperguide. (<http://www.ortho.hyperguides.com>). February, 2007.
6. Soderlund KA, Mansita AP, **Khanna AJ**, Sponseller PD. Discitis. Orthopaedic Hyperguide. (<http://www.ortho.hyperguides.com>). February, 2007.
7. Soderlund KA, Shindle MK, **Khanna AJ**, Sponseller PD. Burners and Stingers. Orthopaedic Hyperguide. (<http://www.ortho.hyperguides.com>). February, 2007.
8. Soderlund KA, Mathus S, **Khanna AJ**. Neck Pain. Orthopaedic Hyperguide. (<http://www.ortho.hyperguides.com>). June, 2007.
9. Glait SA, Manista AP, **Khanna AJ**. Kyphosis. Orthopaedic Hyperguide. (<http://www.ortho.hyperguides.com>). June, 2007.
10. Farjoodi P, **Khanna AJ**. Congenital Anomalies of the Occipitocervical Junction. Orthopaedic Hyperguide. (<http://www.ortho.hyperguides.com>). January, 2008.
11. **Khanna AJ**. Four Biggest Opportunities in Spine Surgery. Becker's Spine Review. February, 2011. (<http://www.beckersasc.com/orthopedic-spine-driven-asc/4-biggest-opportunities-in-spine-surgery-from-spine-surgeon-dr-jay-khanna-of-johns-hopkins.html>)
12. **Khanna AJ**. Eleven Tips to Help Decrease Radiation Exposure During Spine Surgery. Becker's Spine Review. March, 2012. (<http://beckersspine.com/spine/item/11196-11-tips-to-help-decrease-radiation-exposure-during-spine-surgery-and-other-procedures>)
13. **Khanna AJ**. Radiation Exposure in Spine Surgery. Becker's Spine Review. March, 2012. (<http://beckersspine.com/spine/item/11195-radiation-exposure-in-spine-surgery-qa-with-dr-a-jay-khanna>)

Live/Broadcast Surgeries

1. **Khanna AJ**, Lemma MA. Kyphoplasty Procedure. <http://www.OR-Live.com>. September, 2005.

Teaching

Classroom Instruction (Course Moderator, Co-Director or Director)

1. Moderator and Speaker, Spine Section, Annual Board Review Course. *American Academy of Orthopaedic Surgeons*. March 31 – April 3, 2005; Chicago, IL.
2. Course Co-Director and Speaker. 7th Annual Orthopaedic Surgery Review Course: A Clinical and Basic Science Review of Orthopaedic Surgery. *Johns Hopkins University*. June 26 – July 2,

- 2005; Baltimore, MD.
3. Moderator and Speaker, Spine Section, Annual Board Review Course, *American Academy of Orthopaedic Surgery*. May 31 – June 4, 2006; Chicago, IL.
 4. Course Co-Director and Speaker. 8th Annual Orthopaedic Surgery Review Course: A Clinical and Basic Science Review of Orthopaedic Surgery. *Johns Hopkins University*. April 30 – May 5, 2006; Baltimore, MD.
 5. Course Co-Director and Speaker. 9th Annual Orthopaedic Surgery Review Course: A Clinical and Basic Science Review of Orthopaedic Surgery. *Johns Hopkins University*. April, May, June, 2007; Baltimore, MD.
 6. Moderator and Speaker, Spine Section. Annual Board Review Course. *American Academy of Orthopaedic Surgeons*. May 2 – 6, 2007; Chicago, IL.
 7. Moderator and Speaker, Spine Section. Annual Board Review Course. *American Academy of Orthopaedic Surgeons*. April 30 – May 4, 2008; Chicago, IL.
 8. Course Director and Speaker. 10th Annual Orthopaedic Surgery Review Course: A Clinical and Basic Science Review of Orthopaedic Surgery. *Johns Hopkins University*. July 7 – 11, 2008; Baltimore, MD.
 9. Moderator and Speaker, Spine Section. Annual Board Review Course. *American Academy of Orthopaedic Surgeons*. April 29 – May 3, 2009; Chicago, IL.
 10. Course Director and Speaker. 11th Annual Orthopaedic Surgery Review Course: A Clinical and Basic Science Review of Orthopaedic Surgery. *Johns Hopkins University*. June 8 – 12, 2009; Baltimore, MD.
 11. Moderator and Speaker, Spine Section. Annual Board Review Course. *American Academy of Orthopaedic Surgeons*. April 28 – May 2, 2010; Chicago, IL.
 12. Course Director and Speaker. 12th Annual Orthopaedic Surgery Review Course: A Clinical and Basic Science Review of Orthopaedic Surgery. *Johns Hopkins University*. June 7 – 11, 2010; Baltimore, MD.
 13. Course Co-Director and Speaker. Annual Board Review Course. *American Academy of Orthopaedic Surgeons*. April 13 – 17, 2011; Chicago, IL.
 14. Course Co-Director and Speaker. 13th Annual Orthopaedic Surgery Review Course: A Clinical and Basic Science Review of Orthopaedic Surgery. *Johns Hopkins University*. June 6 – 10, 2011; Baltimore, MD.
 15. Course Director and Speaker. Annual Board Review Course. *American Academy of Orthopaedic Surgeons*. April 11 – 15, 2012; Chicago, IL.
 16. Course Director and Speaker. Annual Board Review Course. *American Academy of Orthopaedic Surgeons*. April 10 – 14, 2013; Chicago, IL.
 17. Course Director and Speaker. Imaging of the Spine: Spectrum of Disease and Illustrative and Interactive Case Reviews. *North American Spine Society 28th Annual Meeting*. October 9, 2013; New Orleans, LA.
 18. Course Director and Speaker. Annual Board Review Course. *American Academy of Orthopaedic Surgeons*. April 9 – 13, 2014; Chicago, IL.
 19. Course Director and Speaker. Annual Board Review Course. *American Academy of Orthopaedic Surgeons*. April 21 - 25, 2015; Chicago, IL.
 20. Symposium Moderator. MR Imaging of Complications and Failures in Spine Surgery. *North American Spine Society 30th Annual Meeting*. October 14 - 17, 2015; Chicago, IL.
 21. Course Co-Director and Speaker. Annual Board Review Course. *American Academy of Orthopaedic Surgeons*. April 5- 9, 2016; Chicago, IL.
 22. Symposium Moderator, Complications in Spine Surgery. *North American Spine Society 31st Annual Meeting*. October 26 - 29, 2016; Boston, MA.
 23. Course Director and Speaker. Spine-Focused Maintenance of Certification Course. *American*

- Academy of Orthopaedic Surgeons*. November 10, 2016; Boston, MA.
24. Course Co-Director and Speaker. Annual Board Review Course. *American Academy of Orthopaedic Surgeons*. April 18 - 22, 2017; Chicago, IL.
 25. Course Director and Speaker. Spine-Focused Maintenance of Certification Course. *American Academy of Orthopaedic Surgeons*. November 4, 2017; Boston, MA.
 26. Course Co-Director and Speaker. Annual Board Review Course. *American Academy of Orthopaedic Surgeons*. April 10 – 14, 2018; Chicago, IL.

Clinical Instruction

- 2003-2004 Course Faculty, *Cleveland Clinic Hands-On Spine Review Course*, Cleveland, OH
- 2004-2012 Clinical Instruction, Johns Hopkins Orthopaedic Surgery Residency Program, Baltimore, MD
- Includes resident teaching in office hours 1-2 days per week.
 - Includes resident teaching in operating room 2-3 days per week.
 - Includes resident and medical student teaching in various conferences 4-6 times per month.

Instruction and Advising of Students in the Johns Hopkins Center for Bioengineering Innovation and Design (CBID) and Department of Biomedical Engineering

2005 – 2006

- Project: OsseoScrew: Device to improve fixation in osteoporotic spine
Role: Physician Advisor to undergraduate student team
Team: Karthik Ponnusamy, Gaurav Gupta, Chevy Iyer, Karthik Trehan, Chris Hui
Outcomes:
- NCIIA Advanced E-Team Grant and BMEidea Stipend, \$18,500
 - Johns Hopkins Business Plan Competition 1st Place 2006, \$5,000
 - US Patent 20070213732
 - Publication: Ponnusamy KE, Iyer S, Gupta G, **Khanna AJ**. Instrumentation of the Osteoporotic Spine: Biomechanical and Clinical Considerations. *The Spine Journal*, 2011.

2007-2008

- Project: Expandable Cage for Spine Interbody Fusion
Role: Physician Advisor to undergraduate student team
Team: Alex Artaki, Adam Canver, Alex Hui
Outcome: NCIIA Advanced E-Team Grant and BMEidea Stipend, \$17,000

2009-2010

- Project: Cortical Concepts: Device to Improve Fixation in the Osteoporotic Spine
Role: Physician Advisor to master's student team
Team: Jason Hsu, Christopher Komanski, Evan Luxon, Nicholas Martinez
Outcomes:
- NCIIA Advanced E-Team Grant and BMEidea Stipend, \$20,000
 - Wharton Business Plan Competition 1st Place, 2010, \$20,000

- Rang the Closing Bell at NASDAQ, August 23, 2010
- University of Cincinnati Spirit of Enterprise MBA Business Plan Competition 2nd Place, 2010
- Poster Competition 1st Place, Johns Hopkins BME Design Day 2010
- Provisional Patent Filed, 2009
- International Patent (PCT) Filed, 2010
- Filed for LLC under name of Cortical Concepts

2009-2010

Project: Minimally Invasive Spinal Decompression
Role: Physician Advisor to undergraduate student team
(co-Advisor Lee Riley, III, MD)
Team: Alice Wu, James Wang, Andrew Wisniewski, Daniel Peng, Elizabeth Cha, Manjima Dhar, Michael Tsai, Nicholas Gisolfi, Sean Li, Sebasitan Kwon
Outcome: Johns Hopkins BME Design Day Competition, 3rd Place, 2010

2009-2010

Project: Custom Screw for Osteoporotic Spine Fixation
Role: Physician Advisor to undergraduate student team
Team: Raghav Badrinath, Gregory Kurtz, Mandava Teja, Kristie Charoen
Outcome: Publication of independent study manuscript.

2010 - Current

Project: Previously: BOSS Medical: Minimally Invasive Method to Harvest Iliac Crest Bone Graft
<http://www.boss-medical.com/>

Now: Avitus Orthopaedics:
<http://avitusortho.com>

Role: Physician Advisor to masters student team
(co-Advisor with Lee Riley, III, MD and Khaled Kebaish, MD)

Team: Neil Shah, Maxim Budyansky, Peter Truskey, Haim Gottfried, Shoval Dekel

Outcomes:

- Company filing: BOSS Medical LLC, State of Maryland, April 2011
- US Provisional patent filing:
 - February 2011: application #61/441,955
 - April 2011: application #61/471,273
- Harvard Business Plan Competition 1st Place (tie), \$37,500
- Johns Hopkins Business Plan Competition, Life Sciences Track 1st Place, \$6000
- MIT Executive Summary Contest Life Sciences Track 1st Place, \$2,000
- Wharton Business Plan Competition 2011, Finalist
- Rice Business Plan Competition, Shark Tank Round 1st Place, \$1000
- Georgia Tech Business Plan Competition 2nd Place, \$2,000
- Awarded grant from Maryland Technology Development Corporation, University Technology Development Fund, Grant # 2011-UTDF-0361-00, \$50,000

- Awarded grant from National Collegiate Inventors and Innovators Alliance (NCIIA) Advanced E-Team grant, Grant #8317-10, \$20,000
- Awarded grant from Technology Accelerator Fund, Department of Biomedical Engineering, Johns Hopkins University, \$45,000
- Abstract published: “Minimally Invasive Iliac Crest Bone Graft Harvesting: A Design and Business Method Overview”. *J. Med. Devices*, June 2011, Volume 5, Issue 2
- Conference presentation: “Minimally Invasive Iliac Crest Bone Graft Harvesting: A Design and Business Method Overview.” Design of Medical Devices Conferences 2011, Orthopaedics Session.
- Awarded grant from *Johns Hopkins-Coulter Translational Partnership Award*, \$104,175
- Awarded grant from *Maryland Technology Development Corporation (TEDCO) and Maryland Innovation Initiative*, \$99,860
- Awarded (NSF SBIR) Phase 1 Grant *from National Science Foundation*, Small Business Innovation Research, \$180,000
- Awarded (NSF SBIR) Phase 2 Grant *from National Science Foundation*, Small Business Innovation Research, \$750,000
- Connecticut Innovations SBIR Phase I Matching Grant, \$30,000
- Connecticut Innovations Technology Talent Bridge, \$10,000
- Connecticut Department of Economic and Community Development Small Business Express Grant, \$40,000
- Connecticut Center for Advanced Technology Small Business Incubator Program Award, \$30,000
- Awarded (NSF SBIR) Phase 2 Grant *from National Science Foundation*, Technology Enhancement for Commercial Partnerships, \$150,000

CME Course Instruction

1. **Khanna AJ.** Cervical Spine Trauma. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. March 31-April 3, 2005; Chicago, IL.
2. **Khanna AJ.** Cervical Degenerative Pathology and Treatment. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. March 31-April 3, 2005; Chicago, IL.
3. **Khanna AJ.** Spinal Cord Injury. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. March 31-April 3, 2005; Chicago, IL.
4. **Khanna AJ.** Review of Highest-Yield Spine Items. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. March 31-April 3, 2005; Chicago, IL.
5. **Khanna AJ.** Cervical Spine Trauma. Orthopaedic Surgery Review Course. *Johns Hopkins University*. June 26-July 1, 2005; Baltimore, MD.
6. **Khanna AJ.** Spinal Cord Injury. Orthopaedic Surgery Review Course. *Johns Hopkins University*. June 26-July 1, 2005; Baltimore, MD.
7. **Khanna AJ.** Review of Highest-Yield Spine Items. Orthopaedic Surgery Review Course. *Johns Hopkins University*. June 26-July 1, 2005; Baltimore, MD.
8. **Khanna AJ.** Spine Anatomy. Orthopaedic Surgery Review Course. *Johns Hopkins University*. April 30 – May 5, 2006; Baltimore, MD.
9. **Khanna AJ.** Cervical Spine Trauma. Orthopaedic Surgery Review Course. *Johns Hopkins University*. April 30 – May 5, 2006; Baltimore, MD.
10. **Khanna AJ.** Spinal Cord Injury. Orthopaedic Surgery Review Course. *Johns Hopkins University*. April 30 – May 5, 2006; Baltimore, MD.
11. **Khanna AJ.** Review of Highest-Yield Spine Items. Orthopaedic Surgery Review Course. *Johns Hopkins University*. April 30 – May 5, 2006; Baltimore, MD.

12. **Khanna AJ.** Cervical Spine Trauma. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. May 31 – June 4, 2006; Chicago, IL.
13. **Khanna AJ.** Cervical Degenerative Pathology and Treatment. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. May 31 – June 4, 2006; Chicago, IL.
14. **Khanna AJ.** Spinal Cord Injury. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. May 31 – June 4, 2006; Chicago, IL.
15. **Khanna AJ.** Review of Highest-Yield Spine Items. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. May 31 – June 4, 2006; Chicago, IL.
16. **Khanna AJ.** Cervical Spine Trauma. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. May 2 – 6, 2007; Chicago, IL.
17. **Khanna AJ.** Cervical Degenerative Pathology and Treatment. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. May 2 – 6, 2007; Chicago, IL.
18. **Khanna AJ.** Spinal Cord Injury. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. May 2 – 6, 2007; Chicago, IL.
19. **Khanna AJ.** Review of Highest-Yield Spine Items. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. May 2 – 6, 2007; Chicago, IL.
20. **Khanna AJ.** Innovations in Spine Surgery: Emerging Techniques in Minimally Invasive Spine Surgery. William S. Baer Annual Lectureship, Department of Orthopaedic Surgery, *Johns Hopkins University*. June 2, 2007; Baltimore, MD.
21. **Khanna AJ.** Cervical Spine Trauma. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 30 – May 4, 2008; Chicago, IL.
22. **Khanna AJ.** Cervical Degenerative Pathology and Treatment. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 30 – May 4, 2008; Chicago, IL.
23. **Khanna AJ.** Spinal Cord Injury. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 30 – May 4, 2008; Chicago, IL.
24. **Khanna AJ.** Review of Highest-Yield Spine Items. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 30 – May 4, 2008; Chicago, IL.
25. **Khanna AJ.** Imaging of the Spine. An Introduction to Spine Care for Physician Assistants and Nurse Practitioners. Spine Master's Institute, *North American Spine Society*. August 1-2, 2008; Burr Ridge, IL.
26. **Khanna AJ.** A Systematic Review of MR Imaging Studies. MRI of the Musculoskeletal System: Essentials for the Orthopaedic Surgeon, Radiologist and Clinician. Departments of Orthopaedic Surgery and Radiology, *Johns Hopkins University*. August 9 – 16, 2008; Barcelona, Spain.
27. **Khanna AJ.** MRI of the Cervical Spine. MRI of the Musculoskeletal System: Essentials for the Orthopaedic Surgeon, Radiologist and Clinician. Departments of Orthopaedic Surgery and Radiology, *Johns Hopkins University*. August 9 – 16, 2008; Barcelona, Spain.
28. **Khanna AJ.** MRI of the Lumbar Spine. MRI of the Musculoskeletal System: Essentials for the Orthopaedic Surgeon, Radiologist and Clinician. Departments of Orthopaedic Surgery and Radiology, *Johns Hopkins University*. August 9 – 16, 2008; Barcelona, Spain.
29. **Khanna AJ.** MRI of the Pediatric Spine. MRI of the Musculoskeletal System: Essentials for the Orthopaedic Surgeon, Radiologist and Clinician. Departments of Orthopaedic Surgery and Radiology, *Johns Hopkins University*. August 9 – 16, 2008; Barcelona, Spain.
30. **Khanna AJ.** Cervical Spine Trauma. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 29 – May 3, 2009; Chicago, IL.
31. **Khanna AJ.** Cervical Degenerative Pathology and Treatment. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 29 – May 3, 2009; Chicago, IL.
32. **Khanna AJ.** Spinal Cord Injury. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 29 – May 3, 2009; Chicago, IL.
33. **Khanna AJ.** Review of Highest-Yield Spine Items. Board Preparation and Review Course,

- American Academy of Orthopaedic Surgeons*. April 29 – May 3, 2009; Chicago, IL.
34. **Khanna AJ.** Innovations in Spine Surgery: Emerging Techniques in Minimally Invasive Spine Surgery. William S. Baer Annual Lectureship, Department of Orthopaedic Surgery, *Johns Hopkins University*. June 5, 2009; Baltimore, MD.
 35. **Khanna AJ.** Cervical Spine Trauma and Spinal Cord Injury. Board Maintenance of Certification Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. November 12 – 15, 2009; Cambridge, MA.
 36. **Khanna AJ.** Degenerative Disease of the Cervical Spine. Board Maintenance of Certification Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. November 12-15, 2009; Cambridge, MA.
 37. **Khanna AJ.** Spine Anatomy. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 28 – May 2, 2010; Chicago, IL.
 38. **Khanna AJ.** Cervical Spine Trauma. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 28 – May 2, 2010; Chicago, IL.
 39. **Khanna AJ.** Cervical Degenerative Pathology and Treatment. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 28 – May 2, 2010; Chicago, IL.
 40. **Khanna AJ.** Spinal Cord Injury. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 28 – May 2, 2010; Chicago, IL.
 41. **Khanna AJ.** Review of Highest-Yield Spine Items. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 28 – May 2, 2010; Chicago, IL.
 42. **Khanna AJ.** Emerging Technologies: Interspinous Process Spacers. Minimally Invasive Spine Surgery Course. *North American Spine Society*. August 6 – 7, 2010; Burr Ridge, IL.
 43. **Khanna AJ.** Axial Lumbar Interbody Fusion. Minimally Invasive Spine Surgery Course. *North American Spine Society*. August 6 – 7, 2010; Burr Ridge, IL.
 44. **Khanna AJ.** Systematic Review of MR Imaging Studies. *North American Spine Society* Online Course. MRI of the Spine: Essentials for the Spine Specialist. August 25, 2010 – August 24, 2011.
 45. **Khanna AJ.** Magnetic Resonance Imaging of the Cervical Spine. *North American Spine Society* Online Course. MRI of the Spine: Essentials for the Spine Specialist. August 25, 2010 – August 24, 2011.
 46. **Khanna AJ.** Magnetic Resonance Imaging of the Lumbar Spine. *North American Spine Society* Online Course. MRI of the Spine: Essentials for the Spine Specialist. August 25, 2010 – August 24, 2011.
 47. **Khanna AJ.** Magnetic Resonance Imaging of the Pediatric Spine. *North American Spine Society* Online Course. MRI of the Spine: Essentials for the Spine Specialist. August 25, 2010 – August 24, 2011.
 48. **Khanna AJ.** Cervical Spine Trauma and Spinal Cord Injury. Board Maintenance of Certification Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. November 11 – 13, 2010; Cambridge, MA.
 49. **Khanna AJ.** Degenerative Disease of the Cervical Spine. Board Maintenance of Certification Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. November 11-13, 2010; Cambridge, MA.
 50. **Khanna AJ.** Spine Anatomy. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 13 – 17, 2011; Chicago, IL.
 51. **Khanna AJ.** Cervical Spine Trauma. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 13 – 17, 2011; Chicago, IL.
 52. **Khanna AJ.** Cervical Degenerative Pathology and Treatment. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 13 – 17, 2011; Chicago, IL.
 53. **Khanna AJ.** Spinal Cord Injury. Board Preparation and Review Course, *American Academy of*

- Orthopaedic Surgeons*. April 13 – 17, 2011; Chicago, IL.
54. **Khanna AJ.** Review of Highest-Yield Spine Items. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 13 – 17, 2011; Chicago, IL.
 55. **Khanna AJ.** Lower Extremity Trauma. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 13 – 17, 2011; Chicago, IL.
 56. **Khanna AJ.** Engineering-Based Innovation in Orthopaedic Surgery: The Center for Bioengineering, Innovation and Design (CBID) Experience. William S. Baer Annual Lectureship, Department of Orthopaedic Surgery, *Johns Hopkins University*. June 10, 2011; Baltimore, MD.
 57. **Khanna AJ.** Cervical Spine Trauma and Spinal Cord Injury. Board Maintenance of Certification Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. November 16-19, 2011; Boston, MA.
 58. **Khanna AJ.** Degenerative Disease of the Cervical Spine. Board Maintenance of Certification Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. November 16 - 19, 2011; Boston, MA.
 59. **Khanna AJ.** Spine Anatomy. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 11 – 15, 2012; Chicago, IL.
 60. **Khanna AJ.** Cervical Spine Trauma. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 11 – 15, 2012; Chicago, IL.
 61. **Khanna AJ.** Cervical Degenerative Pathology and Treatment. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 11 – 15, 2012; Chicago, IL.
 62. **Khanna AJ.** Spinal Cord Injury. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 11 – 15, 2012; Chicago, IL.
 63. **Khanna AJ.** Review of Highest-Yield Spine Items. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 11 – 15, 2012; Chicago, IL.
 64. **Khanna AJ.** Degenerative Disease of the Cervical Spine, Spine Trauma and Spinal Cord Injury. Board Maintenance of Certification Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. November 15 - 17, 2012; Boston, MA.
 65. **Khanna AJ.** Spine Anatomy. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 10 – 14, 2013; Chicago, IL.
 66. **Khanna AJ.** Cervical Spine Trauma. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 10 – 14, 2013; Chicago, IL.
 67. **Khanna AJ.** Cervical Degenerative Pathology and Treatment. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 10 – 14, 2013; Chicago, IL.
 68. **Khanna AJ.** Spinal Cord Injury. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 10 – 14, 2013; Chicago, IL.
 69. **Khanna AJ.** Review of Highest-Yield Spine Items. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 10 – 14, 2013; Chicago, IL.
 70. **Khanna AJ.** Systematic Review of MR Imaging Studies. *North American Spine Society* Online Webinar. MRI of the Spine: Essentials for the Spine Surgeon and Specialist. May 28, 2013.
 71. **Khanna AJ.** Magnetic Resonance Imaging of the Cervical Spine. *North American Spine Society* Online Webinar. MRI of the Spine: Essentials for the Spine Surgeon and Specialist. June 25, 2013.
 72. **Khanna AJ.** Magnetic Resonance Imaging of the Lumbar Spine. *North American Spine Society* Online Webinar. MRI of the Spine: Essentials for the Spine Surgeon and Specialist. June 25, 2013.
 73. **Khanna AJ.** Degenerative Disease of the Cervical Spine, Spine Trauma and Spinal Cord Injury. Board Maintenance of Certification Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. November 14 - 17, 2013; Boston, MA.
 74. **Khanna AJ.** Spine Anatomy. Board Preparation and Review Course, *American Academy of*

- Orthopaedic Surgeons*. April 9 – 13, 2014; Chicago, IL.
75. **Khanna AJ.** Cervical Spine Trauma. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 9 – 13, 2014; Chicago, IL.
 76. **Khanna AJ.** Cervical Degenerative Pathology and Treatment. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 9 – 13, 2014; Chicago, IL.
 77. **Khanna AJ.** Spinal Cord Injury. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 9 – 13, 2014; Chicago, IL.
 78. **Khanna AJ.** Review of Highest-Yield Spine Items. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 9 – 13, 2014; Chicago, IL.
 79. **Khanna AJ.** Degenerative Disease of the Cervical Spine, Spine Trauma and Spinal Cord Injury. Board Maintenance of Certification Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. November 6 - 8, 2014; Boston, MA.
 80. **Khanna AJ.** Cervical Spine Trauma. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 21- 25, 2015; Chicago, IL.
 81. **Khanna AJ.** Cervical Degenerative Pathology and Treatment. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 21- 25, 2015; Chicago, IL..
 82. **Khanna AJ.** Spinal Cord Injury. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 21- 25, 2015; Chicago, IL.
 83. **Khanna AJ.** Review of Highest-Yield Spine Items. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 21- 25, 2015; Chicago, IL.
 84. **Khanna AJ.** Degenerative Disease of the Cervical Spine, Spine Trauma and Spinal Cord Injury. Board Maintenance of Certification Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. November 5 - 7, 2015; Boston, MA.
 85. **Khanna AJ.** Cervical Spine Trauma. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 5 - 9, 2016; Chicago, IL.
 86. **Khanna AJ.** Cervical Degenerative Pathology and Treatment. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 5 - 9, 2016; Chicago, IL.
 87. **Khanna AJ.** Spinal Cord Injury. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 5 - 9, 2016; Chicago, IL.
 88. **Khanna AJ.** Review of Highest-Yield Spine Items. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 5 - 9, 2016; Chicago, IL.
 89. **Khanna AJ.** Degenerative Disease of the Cervical Spine, Spine Trauma, Spinal Cord Injury and Spinal Infections. Board Maintenance of Certification Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. November 17 – 19, 2016; Boston, MA.
 90. **Khanna AJ.** Cervical Spine Trauma. Spine-Focused Maintenance of Certification Course, *American Academy of Orthopaedic Surgeons*. November 19, 2016; Boston, MA.
 91. **Khanna AJ.** Cervical Degenerative Pathology and Treatment. Spine-Focused Maintenance of Certification Course, *American Academy of Orthopaedic Surgeons*. November 19, 2016; Boston, MA
 92. **Khanna AJ.** Spinal Cord Injury. Spine-Focused Maintenance of Certification Course, *American Academy of Orthopaedic Surgeons*. November 19, 2016; Boston, MA.
 93. **Khanna AJ.** Spine Imaging: MRI and Other Modalities. Spine-Focused Maintenance of Certification Course, *American Academy of Orthopaedic Surgeons*. November 19, 2016; Boston, MA.
 94. **Khanna AJ.** Review of Highest-Yield Spine Items. Spine-Focused Maintenance of Certification Course, *American Academy of Orthopaedic Surgeons*. November 19, 2016; Boston, MA.
 95. **Khanna AJ.** Cervical Spine Trauma. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 18 -22, 2017; Chicago, IL.

96. **Khanna AJ.** Cervical Degenerative Pathology and Treatment. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 18 -22, 2017; Chicago, IL.
97. **Khanna AJ.** Spinal Cord Injury. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 18 -22, 2017; Chicago, IL.
98. **Khanna AJ.** Review of Highest-Yield Spine Items. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 18 -22, 2017; Chicago, IL.
99. **Khanna AJ.** Degenerative Disease of the Cervical Spine, Spine Trauma, Spinal Cord Injury and Spinal Infections. Board Maintenance of Certification Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. November 4, 2017; Boston, MA.
100. **Khanna AJ.** Cervical Spine Trauma. Spine-Focused Maintenance of Certification Course, *American Academy of Orthopaedic Surgeons*. November 4, 2017; Boston, MA.
101. **Khanna AJ.** Cervical Degenerative Pathology and Treatment. Spine-Focused Maintenance of Certification Course, *American Academy of Orthopaedic Surgeons*. November 4, 2017; Boston, MA.
102. **Khanna AJ.** Spinal Cord Injury. Spine-Focused Maintenance of Certification Course, *American Academy of Orthopaedic Surgeons*. November 4, 2017; Boston, MA.
103. **Khanna AJ.** Spine Imaging: MRI and Other Modalities. Spine-Focused Maintenance of Certification Course, *American Academy of Orthopaedic Surgeons*. November 4, 2017; Boston, MA.
104. **Khanna AJ.** Review of Highest-Yield Spine Items. Spine-Focused Maintenance of Certification Course, *American Academy of Orthopaedic Surgeons*. November 4, 2017; Boston, MA.
105. **Khanna AJ.** Cervical Spine Trauma. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 10-14, 2018; Chicago, IL.
106. **Khanna AJ.** Cervical Degenerative Pathology and Treatment. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 10-14, 2018; Chicago, IL.
107. **Khanna AJ.** Spinal Cord Injury. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 10-14, 2018; Chicago, IL.
108. **Khanna AJ.** Review of Highest-Yield Spine Items. Board Preparation and Review Course, *American Academy of Orthopaedic Surgeons*. April 10-14, 2018; Chicago, IL.

Non-CME Course Instruction

1. **Khanna AJ.** Moderator and Speaker, Spine Section. Annual Orthopaedic Surgery In-Training Review Course. *Johns Hopkins University*. October, 2004; Baltimore, MD.
2. **Khanna AJ.** Moderator and Speaker, Spine Section. Annual Orthopaedic Surgery In-Training Review Course. *Johns Hopkins University*. September, 2005; Baltimore, MD.
3. **Khanna AJ.** Moderator and Speaker, Spine Section. Annual Orthopaedic Surgery In-Training Review Course. *Johns Hopkins University*. September 7, 2006; Baltimore, MD.
4. **Khanna AJ.** Moderator and Speaker, Spine Section. Annual Orthopaedic Surgery In-Training Review Course. *Johns Hopkins University*. July 26, 2007; Baltimore, MD.
5. **Khanna AJ.** Spine Anatomy. Orthopaedic Surgery Review Course. *Johns Hopkins University*. April 13 – 15, 2007; Baltimore, MD.
6. **Khanna AJ, Shen FH.** Spine Biomechanics. Orthopaedic Surgery Review Course. *Johns Hopkins University*. April 13 – 15, 2007; Baltimore, MD.
7. **Khanna AJ.** Cervical Spine Trauma. Orthopaedic Surgery Review Course. *Johns Hopkins University*. April 13 – 15, 2007; Baltimore, MD.
8. **Khanna AJ.** Cervical Degenerative Disorders. Orthopaedic Surgery Review Course. *Johns Hopkins University*. April 13 – 15, 2007; Baltimore, MD.

9. **Khanna AJ**, Shen FH. Thoracolumbar Trauma. Orthopaedic Surgery Review Course. *Johns Hopkins University*. April 13 – 15, 2007; Baltimore, MD.
10. **Khanna AJ**, Shen FH. Thoracolumbar Degenerative Disorders. Orthopaedic Surgery Review Course. *Johns Hopkins University*. April 13 – 15, 2007; Baltimore, MD.
11. **Khanna AJ**, Shen FH. Spine Infections. Orthopaedic Surgery Review Course. *Johns Hopkins University*. April 13 – 15, 2007, Baltimore, MD.
12. **Khanna AJ**. Spinal Cord Injury. Orthopaedic Surgery Review Course. *Johns Hopkins University*. April 13 – 15, 2007; Baltimore, MD.
13. **Khanna AJ**. Review of Highest-Yield Spine Items. Orthopaedic Surgery Review Course. *Johns Hopkins University*. April 13 – 15, 2007; Baltimore, MD.
14. **Khanna AJ**, Shen FH. Analysis of Spine SAE and OITE Examinations. Orthopaedic Surgery Review Course. *Johns Hopkins University*. April 13 – 15, 2007; Baltimore, MD.
15. **Khanna AJ**. Spine Anatomy. Orthopaedic Surgery Review Course. *Johns Hopkins University*. July 7 – 11, 2008; Baltimore, MD.
16. **Khanna AJ**, Shen FH. Spine Biomechanics. Orthopaedic Surgery Review Course. *Johns Hopkins University*. July 7 – 11, 2008; Baltimore, MD.
17. **Khanna AJ**. Cervical Spine Trauma. Orthopaedic Surgery Review Course. *Johns Hopkins University*. July 7 – 11, 2008; Baltimore, MD.
18. **Khanna AJ**. Cervical Degenerative Disorders. Orthopaedic Surgery Review Course. *Johns Hopkins University*. July 7 – 11, 2008; Baltimore, MD.
19. **Khanna AJ**, Shen FH. Thoracolumbar Trauma. Orthopaedic Surgery Review Course. *Johns Hopkins University*. July 7 – 11, 2008; Baltimore, MD.
20. **Khanna AJ**, Shen FH. Thoracolumbar Degenerative Disorders. Orthopaedic Surgery Review Course. *Johns Hopkins University*. July 7 – 11, 2008; Baltimore, MD.
21. **Khanna AJ**, Shen FH. Spine Infections. Orthopaedic Surgery Review Course. *Johns Hopkins University*. July 7 – 11, 2008, Baltimore, MD.
22. **Khanna AJ**. Spinal Cord Injury. Orthopaedic Surgery Review Course. *Johns Hopkins University*. July 7 – 11, 2008; Baltimore, MD.
23. **Khanna AJ**. Review of Highest-Yield Spine Items. Orthopaedic Surgery Review Course. *Johns Hopkins University*. July 7 – 11, 2008; Baltimore, MD.
24. **Khanna AJ**, Shen FH. Analysis of Spine SAE and OITE Examinations. Orthopaedic Surgery Review Course. *Johns Hopkins University*. July 7 – 11, 2008; Baltimore, MD.
25. **Khanna AJ**. Moderator and Speaker, Spine Section. Annual Orthopaedic Surgery In-Training Review Course. *Johns Hopkins University*. October, 2008; Baltimore, MD.
26. **Khanna AJ**. Spine Anatomy. Orthopaedic Surgery Review Course. *Johns Hopkins University*. June 8 – 12, 2009; Baltimore, MD.
27. **Khanna AJ**, Shen FH. Spine Biomechanics. Orthopaedic Surgery Review Course. *Johns Hopkins University*. June 8 – 12, 2009; Baltimore, MD.
28. **Khanna AJ**. Cervical Spine Trauma. Orthopaedic Surgery Review Course. *Johns Hopkins University*. June 8 – 12, 2009; Baltimore, MD.
29. **Khanna AJ**. Cervical Degenerative Disorders. Orthopaedic Surgery Review Course. *Johns Hopkins University*. June 8 – 12, 2009; Baltimore, MD.
30. **Khanna AJ**, Shen FH. Spine Infections. Orthopaedic Surgery Review Course. *Johns Hopkins University*. June 8 – 12, 2009, Baltimore, MD.
31. **Khanna AJ**. Spinal Cord Injury. Orthopaedic Surgery Review Course. *Johns Hopkins University*. June 8 – 12, 2009; Baltimore, MD.
32. **Khanna AJ**. Review of Highest-Yield Spine Items. Orthopaedic Surgery Review Course. *Johns Hopkins University*. June 8 – 12, 2009; Baltimore, MD.

33. **Khanna AJ**, Shen FH. Analysis of Spine SAE and OITE Examinations. Orthopaedic Surgery Review Course. *Johns Hopkins University*. June 8 – 12, 2009; Baltimore, MD.
34. **Khanna AJ**. Moderator and Speaker, Spine Section. Annual Orthopaedic Surgery In-Training Review Course. *Johns Hopkins University*. October, 2009; Baltimore, MD.
35. **Khanna AJ**. Spine Anatomy. Orthopaedic Surgery Review Course. *Johns Hopkins University*. June 7 – 11, 2010; Baltimore, MD.
36. **Khanna AJ**, Shen FH. Spine Biomechanics. Orthopaedic Surgery Review Course. *Johns Hopkins University*. June 7 – 11, 2010; Baltimore, MD.
37. **Khanna AJ**. Cervical Spine Trauma. Orthopaedic Surgery Review Course. *Johns Hopkins University*. June 7 – 11, 2010; Baltimore, MD.
38. **Khanna AJ**. Cervical Degenerative Disorders. Orthopaedic Surgery Review Course. *Johns Hopkins University*. June 7 – 11, 2010; Baltimore, MD.
39. **Khanna AJ**. Spinal Cord Injury. Orthopaedic Surgery Review Course. *Johns Hopkins University*. June 7 – 11, 2010; Baltimore, MD.
40. **Khanna AJ**. Review of Highest-Yield Spine Items. Orthopaedic Surgery Review Course. *Johns Hopkins University*. June 7 – 11, 2010; Baltimore, MD.
41. **Khanna AJ**, Shen FH. Analysis of Spine SAE and OITE Examinations. Orthopaedic Surgery Review Course. *Johns Hopkins University*. June 7 – 11, 2010; Baltimore, MD.
42. **Khanna AJ**. Moderator and Speaker, Spine Section. Annual Orthopaedic Surgery In-Training Review Course. *Johns Hopkins University*. October, 2010; Baltimore, MD.
43. **Khanna AJ**. Systematic Review of MR Imaging Studies. Orthopaedic Surgery Review Course for 2nd Time Test Takers. *Johns Hopkins University*. May 10, 2011; Baltimore, MD.
44. **Khanna AJ**. Magnetic Resonance Imaging of the Cervical Spine. Orthopaedic Surgery Review Course for 2nd Time Test Takers. *Johns Hopkins University*. May 10, 2011; Baltimore, MD.
45. **Khanna AJ**. Magnetic Resonance Imaging of the Lumbar Spine. Orthopaedic Surgery Review Course for 2nd Time Test Takers. *Johns Hopkins University*. May 10, 2011; Baltimore, MD.
46. **Khanna AJ**. Review of Highest-Yield Spine Items. Orthopaedic Surgery Review Course for 2nd Time Test Takers. *Johns Hopkins University*. May 11, 2011; Baltimore, MD.
47. **Khanna AJ**, Shen FH. Analysis of Spine SAE and OITE Examinations. Orthopaedic Surgery Review Course for 2nd Time Test Takers. *Johns Hopkins University*. May 11, 2011; Baltimore, MD.
48. **Khanna AJ**. Spine Anatomy. Orthopaedic Surgery Review Course. *Johns Hopkins University*. June 6 – 10, 2011; Baltimore, MD.
49. **Khanna AJ**. Cervical Spine Trauma. Orthopaedic Surgery Review Course. *Johns Hopkins University*. June 6 – 10, 2011; Baltimore, MD.
50. **Khanna AJ**. Cervical Degenerative Disorders. Orthopaedic Surgery Review Course. *Johns Hopkins University*. June 6 – 10, 2011; Baltimore, MD.
51. **Khanna AJ**. **Spinal Cord Injury**. Orthopaedic Surgery Review Course. *Johns Hopkins University*. June 6 – 10, 2011; Baltimore, MD.
52. **Khanna AJ**, Shen FH. Analysis of Spine SAE and OITE Examinations. Orthopaedic Surgery Review Course. *Johns Hopkins University*. June 6 – 10, 2011; Baltimore, MD.
53. **Khanna AJ**. Moderator and Speaker, Spine Section. Annual Orthopaedic Surgery In-Training Review Course. *Johns Hopkins University*. November, 2011; Baltimore, MD.

Educational Program Building/Leadership

2004 – 2010 Development and Implementation of Surgical Teaching Module Concept. Department of Orthopaedic Surgery, *Johns Hopkins University*. Baltimore, MD

- 2004 - 2010 Development and Delivery of Musculoskeletal MRI Teaching Conference. Department of Orthopaedic Surgery, *Johns Hopkins University*. Baltimore, MD.
- 2010 – 2012 Development and Delivery of *North American Spine Society* Online MRI Course Burr Ridge, IL
- 2008 – 2012 Assistant Residency Director, Department of Orthopaedic Surgery, Johns Hopkins University
- 2008 – 2012 Co-Chair and Member, Education Committee, Department of Orthopaedic Surgery, Johns Hopkins University

CLINICAL ACTIVITIES

State Licenses

- 10/96 Maryland Medical License #D0051264 (Expires 9/30/2020)
7/03 Ohio State Medical License #82884 (Expired after completion of fellowship in 2004)
12/11 District of Columbia Medical License #MD040007 (Expires 12/31/2018)
10/12 Virginia Medical License #0101252916 (Expires 3/31/2020)

Certifications

- 6/93 USMLE Step I
3/95 USMLE Step II
5/96 USMLE Step III
7/03 American Board of Orthopaedic Surgery, Part I Examination
7/06 American Board of Orthopaedic Surgery, Part II Examination
7/06 Board Certification, American Board of Orthopaedic Surgery
3/08 Fellow, American Academy of Orthopaedic Surgeons
6/15 Board Recertification, American Board of Orthopaedic Surgery (expires 12/31/26)

Hospital Privileges

Suburban Hospital, a Member of Johns Hopkins Medicine
Johns Hopkins Hospital
Johns Hopkins Bayview Medical Center
Sibley Memorial Hospital, a Member of Johns Hopkins Medicine

Clinical Service Responsibilities

- Outpatient Activities:* Full Day Clinic Sessions: 2 to 3 per week
Office site: Suburban Outpatient Medical Center (Bethesda, MD)
- Inpatient Activities:* OR days: 2 to 3 per week
Inpatient Consultations

Clinical Program Building/Leadership

- 2004 – 2011 Co-Director, Division of Spine Surgery, Johns Hopkins Orthopaedics at Good

Samaritan Hospital
Baltimore, MD

- 2007 – 2012 Assistant Residency Director, Department of Orthopaedic Surgery
Johns Hopkins University, Baltimore, MD
- 2011 – Present Division Chief, Johns Hopkins Orthopaedic Surgery—National Capital Region
Bethesda, MD

SYSTEM INNOVATION AND QUALITY IMPROVEMENT ACTIVITIES

System Innovation and Quality Improvement Publications

Douglas FL, Acharya S, Davis BL, Dhinojwala, Fenning SD, Gray M, Greenwald AS, Greenwald JFI, Hess M, **Khanna AJ**, Kumar UN, Yazdi Y. Value-driven Engineering for US Global Competitiveness: *A Call for a National Platform to Advance Value-driven Engineering*. Austen Bioinnovation Institute. June 14, 2011: 1 -37. <http://www.abiakron.org/Data/Sites/1/pdf/abiawhitepaper6-14-11.pdf>

System Innovation and Quality Improvement efforts within JHM:

- 2011-2012 JHM Collaborative Planning Team (CPT) Member, 2011-2012
Role: To work with JHM Leadership to develop a new strategic planning process to help guide Johns Hopkins' continued leadership in patient care, medical education and research at the national and international levels. Responsibilities included participation in meetings, online events and conference calls to develop a series of strategic priorities for our Institution.

Innovation and Quality Improvement efforts outside of JHM

- 2012 Podium Presentation:
Driving Clinical Utility by Incentivizing Clinicians to Participate. *A National Conference on Value-Driven Engineering to Improve Medical Innovation for U.S. Global Competitiveness*. April 22, 2012; Akron, Ohio.

System Innovation and Quality Improvement Program Building/Leadership

- 2011 – 2012 Steering Committee Member, *Value-Driven Engineering and U.S. Global Competitiveness Study Group*.
Role: To be a founding and key contributing member to a group of leaders from the healthcare, engineering, medical device, governmental agency (NIH and FDA), legal and financial industries to help define the concept of “Value-Driven Engineering” and develop a program to ensure that the United States remains competitive in the global medical device industry

ORGANIZATIONAL ACTIVITIES

Institutional Administrative Appointments

- 2008 – 2011 Clinical Director
Center for Bioengineering Innovation and Design (CBID)
Department of Biomedical Engineering, Johns Hopkins University, Baltimore, MD

<http://cbid.bme.jhu.edu/>

- 2008 – 2011 Chair, Clinical Advisory Board
Center for Bioengineering Innovation and Design (CBID)
Department of Biomedical Engineering, Johns Hopkins University, Baltimore, MD
- 2004 – 2011 Co-Director, Division of Spine Surgery
Johns Hopkins Orthopaedic Surgery at Good Samaritan Hospital
Baltimore, MD
- 2011 – Present Division Chief
Johns Hopkins Orthopaedic Surgery—National Capital Region
Bethesda, MD
- 2011 – Present Office Medical Director (OMD)
Johns Hopkins Community Physicians
Johns Hopkins Orthopaedic Surgery—National Capital Region
Bethesda, MD
- 2013 – Present Vice Chair of Professional Development
Department of Orthopaedic Surgery,
Johns Hopkins University
- 2014 - 2016 Vice Chair
Department of Orthopaedic Surgery
Suburban Hospital, *a Member of Johns Hopkins Medicine*
- 2014 – Present Member, Johns Hopkins Spine Clinical Community Leadership

Leadership Programs

- 2012 – 2013 Johns Hopkins Leadership Development Program (LDP)
2013 – 2014 American Academy of Orthopaedic Surgeons (AAOS) Leadership Fellows Program
(LFP)

Editorial Activities

- 2005-2010 Spine Section Editor, Orthopaedic Hyperguide - (<http://www.ortho.hyperguides.com>)
2006-2009 Advisory Editorial Board Member, *The Spine Journal*, North American Spine Society
2009-Present Associate Editor, *The Spine Journal*, North American Spine Society
2009-Present Editorial Board Member, *SpineLine*, North American Spine Society
2016-Present Editorial Board Member, *Scoliosis and Spinal Disorders*

Advisory Committees, Review Groups, Study Sections, Boards

- 2004 – 2009 Reviewer, *Supportive Cancer Therapy*
2005 – 2009 Consultant Reviewer, *Clinical Orthopaedics and Related Research*
Lippincott Wilkins & Wilkins, Philadelphia, PA.
2006 – 2011 CME Advisory Board Member, Vindico Medical Education
2006 – Present Reviewer, *The Spine Journal*, Elsevier Science
2007 – Present Reviewer, Spine Section, *Orthopaedic Knowledge Online*, American Academy of
Orthopaedic Surgeons
2008 – Present Clinical Advisory Board Member, *Center for Bioengineering Innovation & Design*

Department of Biomedical Engineering, Johns Hopkins University
2009 – 2011 Financial Resource Development Committee, *North American Spine Society*
2009 – 2015 Audit Committee, *North American Spine Society*
2009 – Present CME Committee Member, *North American Spine Society*
2009 – Present Adult Spine Evaluation Committee, *American Academy of Orthopaedic Surgery*
2011 – 2012 Collaborative Planning Team, *Johns Hopkins Medicine*
2011 – 2015 Steering Committee Member, *Value-Driven Engineering and U.S. Global Competitiveness Study Group*
2011 – Present Oversight Committee Member, *Coulter Foundation Translational Partnership Award*
Department of Biomedical Engineering, Johns Hopkins University
2012 – Present Reviewer, *Journal of the American Academy of Orthopaedic Surgeons (JAAOS)*
2012 – Present Section Development Committee, *North American Spine Society*
2012 – 2014 Reviewer, *European Spine Journal*
2013 – 2016 Suburban Hospital Foundation Board of Trustees
2015 – 2016 PhD Thesis Committee Member
Deformable Image Registration for Surgical Guidance Using Intraoperative Cone-Beam CT
Department of Biomedical Engineering, *Johns Hopkins University*
by Sureerat Reuangamornrat
2016 – 2017 Director/Chair Search Committee Member
Department of Biomedical Engineering
Johns Hopkins University

Professional Societies

1995 – Present Alpha Omega Alpha Honor Society (AOA)
1995 – Present Georgetown University Alumni Association
1996 – Present Johns Hopkins Medical and Surgical Association
1998 – Present American Academy of Orthopaedic Surgeons (AAOS)
Adult Spine Self Assessment Examination (SAE) Committee
Orthopaedic In-Training Examination (OITE) Review Panel
Leadership Fellow (2013)
2000 – Present American Medical Association (AMA)
2002 – Present North American Spine Society (NASS)
CME Committee Member
Audit Committee Member
Financial Resource Development Committee Member
Chair, NASS Radiology Section
Section Development Committee Member
Minimally Invasive Spine Surgery Section Member
2003 – Present American Association of Physicians of Indian Origin (AAPI)
2004 – Present AO North America
2004 – Present Spine Study Group
2005 – Present AO ASIF Spine Faculty, AO North America
2005 – 2010 Baltimore Bone Club
2007 – Present American Society of Spine Radiology
2007 – Present Maryland Orthopaedic Association
2007 – Present MedChi: The Maryland State Medical Society
2012 – Present Southern Orthopaedic Association
2012 – Present Society of Minimally Invasive Spine Surgery
2014 – Present Argentinian Association of Orthopaedic Surgery and Traumatology
2016 – Present American Orthopaedic Association (AOA)

Conference Organizer/Session Chair

1. Moderator, Spine Section. Board Preparation and Review Course. *American Academy of Orthopaedic Surgeons*. March 31 – April 3, 2005; Chicago, IL.
2. Course Co-Director. 7th Annual Orthopaedic Surgery Review Course: A Clinical and Basic Science Review of Orthopaedic Surgery. *Johns Hopkins University*. June 26 – July 2, 2005; Baltimore, MD.
3. Moderator, Spine Section. Board Preparation and Review Course. *American Academy of Orthopaedic Surgeons*. May 31 – June 4, 2006; Chicago, IL.
4. Course Co-Director. 8th Annual Orthopaedic Surgery Review Course: A Clinical and Basic Science Review of Orthopaedic Surgery. *Johns Hopkins University*. April 30 – May 5, 2006; Baltimore, MD.
5. Course Director. 9th Annual Orthopaedic Review Course: A Clinical and Basic Science Review of Orthopaedic Surgery. *Johns Hopkins University*. April 13 – 17, 2007; Baltimore, MD.
6. Course Director. 9th Annual Orthopaedic Review Course: A Clinical and Basic Science Review of Orthopaedic Surgery. *Johns Hopkins University*. May 18 – 20, 2007 (Repeating Course); Baltimore, MD.
7. Course Director. 9th Annual Orthopaedic Review Course: A Clinical and Basic Science Review of Orthopaedic Surgery. *Johns Hopkins University*. June 28 – July 1, 2007 (Repeating Course); Baltimore, MD.
8. Session Chair. Lumbar Decompressive Techniques. Current Concepts in Spine Surgery. Annual Meeting, *New Delhi and Chandigarh Spine Society*. March 17 – 18, 2007; Chandigarh, India.
9. Moderator, Spine Section. Board Preparation and Review Course. *American Academy of Orthopaedic Surgeons*. May 2 – 6, 2007; Chicago, IL.
10. Spine Section Moderator. Board Preparation and Review Course. *American Academy of Orthopaedic Surgeons*. April 30 – May 4, 2008; Chicago, IL.
11. Course Director. 10th Annual Orthopaedic Review Course: A Clinical and Basic Science Review of Orthopaedic Surgery. *Johns Hopkins University*. July 7 -11, 2008; Baltimore, MD.
12. Course Co-Director. MRI of the Musculoskeletal System: Essentials for the Orthopaedic Surgeon, Radiologist and Clinician. Departments of Orthopaedic Surgery and Radiology, *Johns Hopkins University*. August 9 – 16, 2008. Barcelona, Spain.
13. Spine Section Moderator. Board Preparation and Review Course. *American Academy of Orthopaedic Surgeons*. April 29 – May 3, 2009; Chicago, IL.
14. Conference Moderator. Innovations in Orthopaedic Surgery. William S. Baer Annual Lectureship, Department of Orthopaedic Surgery, *Johns Hopkins University*. June 5, 2009; Baltimore, MD.
15. Course Director. 11th Annual Orthopaedic Review Course: A Clinical and Basic Science Review of Orthopaedic Surgery. *Johns Hopkins University*. June 8 -12, 2009; Baltimore, MD.
16. Course Director. 12th Annual Orthopaedic Review Course: A Clinical and Basic Science Review of Orthopaedic Surgery. *Johns Hopkins University*. June 7 -11, 2010; Baltimore, MD.
17. Course Director. MRI of the Spine: Essentials for the Spine Specialist. *North American Spine Society* Online Course. August 25, 2010 to August 24, 2011.
18. Course Co-Director. Board Preparation and Review Course. *American Academy of Orthopaedic Surgeons*. April 13 – April 17, 2011; Chicago, IL.
19. Session Co-Chair. MRI of the Spine and Spinal Image Guidance. *North American Spine Society*, 26th Annual Meeting. November 1, 2011; Chicago, IL.
20. Session Chair. Spine Imaging. *North American Spine Society*, 26th Annual Meeting. November 4, 2011; Chicago, IL.
21. Instructional Course Lecture (ICL) Moderator. MRI of the Spine: Essentials for the Orthopaedic

- Surgeon. *American Academy of Orthopaedic Surgeons*, 78th Annual Meeting. February 9, 2012; San Francisco, CA.
22. Course Director. Board Preparation and Review Course. *American Academy of Orthopaedic Surgeons*. April 11 – April 15, 2012; Chicago, IL.
 23. Program Committee Member. *A National Conference on Value-Driven Engineering to Improve Medical Innovation for U.S. Global Competitiveness*. April 22 - 24, 2012; Akron, Ohio.
 24. Session Chair. Lumbar Spine Complications. 19th Annual Brussels International Spine Symposium. November 9 – 10, 2012; Brussels, Belgium.
 25. Course Director. Board Preparation and Review Course. *American Academy of Orthopaedic Surgeons*. April 10 – April 14, 2013; Chicago, IL.
 26. Course Director. *North American Spine Society* Online Webinar Series. MRI of the Spine: Essentials for the Spine Surgeon and Specialist. May 28, 2013, June 25, 2013 and July 23, 2013.
 27. Course Director and Speaker. Imaging of the Spine: Spectrum of Disease and Illustrative and Interactive Case Reviews. *North American Spine Society* 28th Annual Meeting. October 9, 2013; New Orleans, LA.
 28. Course Co-Chair. *Spine Study Group and Association for Collaborative Spine Research (ACSR)* Meeting. January 29-31, 2014; San Diego, CA.
 29. Session Moderator. Identifying Knowledge Gaps in Spinal Trauma: Improvements in Fusion, Bone Graft Substitutes and Extenders. Extremity War Injuries IX: Reducing Disability within the Military. *American Academy of Orthopaedic Surgeons*. February 12, 2014; Washington, DC.
 30. Course Director. Board Preparation and Review Course. *American Academy of Orthopaedic Surgeons*. April 9 – April 13, 2014; Chicago, IL.
 31. Course Co-Coordinator. Primer Curso Intensivo de Ortopedia y Traumatología: Conceptos fundamentales presentado por AAOS y AAOT (First Intensive Course of Orthopaedic Surgery and Traumatology: Fundamental Concepts Presented by the American Academy of Orthopaedic Surgeons and the Argentinian Association of Orthopaedic Surgery and Traumatology). December 7 – 10, 2014; Buenos Aires, Argentina.
 32. Course Director. Board Preparation and Review Course. *American Academy of Orthopaedic Surgeons*. April 21 – April 25, 2015; Chicago, IL.
 33. Course Co-Director. Board Preparation and Review Course. *American Academy of Orthopaedic Surgeons*. April 5 - 9, 2016; Chicago, IL.
 34. Course Co-Director. Board Preparation and Review Course. *American Academy of Orthopaedic Surgeons*. April 18 - 22, 2017; Chicago, IL.
 35. Course Director. Spine-Focused Maintenance of Certification Course, *American Academy of Orthopaedic Surgeons*. November 4, 2017; Boston, MA.
 36. Course Co-Director. Board Preparation and Review Course. *American Academy of Orthopaedic Surgeons*. April 10 – 14, 2018; Chicago, IL.

RECOGNITION

Awards and Honors

- | | |
|------|--|
| 1992 | Academic Honors: <i>Magna Cum Laude</i> , <i>Georgetown University</i> , Washington DC. |
| 1994 | Alpha Omega Alpha Honor Society, <i>Georgetown University School of Medicine</i> , Washington DC. |
| 2000 | Aventis Orthopaedic Resident Scholarship Recipient, 67 th Annual Meeting, <i>American Academy of Orthopaedic Surgeons</i> , Orlando, FL |
| 2001 | Wyeth-Ayerst Orthopaedic Resident Scholarship Recipient and Orthopaedic Resident Reporter Program - 68 th Annual Meeting, <i>American Academy of Orthopaedic Surgeons</i> , |

- San Francisco, CA
- 2002 Aventis Orthopaedic Resident Scholarship Recipient, *SICOT/SIROT XXII World Congress*, San Diego, CA
- 2010 1st Place, Wharton Business Plan Competition (with Cortical Concepts, LLC student team)
- 2010 Named 50 of the Best Spine Specialists in America, *Becker's Orthopaedic and Spine Review*
<http://www.beckersorthopedicandspine.com/>
- 2011 1st Place, Harvard Business Plan Competition (with Boss Medical, LLC student team)
- 2011 1st Place, Johns Hopkins Business Plan Competition, Life Sciences Track (with Boss Medical, LLC student team)
- 2011 2nd Place, Georgia Tech Business Plan Competition (with Boss Medical, LLC student team)
- 2011 Named 100 of the Best Spine Surgeons and Specialists in America, *Becker's Orthopaedic and Spine Review*; <http://www.beckersorthopedicandspine.com/>
- 2012 *Johns Hopkins-Coulter Translational Partnership Award*, Department of Biomedical Engineering, Johns Hopkins University
- 2012 *Spine Technology Award*
Announced in *Orthopaedics This Week* and at NASS Meeting
LevelCheck Method for Automatic Intraoperative Labeling of Images in Spine Surgery (with Jeffrey Siewerdsen, PhD and I-STAR Lab)
- 2013 American Academy of Orthopaedic Surgery (AAOS) Leadership Fellow
- 2014 Becker's Spine Leadership Award, *Becker's Orthopaedic and Spine Review*;
<http://www.beckersorthopedicandspine.com/>
- 2015 Top Doctor Award, *Washingtonian Magazine*
- 2015 Best Doctors in America Award, *Best Doctors*
- 2016 Top Doctor Award, *Washingtonian Magazine*
- 2016 Best Doctors in America Award, *Best Doctors*
- 2017 Top Doctor Award, *Washingtonian Magazine*
- 2017 Best Doctors in America Award, *Best Doctors*
- 2018 Top Doctor Award, *Washingtonian Magazine*

Awards and Honors Relating to Avitus Orthopaedics

- 2011 1st Place Life Sciences MIT 100k Executive Summary Competition
- 2011 Awarded Johns Hopkins Coulter Translational Partnership Award
- 2011 Awarded Johns Hopkins Technology Accelerator Fund Grant
- 2011 Awarded Maryland TEDCO UTDF Grant
- 2011 Finalist in 2011 Mass Challenge Accelerator Competition
- 2011 Awarded NCIIA Advanced E-Team Grant
- 2011 1st Place (Tie) in Harvard Business Plan Competition
- 2011 1st Place in Johns Hopkins Business Plan Competition
- 2011 Finalist in the Wharton Business Plan Competition
- 2011 2nd Place in Georgia Tech Business Plan Competition
- 2012 3rd Place in NAPEC Innovation Challenge
- 2013 National Science Foundation Small Business Innovation Research Phase I/Ib award
- 2013 3rd Place in George Washington Business Plan Competition
- 2014 National Science Foundation Small Business Innovation Research Phase II award

Invited Talks/Visiting Professorships/Panels

- 9/8/03 Adolescent Idiopathic Scoliosis: Management and Surgical Techniques. Grand Rounds. Department Orthopaedic Surgery and Neurosurgery, *The Cleveland Clinic Foundation*. Cleveland, OH.

- 2/8/06 Minimally Invasive Spine Surgery. Grand Rounds and Visiting Professorship. Department of Orthopaedic Surgery, *University of Virginia*. Charlottesville, VA.
- 2/8/06 Kyphoplasty. Grand Rounds and Visiting Professorship. Department of Orthopaedic Surgery, *University of Virginia*. Charlottesville, VA.
- 9/14/06 MRI of the Lumbar and Cervical Spine. Grand Rounds and Visiting Professorship. Department of Orthopaedic Surgery, *University of Virginia*, Charlottesville, VA.
- 10/12/06 Emerging Technologies: Kyphoplasty. 4th Annual UVA Orthopaedic Surgery Subspecialty Meeting. *University of Virginia*, Charlottesville, VA.
- 9/25/07 Spine Surgery Review for Orthopaedic In-Training Examination & Visiting Professorship. Department of Orthopaedic Surgery, *Walter Reed Army Medical Center*. Washington, DC.
- 10/28/08 Spine Surgery Review for Orthopaedic In-Training Examination & Visiting Professorship. Department of Orthopaedic Surgery, *Walter Reed Army Medical Center*, Washington, DC.
- 11/10/09 Spine Surgery Review for Orthopaedic In-Training Examination & Visiting Professorship. Department of Orthopaedic Surgery, *Walter Reed Army Medical Center*, Washington, DC.
- 10/21/10 Spine Surgery Review for Orthopaedic In-Training Examination & Visiting Professorship. Department of Orthopaedic Surgery, *Walter Reed Army Medical Center*. Washington, DC.
- 1/28/11 Surgical Management of Osteoporotic Vertebral Fractures. Osteoporosis Grand Rounds. *World Federation of Ukrainian Medical Societies*.
- 3/10-11/11 Value-Driven Engineering: Training the Next Generation to Change the Paradigm. *Value-Driven Engineering and U.S. Global Competitiveness: Safe Haven Summit*. Washington, DC.
- 9/22/11 Spine Surgery Review for Orthopaedic In-Training Examination & Visiting Professorship. Department of Orthopaedic Surgery, *Walter Reed Army Medical Center*. Bethesda, MD.
- 4/22/12 Driving Clinical Utility by Incentivizing Clinicians to Participate. *A National Conference on Value-Driven Engineering to Improve Medical Innovation for U.S. Global Competitiveness*. Akron, Ohio.
- 9/6/12 Spine Surgery Review for Orthopaedic In-Training Examination & Visiting Professorship. Department of Orthopaedic Surgery, *Walter Reed National Military Medical Center*. Bethesda, MD.
- 11/13/12 Where Does the Pain Come From? A Surgeon's Perspective on Back Pain and Treatment Options in Older Adults. *American College of Rheumatology Annual Meeting*. Washington, DC.
- 10/23/14 Spine Surgery Review for Orthopaedic In-Training Examination & Visiting Professorship. Department of Orthopaedic Surgery, *Walter Reed National Military Medical Center*. Bethesda, MD.

- 2/7/15 Key Note Address: Complications and Failures of Lumbar Spine Surgery: Why Does the Failed Back Fail? *American Society of Spine Radiology Annual Meeting*. Las Vegas, NV.
- 10/8/15 Spine Surgery Review for Orthopaedic In-Training Examination & Visiting Professorship. Department of Orthopaedic Surgery, *Walter Reed National Military Medical Center*. Bethesda, MD.
- 3/31/15 Complications and Failures of Spine Surgery: Avoidance, Treatment and Imaging Manifestations. *Apollo Hospital and Medical Center*. New Delhi, India.
- 4/1/15 Cervical Spinal Stenosis, Radiculopathy and Myelopathy: Treatment Options and Case Reviews. *HCL Healthcare, Johns Hopkins India*. New Delhi, India.
- 10/6/16 Spine Surgery Review for Orthopaedic In-Training Examination & Visiting Professorship. Department of Orthopaedic Surgery, *Walter Reed National Military Medical Center*. Bethesda, MD.
- 10/20/17 Spine Surgery Review for Orthopaedic In-Training Examination & Visiting Professorship. Department of Orthopaedic Surgery, *Walter Reed National Military Medical Center*. Bethesda, MD.
- 10/5/18 Macroeconomic Trends in Spine and Pain Care. *The Business of Pain Medicine: 21st Century Challenges and Solutions*. National Harbor, Oxon Hill, Maryland.
- 10/19/18 Spine Surgery Review for Orthopaedic In-Training Examination & Visiting Professorship. Department of Orthopaedic Surgery, *Walter Reed National Military Medical Center*. Bethesda, MD.