16th Annual
Evidence & Technology
Spine Summit
Park City, UT
February 19-22, 2020
Final Program
Thank you for attending the 16th Annual Evidence & Technology Spine Summit at Park City’s Canyons Village.

The Summit explores surgical, medical and joint topics, including Failed Back Syndrome, Robotics and Navigation in Spine Surgery, Injectable Biologics, Opioid Crisis, Adult Deformity Surgery, Pain Management, and Complications. Faculty will address the current thinking and evidence-based medicine in this relaxed and highly interactive setting to stimulate discussion.

Full breakfasts, beverage and Après Ski breaks as well as the Welcome Reception are in the Technical Exhibition, Kokopelli II & III. Enjoy heavy hors d’oeuvres, wine and beer at the Welcome Reception on Thursday, February 20, 7:30-9:00 p.m.

Park City’s Canyons Village is a premier ski resort offering ski-in and ski-out availability, numerous amenities, restaurants and exciting nightlife.

We look forward to your participation this week.

Surgical Course Directors:
John G. DeVine, MD
Patrick C. Hsieh, MD
Brandon D. Lawrence, MD
Alpesh A. Patel, MD, FACS

Medical Course Directors:
Scott Kreiner, MD
David R. O’Brien, Jr., MD

Emeritus Course Directors:
Darrel S. Brodke, MD
Michael C. Geraci, MD, PT
Alan S. Hilibrand, MD
Joshua D. Rittenberg, MD
William J. Sullivan, MD
Jeffrey C. Wang, MD
Jim A. Youssef, MD

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**Continuing Medical Education (CME) Credit**

This activity has been planned and implemented in accordance with the Essentials and Standards of the Accreditation Council for Continuing Medical Education (ACCME). The North American Spine Society is accredited by the ACCME to provide continuing medical education for physicians and takes responsibility for the content, quality and scientific integrity of this CME activity.

The North American Spine Society designates this live activity for a maximum of 16 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

The American Medical Association has determined that physicians not licensed in the U.S. to participate in this CME activity are eligible for AMA PRA Category 1 Credits™.

The American Academy of Physician Assistants (AAPA) accepts Category 1 credit from AOACCME, prescribed credit from the American Academy of Family Physicians (AAFP) and AMA PRA Category 1 Credit™ for the Physician’s Recognition Award from organizations accredited by the ACCME, such as NASS.

Each state has different requirements for nurses, physical therapists and other nonphysician providers; please contact your credit-granting organization for their requirements.

**Meeting Objectives**

Upon completion of this conference, participants will gain strategies to:

- Review the specific pros, cons and scientific evidence regarding today's newest cutting edge spinal technologies;
- Participate directly in open forum dialogues on critical spinal practice issues and scientific controversies with a panel of key experts in each area;
- Explain to patients the key indications and limitations of the newest and most fundamental spinal therapies available today through focused didactic and open debate formats;
- Evaluate the advantages and drawbacks of several new spinal technologies as they apply to cases commonly encountered in spinal surgical practice.

**Evidence & Technology Spine Summit Session On Demand Recording**

Order the 16th Annual Evidence & Technology Spine Summit recording and get 24/7 access to the scientific presentations. This recording includes the electronic posters and scientific sessions. These web-based, fully synchronized audio, video and slide presentations are available anywhere you have an internet connection. Free to NASS member attendees.

**Disclaimer**

The material presented at the 16th Annual Evidence & Technology Spine Summit is made available by the North American Spine Society for educational purposes only. The material is not intended to represent the only, nor necessarily the best, method or procedure appropriate for the medical situations discussed; rather, it is intended to present an approach, view, statement or opinion of the faculty which may be helpful to others who face similar situations.

NASS disclaims any and all liability for injury or other damages to any individual attending the meeting and for all claims which may arise out of the use of the techniques demonstrated therein by such individuals, whether these claims shall be asserted by physicians or any other person.

This final program contains confirmed program content, faculty and presenters as of [month] [date], 2020. Any changes to the published final program will be announced at the beginning of each session.
Welcome Reception
The Welcome Reception is on Thursday, February 20 in the Technical Exhibition (Kokopelli II & III). This is a great opportunity to discuss meeting sessions, and meet colleagues and friends.

SpinePAC President’s Dinner
Drs. William Sullivan and Philip Schnieder will host a dinner at The Refectory-High West’s Distillery on Friday, February 21, from 7 to 9:30 p.m. Enjoy a savory 4-course meal, taste High West’s specialized whiskey cocktails and embark on a tour of the distillery, all while in the beautiful Uinta Mountains. Stop by the SpinePAC table for details.

Technical Exhibition
Visit the Technical Exhibition to complement the professional meetings and clinical sessions by evaluating first-hand the latest developments in equipment, supplies and services from 25 spine care companies.

Breakfasts, coffee/Après Ski breaks and the Welcome Reception are in the Technical Exhibition, Kokopelli II & III.

Technical Exhibition hours:
- Wednesday, February 19: 4:30-7:00 p.m.
- Thursday, February 20: 6:30-10:00 a.m.; 4:00-7:00 p.m.
- Friday, February 21: 6:30-10:00 a.m.; 4:00-7:00 p.m.
- Saturday, February 22: 7:00-9:30 a.m.

Industry Innovation Presentations
These presentations will occur throughout the week. Companies will highlight research and product information. Gain insight into the latest technological innovations.

- Thursday, February 20: 8:30-9:00 a.m.; 5:30-6:00 p.m.
- Friday, February 21: 8:30-9:00 a.m.
### Wednesday, February 19

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<tr>
<th>Time</th>
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<td>3:00-6:30 p.m.</td>
<td>Attendee and Guest Registration/Speaker Information Center</td>
<td>Kokopelli Lobby</td>
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<td>Technical Exhibition</td>
<td>Kokopelli II &amp; III</td>
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<td>5:00-6:30 p.m.</td>
<td>Après Ski Refreshments</td>
<td>Kokopelli II &amp; III</td>
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<td>5:00-6:30 p.m.</td>
<td><strong>Joint Session:</strong> Current State and Economic Impact of Allogeneic Cells as Fusion Adjuncts and Disc Regeneration</td>
<td>Kokopelli I</td>
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### Thursday, February 20

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<tr>
<td>6:30-7:30 a.m.</td>
<td>Breakfast</td>
<td>Kokopelli II &amp; III</td>
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<td>Networking Break</td>
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<td>9:00-10:30 a.m.</td>
<td><strong>Medical Session:</strong> Intervention Treatment of Axial Low Back Pain</td>
<td>White Pine Ballroom</td>
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<td>10:30 a.m.-4:00 p.m.</td>
<td>Break</td>
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<td>4:00 p.m.</td>
<td>Beverage Break</td>
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<td>Joint Session: The Opioid Crisis: What Now?</td>
<td>Kokopelli I</td>
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<td>8:30-9:00 a.m.</td>
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<td>Networking Break</td>
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<tr>
<td>9:00-10:30 a.m.</td>
<td>Medical Session: Injectable Biologics</td>
<td>White Pine Ballroom</td>
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<td>Surgical Session: The Current State of Infection Management in Spine Surgery</td>
<td>Kokopelli I</td>
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<td>10:30 a.m.-4:00 p.m.</td>
<td>Break</td>
<td>Kokopelli II &amp; III</td>
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<td>4:00 p.m.</td>
<td>Beverage Break</td>
<td>Kokopelli II &amp; III</td>
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<tr>
<td>4:00-5:00 p.m.</td>
<td>Joint Session: 2020 Advocacy Update</td>
<td>Kokopelli I</td>
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<td>4:00-7:00 p.m.</td>
<td>Registration/Speaker Information Center</td>
<td>Kokopelli Lobby</td>
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<td>5:00-5:30 p.m.</td>
<td>Networking Break</td>
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<td>Après Ski Refreshments</td>
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<tr>
<td>5:30-7:00 p.m.</td>
<td>Medical Session: Technologies Influencing Interventional Spine Care</td>
<td>White Pine Ballroom</td>
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**Saturday, February 22**

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<tr>
<td>7:00-8:00 a.m.</td>
<td>Breakfast</td>
<td>Kokopelli II &amp; III</td>
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<td>Technical Exhibition</td>
<td>Kokopelli II &amp; III</td>
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<td>7:00-10:00 a.m.</td>
<td>Registration/Speaker Information Center</td>
<td>Kokopelli Lobby</td>
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<td>7:30-9:00 a.m.</td>
<td>Joint Session: Redefining the Hospital/Industry Relationship</td>
<td>Kokopelli I</td>
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<td>9:00-9:30 a.m.</td>
<td>Networking Break</td>
<td>Kokopelli II &amp; III</td>
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<td>9:30-11:00 a.m.</td>
<td>Medical Session: Management of Chronic Pain in the Fewer Opioid Era</td>
<td>White Pine Ballroom</td>
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<td>Surgical Session: Management of Unexpected Complications in Spine Surgery</td>
<td>Kokopelli I</td>
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<tr>
<td>11:00 a.m.</td>
<td>Meeting Adjourns</td>
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**Wednesday, February 19**

**3:00-6:30 p.m.**

**Attendee and Guest Registration/Speaker Information Center**
Kokopelli Lobby

**4:30-7:00 p.m.**

**Technical Exhibition**
**Après Ski Refreshments (5:00-6:30 p.m.)**
Kokopelli II & III

**5:00-6:30 p.m.**

**Joint Session:**
**Current State and Economic Impact of Allogeneic Cells as Fusion Adjuncts and Disc Regeneration**
Kokopelli I
Moderators: Patrick C. Hsieh, MD, MS and Scott Kreiner, MD

- 5:00 Current Science and Evidence for Allogenic Stem Cells in Treatment of Degenerative Spine Disease
  Zorica Buser, PhD

- 5:15 Regenerative Medicine and Stem Cell Clinics: Myth or Reality
  Allen S. Chen, MD, MPH

- 5:30 Evidence for Intradiscal Biologic Treatments
  Byron J. Schneider, MD

- 5:45 Current Clinical Evidence of Spine Fusion with Allogeneic Stem Cells
  John C. Liu, MD

- 6:00 Is There Value in the Use of Allogeneic Stem Cells for Spine Fusions?
  Brandon D. Lawrence, MD

- 6:15 Discussion, Questions and Answers

**Thursday, February 20**

**6:30-7:30 a.m.**

**Breakfast**
Kokopelli II & III

**6:30-10:00 a.m.**

**Registration/Speaker Information Center**
Kokopelli Lobby

**Technical Exhibition**
Kokopelli II & III

**6:30-10:00 a.m.**

**Welcome/Introduction**
Kokopelli I

**7:05-8:30 a.m.**

**Joint Session:**
**Failed Back Syndrome: Is This Real?**
Kokopelli I
Moderator: John G. DeVine, MD

- 7:05 Failed Back Surgery Syndrome--What Is This?
  Sigurd H. Berven, MD

- 7:20 The Work-up: Rule Everything Out First
  John C. France, MD

- 7:35 Pitfalls in the Work-up and Treatment
  Gregory Grabowski, MD

- 7:50 Failed Back Surgery Syndrome: Conservative Management
  Jerome Schofferman, MD

- 8:05 Neuromodulation After Lumbar Spine Surgery
  Scott Kreiner, MD

- 8:20 Discussion, Questions and Answers
### 8:30-9:00 a.m.

**Industry Innovation Presentations**  
Kokopelli I

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<tr>
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| 8:30  | Orthofix  
The M6-C™ Artificial Cervical Disc: The Natural Choice            | James Ryaby, MD                                                             |
| 8:36  | Kuros Biosciences  
An Investigational Study of a Novel Parathyroid Hormone-Based Bone Graft Substitute for Interbody Spinal Fusion Using An In-Vivo Ovine Model: Emphasis on Osseointegration and Neurohistopathologic Response | Kyle B. Mueller, MD                                                         |
| 8:42  | Nexxt Spine  
Nexxt Matrixx: The Nexxt Level of 3D Printing  
Aaron Jennings, MBA and Mariah Woods, PhD |                                                                           |
| 8:48  | SeaSpine  
Strengthening the Bone-Implant Interface with Macro and Micro-scale Complimentary Technologies: An In-Vivo Evaluation | Gina MacBarb, PhD                                                          |
| 8:54  | Terumo BCT  
Autologous Biologics for Optimization of Spinal Fusion Outcomes  
Peter Passias, MD |                                                                           |

**Networking Break**  
Kokopelli II & III

### 9:00-10:30 a.m.

**Surgical Session:**  
Overcoming Decision Making Biases in Spine Surgery  
Kokopelli I  
Moderator: Andrew T. Dailey, MD

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<tr>
<td>9:00</td>
<td>Surgeons are Human After All: Common Biases</td>
<td>Sigurd H. Berven, MD</td>
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<td>9:20</td>
<td>Heuristics vs. Evidence-based Decision Making</td>
<td>Alan S. Hilibrand, MD</td>
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<td>9:40</td>
<td>Patient’s Perspective on Shared Decision Making</td>
<td>Nick Spina, MD</td>
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<td>10:00</td>
<td>Strategies to Overcome Bias: Seeking Quality and Consistency</td>
<td>Michael D. Daubs, MD</td>
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<td>10:20</td>
<td>Discussion, Questions and Answers</td>
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### 10:30 a.m.-4:00 p.m.

**Break**

**4:00 p.m.**  
**Beverage Break**  
Kokopelli II & III

### 4:00-7:00 p.m.

**Registration/Speaker Information Center**  
Kokopelli Lobby

**Technical Exhibition**  
Kokopelli II & III

### 9:00-10:30 a.m.

**Medical Session:**  
Interventional Treatment of Axial Low Back Pain  
White Pine Ballroom  
Moderator: David R. O’Brien, Jr., MD

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<td>9:00</td>
<td>Introduction</td>
<td>David R. O’Brien, Jr., MD</td>
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<tr>
<td>9:05</td>
<td>Etiologies of Axial Low Back Pain</td>
<td>David R. O’Brien, Jr., MD</td>
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<td>9:15</td>
<td>Facet Joint Blocks and Radiofrequency Ablation</td>
<td>Byron J. Schneider, MD</td>
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<td>9:45</td>
<td>Basivertebral Nerve Ablation</td>
<td>Scott Kreiner, MD</td>
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<td>10:00</td>
<td>Sacroiliac Joint Pain: Fusion vs. Radiofrequency Ablation</td>
<td>Zachary McCormick, MD</td>
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<td>10:15</td>
<td>Discussion, Questions and Answers</td>
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4:00-5:30 p.m.

**Surgical Session:**
**Robotics and Navigation in Complex and Minimally Invasive Spine Surgery**
Kokopelli I
Moderator: Patrick C. Hsieh, MD, MS

- 4:00 Why and How to Adopt Navigation and Robotics in Spine Surgery
  Jean Jacques Abitbol, MD

- 4:15 Navigation and Image Guidance in Complex and Minimally Invasive Spine Surgery
  John C. Liu, MD

- 4:30 Current Application of Robotics in Spine Surgery in 2020
  Paul Park, MD

- 4:45 Where is the Future of Navigation and Robotics in Spine Surgery?
  Wellington K. Hsu, MD

**Surgical Debate:**

- 5:00 Free-hand Technique and Conventional Surgical Treatment is Safe and Economical in Spine Surgery
  Andrew T. Dailey, MD

  Wellington K. Hsu, MD

- 5:20 Discussion, Questions and Answers

4:00-5:30 p.m.

**Medical Session:**
**Neuromodulation and Endoscopic Spine Procedures for the Interventionalist**
White Pine Ballroom
Moderator: Scott Kreiner, MD

  Scott Kreiner, MD

- 4:15 Cost-Utility Considerations in Spinal Cord Stimulation
  Graham Wagner, MD

- 4:30 A Primer on Dorsal Root Ganglion Stimulation
  Shane Brogan, MD

- 4:45 Endoscopic Spine: Approaches and Indications
  W. Evan Rivers, DO

- 5:05 Suggestions for the Responsible Training and Practice of Endoscopic Spine Surgeons
  W. Evan Rivers, DO

- 5:20 Discussion, Questions and Answers

5:30-6:00 p.m.

**Industry Innovation Presentations**
Kokopelli I

- 5:30 Cerapedics
  Morphological and Mechanical Evaluation of Newly Formed Bone
  Emmett Shearer, PhD

- 5:36 Globus
  Expandable Technology for Complex Spinal Applications
  Robert Brady, MD

- 5:42 NuVasive
  Surface Technologies to Drive Fusion
  Greg Williams, MD

- 5:48 Relevant Medsystems
  The Intracept® Procedure for the Relief of Chronic Vertebrogenic Low Back Pain
  Ray Baker, MD

**Networking Break**
**Après Ski Refreshments**
Kokopelli II & III

6:00-7:30 p.m.

**Joint Session:**
**Treatment of Lumbar Spine Disorders with Percutaneous Techniques: Endoscopy, Intracept® and Plasma Rich Protein (PRP)**
Kokopelli I
Moderators: Brandon D. Lawrence, MD and Zachary McCormick, MD

- 6:00 Walking the Line: Endoscopic vs. Open Spine Surgery
  W. Evan Rivers, DO

- 6:20 The Operative Perspective on Endoscopic Discectomy: Case and Video Presentation
  Michael C. Gerling, MD

- 6:40 Vertebrogenic Pain: Diagnosis and Treatment with Basivertebral Nerve Ablation
  Matthew Smuck, MD

- 7:00 Platelet Rich Plasma for the Treatment of Lumbosacral Discogenic Pain: State of the Evidence
  Zachary McCormick, MD

- 7:20 Discussion, Questions and Answers

7:30-9:00 p.m.

**Welcome Reception**
Kokopelli II & III
**Friday, February 21**

**6:30-7:30 a.m.**

**Breakfast**
Kokopelli II & III

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**6:30-10:00 a.m.**

**Registration/Speaker Information Center**
Kokopelli Lobby

**Technical Exhibition**
Kokopelli II & III

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**7:00-8:30 a.m.**

**Joint Session:**
**The Opioid Crisis: What Now?**
Kokopelli I
Moderators: Brandon D. Lawrence, MD and John G. DeVine, MD

- **7:00** Crisis Update: The Opioid Epidemic by the Numbers
  Sigurd H. Berven, MD

- **7:15** Opioids Perspective and Practice: Who is at Risk for Addiction?
  Jean Jacques Abitbol, MD

- **7:30** Opioids in Spine Pain Management: There is a Role
  Jerome Schofferman

- **7:45** Incorporating Alternative Perioperative Pain Control Options (Anti-inflammatories, Neuromodulators, Erector Spine Blocks)
  Nick Spina, MD

- **8:00** NSAIDs and Muscle Relaxants for Chronic Low Back Pain: Management Considerations and Evidence
  Zachary McCormick, MD

- **8:15** Discussion, Questions and Answers

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**8:30-9:00 a.m.**

**Industry Innovation Presentations**
Kokopelli I

- **8:30** Life Spine
  Restoration of Lordosis and Disc Height in TLIF Procedures: Review of a Novel Expandable Interbody Cage

- **8:36** SI-Bone
  Trends in Spinopelvic Fixation and SI Joint Fusion in Adult Deformity

- **8:42** Globus
  Single Position Lateral Surgery featuring ExcelsiusGPS
  Robert Brady, MD

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**8:48**

**CTL Amedica**
Benefits of Silicon Nitride in Spine Surgery
Jayme R. Hiratzka, MD

**Networking Break**
Kokopelli II & III

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**9:00-10:30 a.m.**

**Surgical Session:**
**The Current State of Infection Management in Spine Surgery**
Kokopelli I
Moderator: Brandon D. Lawrence, MD

- **9:00** Cervical Epidural Abscess
  Nick Spina, MD

- **9:15** Strategies to Address Osteomyelitis/Discitis Presenting with Significant Deformity Utilizing the Retropelvic Approach
  Jim A. Youssef, MD

- **9:30** Optimizing Modifiable Risk Factors Prior to Spine Surgery to Prevent Infection
  Jason W. Savage, MD

- **9:45** Post-operative Wound Infection After Instrumented Spine Surgery: Optimizing Outcomes, Retention of Hardware and Vacuum-assisted Closure
  Matt Colman, MD

- **10:00** Utilizing Disclosing Agents in Spine Surgery to Improve Outcomes
  Jeremy Shaw, MD

- **10:15** Discussion, Questions and Answers

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**9:00-10:30 a.m.**

**Medical Session:**
**Injectable Biologics**
White Pine Ballroom
Moderator: Zachary McCormick, MD

- **9:00** Introduction
  Zachary McCormick, MD

- **9:02** Understanding the Basics of Biologics
  Allen S. Chen, MD, MPH

- **9:25** Injectable Biologics for Discogenic Pain: An Evidence Update
  Byron J. Schneider, MD

- **9:45** Platelet Rich Plasma Injection for Sacroiliac Joint Complex Pain: An Evidence Update
  Zachary McCormick, MD
10:05  Stem Cells for Disc Regeneration: Patient Selection and Health Care Coverage
       Zorica Buser, PhD
10:25  Discussion, Questions and Answers

10:30 a.m.-4:00 p.m.
Break

4:00 p.m.
Beverage Break
Kokopelli II & III

4:00-5:00 p.m.
Joint Session:
2020 Advocacy Update
Kokopelli I
Moderator: Phillip L. Schneider, MD
4:00  Update on Current NASS Priority Legislation
       John G. Finkenberg, MD
4:10  Insights Into The 116th Congress
       U.S. Representative Ron Kind
4:30  How the Election Results Could Impact Healthcare
       Alan S. Hilibrand, MD
4:40  Political Engagement for NASS in An Election Year
       Paul R. Gause, MD
4:50  Modernizing of Congress
       U.S. Representative Tom Graves

5:30-7:00 p.m.
Surgical Session:
Adult Deformity Surgery: Who Needs It? Who Should Avoid It? Who is at Risk for Complications? Who is Amenable to Other Surgical Options?
Kokopelli I
Moderator: John G. DeVine, MD
5:30  Introduction and Case Presentation
       John G. DeVine, MD
       Michael D. Daubs, MD
5:55  The Work-up: When to Say the Risks of Surgery Outweigh the Potential Benefit
       Gregory Grabowski, MD
6:10  Preoperative: Optimization in the Elderly
       Sigurd H. Berven, MD
6:25  Intraoperative: Fixation Strategies in the Elderly Patient
       John C. France, MD
6:40  Case Resolution
       John G. DeVine, MD
6:45  Discussion, Questions and Answers

5:30-7:00 p.m.
Medical Session:
Technologies Influencing Interventional Spine Care
White Pine Ballroom
Moderator: Matthew Smuck, MD
5:30  Introduction
       Matthew Smuck, MD
5:40  Telehealth: Interventional Spine Care by Video
       Byron J. Schneider, MD
6:00  Endoscopic Interventions: Looking Ahead
       W. Evan Rivers, DO
6:15  Digital Technologies and Precision Spine Care
       Matthew Smuck, MD
6:45  Discussion, Questions and Answers

Friday, February 21

4:00-7:00 p.m.
Registration/Speaker Information Center
Kokopelli Lobby
Technical Exhibition
Kokopelli II & III

5:00-5:30 p.m.
Networking Break
Après Ski Refreshments
Kokopelli II & III
Saturday, February 22

7:00-8:00 a.m.
**Breakfast**
Kokopelli II & III

7:00-9:30 a.m.
**Technical Exhibition**
Kokopelli II & III

7:00-10:00 a.m.
**Registration/Speaker Information Center**
Kokopelli Lobby

7:30-9:00 a.m.
**Joint Session: Redefining the Hospital/Industry Relationship**
Kokopelli I
Moderator: Jason W. Savage, MD

7:30  Pitfalls of Race to the Bottom Pricing
Andrew T. Dailey, MD

7:50  Why Partnership is Better Than a Battle
Jason W. Savage, MD

8:10  Tactics for Creating New Partnerships
Jeffrey C. Wang, MD

8:30  Strategies for New Companies Entering Established Markets
Jim A. Youssef, MD

8:50  Discussion, Questions and Answers

9:30-11:00 a.m.
**Surgical Session: Management of Unexpected Complications in Spine Surgery**
Kokopelli I
Moderator: Jim A. Youssef, MD

9:30  What to do with Worsening Pain and Functional Outcome After Elective Spine Surgery?
Jeffrey C. Wang, MD

9:45  Complication Management in Minimally Invasive Spine Surgery
John C. Liu, MD

10:00  Dysphagia and Esophageal Injury after Anterior Cervical Surgery
Darrel S. Brodke, MD

10:15  Prevention and Management of Proximal Junctional Failures in Adult Spinal Deformity Surgery
Michael D. Daubs, MD

10:30  Staying Out of Trouble in Minimally Invasive Lateral Lumbar Spine Surgeries
Jim A. Youssef, MD

10:45  Management of Major Neurological Deficits After Spine Surgery
Paul Park, MD

11:00  Discussion, Questions and Answers

9:30-11:00 a.m.
**Medical Session: Management of Chronic Pain in the Fewer Opioid Era**
White Pine Ballroom
Moderator: Jerome Schofferman, MD

9:30  Introduction
Jerome Schofferman, MD

9:35  Approaching the Management of Patient Expectations in Patients with Chronic Low Back Pain: Enthusiasm vs. Realism
Zachary McCormick, MD

9:50  Medical Cannabis
Jerome Schofferman, MD

10:05  Cognitive Behavioral Therapy and Mindfulness Training
Katherine T. Fortenberry, PhD

10:25  Nutritional Potential for Pain Mitigation
Carrie A. Diulus, MD

10:40  Appropriate Use of Opioids Still Has a Role
Jerome Schofferman, MD

10:50  Discussion, Questions and Answers
Exhibit listing as of January 24, 2020

Breakfast, coffee/Après Ski breaks and the Welcome Reception are held in the Technical Exhibition, Kokopelli II & III.

**Cerapedics, Inc. **
www.cerapedics.com

Cerapedics is an advanced orthobiologics company focused on developing its proprietary biomimetic small peptide molecule (P-15) for commercialization in spinal applications. i-FACTOR® Peptide Enhanced Bone Graft (P-15/ABM) is only the second FDA PMA Approved bone graft on the market, and it has shown statistical superiority to local autograft through an IDE trial on single-level ACDFs in overall clinical success at two years. i-FACTOR® is the only biologic bone graft in orthopedics that incorporates a small peptide as an attachment factor to stimulate the natural bone healing process. This novel mechanism of action (Attract, Attach, Activate) is designed to support safer and more predictable bone formation compared to other commercially available bone growth factors.

**CTL Amedica **
www.ctlamedica.com

CTL Amedica Corporation is a forward thinking medical device design, development and manufacturing company aiming to become the leader in medical device technologies and biomaterials. Combining in-house manufacturing, advanced biomaterials and a robust R&D Center of Excellence continues to separate us from the competition. Visit us to learn how science, technology and cutting edge materials blend to create the CTL experience.

**DePuy Synthes Spine **
www.jnjmedicaldevices.com

DePuy Synthes Spine is the second largest spine company in the world with one of the most comprehensive portfolios of spinal care solutions that address key areas including thoracolumbar, cervical, aging spine, interbody fusion, and minimally invasive surgery.

**Globus Medical—Robotics **
www.globusmedical.com

Globus Robotics—ExcelsiusGPS® by Globus Medical is the first robotic navigation platform on the market which can go from robotics to navigation in seconds. Intuitively designed, the system streamlines the surgical workflow allowing for real-time tracking of instruments and implants. ExcelsiusGPS® enables confidence throughout the procedure and helps to migrate risk through its audible, visual, and tactile feedback ensuring accuracy each and every time.

**Integrity Implants **
www.integrityimplants.com

Founded in 2016, Integrity Implants focuses on unique expandable interbody technology. The FlareHawk family of expandable interbody are the world's first to expand in height, width and lordosis. FlareHawk, the answer to expandable interbody—expansion without compromise.

**Kuros Biosciences **
www.kurosbiosciences.com

Everyone with an interest in Spine research is talking about the "what" of surface topography & bone formation; Kuros are the first to figure out the "why". With over 30 peer-reviewed publications on surface-driven bone formation, we're confident as leaders in the science of orthobiology. 150 years cumulative research has delivered a bone graft that harnesses osteoimmunology to provide uniform, strong, stable and reliable fusions. Visit us at our booth to find out more about MagnetOs bone graft.

**Kyocera Medical Technologies, Inc. **
www.kyocera-medical.com

Kyocera Medical Technologies presents a complete line of cervical & lumbar cages with proprietary Tesera® porous titanium structure, engineered for bone on-growth & ingrowth, with load sharing bone interfaces and bone-like modulus of elasticity. Today we offer multiple systems for Anterior Cervical and Anterior Lumbar fusions in both traditional and standalone variants, as well as PLIF, TLIF and Lateral variants, all with multiple footprints and lordotic angles.

**Life Spine **
www.lifespine.com

Life Spine is a designer, developer and manufacturer of spinal implants and instrumentation. We focus on providing innovative solutions to address spinal pathology from the occiput to the sacrum. Our comprehensive product portfolio that centers around fusion and minimally invasive surgeries is driven by patient and surgeon needs.
**Lumenis #25**  
www.lumenis.com

Lumenis, the world’s largest surgical laser company, provides minimally invasive solutions for Spine, Gynecology, ENT, Urology and General Surgery. A rich assortment of CO2 and Holmium laser products is available for a variety of spinal pathologies, including microdiscectomy (MED) and endodiscectomy (PELD). Brands: Lumenis® MOSESTM pulse 120H, UltraPulse® duo, Holmium and CO2 range of end and side-firing fibers.

**Medtronic #6**  
www.medtronic.com

We believe in applying the full power of technology for better patient outcomes. In addition to alleviating pain, restoring health, and extending lives, we work in partnership with others to create seamless, more efficient care. Learn how we’re taking healthcare Further, Together at Medtronic.com.

**MicroGenDX #12**  
www.microgendx.com

MicroGen DX identifies causative microbes within patient samples and matches DNA sequence codes of 30,000+ microbial species with 99.9% accuracy. This technology provides physicians with the precise information needed to make confident treatment decisions based on solid DNA evidence. This knowledge ensures targeted antibiotic selection leading to superior patient outcomes.

**Misonix, Inc. #10**  
www.misonix.com

Misonix recognized leader in developing ultrasonic surgical devices for hard and soft tissue removal. The BoneScalpel is a unique tissue-selective ultrasonic osteotome allowing for en-bloc bone removal and refined osteotomies while sparing soft tissue structures. Many surgeons have noted the BoneScalpel as one of the greatest advancements in spine surgery.

**NuVasive, Inc. #19**  
www.nuvasive.com

NuVasive, Inc. (NASDAQ: NUVA) is the leader in spine technology innovation, focused on transforming spine surgery and beyond with minimally disruptive, procedurally integrated solutions designed to deliver reproducible and clinically-proven surgical outcomes. The Company's portfolio includes access instruments, implantable hardware, biologics, software systems for surgical planning, navigation and imaging solutions, magnetically adjustable implant systems for spine and orthopedics, and intraoperative monitoring service offerings. With more than $1 billion in revenues, NuVasive has approximately 2,600 employees and operates in more than 50 countries serving surgeons, hospitals and patients. For more information, please visit www.nuvasive.com.

**Orthofix, Inc. #11**  
www.orthofix.com

Orthofix is a global medical device company focused on musculoskeletal healing products and value-added services. The Company’s mission is to improve patients’ lives by providing superior reconstruction and regenerative musculoskeletal solutions to physicians worldwide. Headquartered in Lewisville, Texas, the Company has two strategic business units: Extremities and Spine.

**Relievant Medsystems, Inc. #13**  
www.relievant.com

Relievant Medsystems, a medical device company focused on solutions for chronic low back pain (CLBP), developed the Intracept Procedure—a minimally invasive procedure targeting the basivertebral nerve for the relief of CLBP. The Intracept Procedure is supported with two Level I randomized controlled trials demonstrating durable relief, clinical significance and consistent outcomes in subjects with CLBP. The Intracept System is FDA 510(k) cleared and commercially available in the US.

**RIWOspine, a Richard Wolf Company #15**  
www.riwospine.com

Richard Wolf Spine Endoscopy is now RIWOspine to better address the unique needs of the spine endoscopy community, with a global emphasis on innovation and education. We retain the resources of Richard Wolf, as well as a rich history of innovation in spine endoscopy, including the first instrument sets and techniques for transfemoral, interlaminar, cervical, stenosis, and rhizotomy. Visit us for the latest in spine endoscopy.
SeaSpine is a global medical device technology company focused on the design, development, and commercialization of surgical solutions for the treatment of patients suffering from spinal disorders. SeaSpine offers a differentiated, comprehensive portfolio of orthobiologics and spinal implant solutions to meet the varying needs and fusion requirements of its surgeon customers.

SI-BONE, Inc. is the leading sacroiliac (SI) joint medical device company dedicated to the development of tools for diagnosing and treating patients with low back issues related to certain SI joint disorders. The company has developed, and is manufacturing and marketing, minimally invasive products for patients with these disorders. The iFuse Implant System was developed as a minimally invasive surgical option for patients who have failed non-surgical options.

Spinal Elements is a leading designer, developer, and manufacturer of surgical solutions for spinal disorders headquartered in Carlsbad, California. Spinal Elements’ mission is to improve the lives of those who rely on our technology by being a trusted provider of innovation, quality, service, and value to those delivering care to spine surgery patients. We will continue to surround core differentiated technologies with supportive products and services to provide complete surgical solutions.

Spineology, an innovator in anatomy-conserving spine surgery, develops spinal implants and instruments. Spineology surgical techniques conserve spinal bone, ligament and muscle tissue. Spineology is committed to increasing procedural efficiency, reducing surgical morbidity and accelerating patient recovery. Learn more at spineology.com.

Stryker is one of the world’s leading medical technology companies and, together with our customers, is driven to make healthcare better. We offer innovative products and services in Orthopaedics, Medical and Surgical, and Neurotechnology and Spine that help improve patient and hospital outcomes.

Terumo BCT is a global leader in blood component, therapeutic apheresis, cellular and autologous biologic technologies. We believe in the potential of cells to do even more for patients than they do today. This belief inspires us to share our expertise in cell separation and collaborate with customers to advance the practice of autologous biologic technologies together.

Xtant Medical develops, manufactures and markets class-leading regenerative medicine products and medical devices for domestic and international markets. Xtant products serve the specialized needs of orthopedic and neurological surgeons, including orthobiologics for the promotion of bone healing, implants and instrumentation for the treatment of spinal disease, tissue grafts for the treatment of orthopedic disorders, and biologics to promote healing following cranial, foot and ankle surgeries.
NASS Financial Conflict of Interest Disclosure Policy

NASS recognizes that professional relationships with industry are essential for development of new spine technologies and medical advancement. According to the NASS Ethics Committee, which authored the disclosure policy, “the goal is to create an environment of scientific validity, in which learners can accurately judge whether the information they receive is objective and unbiased, and to be sure that our members are current and forthright in their dealings with one another and with their colleagues and patients.” The establishment of uniform disclosure requirements frees individuals from having to decide which relationships might influence his or her decision-making and which are irrelevant; transparent disclosure allows the audience to participate in the interpretation of the significance. All authors and faculty speaking at the Annual Meeting have been required to provide complete disclosure of all potential conflicts of interest.

Commercial Support Disclosure

As a sponsor accredited by the ACCME, the North American Spine Society must ensure balance, independence, objectivity and scientific rigor in all its sponsored activities. All individuals participating in a NASS-sponsored CME activity should disclose to the audience all financial interests or other relationships with any commercial interest that occurred within the past 12 months. Financial interests or other relationships, include: grants or research support, employee, consultant, major stockholder, member of the speaker's bureau, etc. Disclosure information is available visually on a PowerPoint® slide before each presentation, in this Final Program and in The Spine Journal Proceedings supplement. Also, audience members who volunteer questions or statements during symposia, focused discussions, or other educational events should disclose their own conflicts to the assembled group before proceeding with their comments.

Program Committee Statement on Resolution of Conflict of Interest in Presentations

The intent of this disclosure is to ensure that all conflicts of interest, if any, have been identified and have been resolved prior to the speaker's presentation. By doing so, the North American Spine Society has determined that the speaker's or author's interests or relationships have not influenced the presentation with regard to exposition or conclusion; nor does the Society view the existence of these interests or commitments as necessarily implying bias or decreasing the value of the presentation.

FDA Disclosure

If a device or drug requiring FDA approval is an important component of a presentation, the author must indicate the FDA status of those devices or drugs as Approved, Investigational or Not Approved for distribution within the United States. The Final Program and The Spine Journal Proceedings supplement will include all FDA status information. Certain medical devices and drugs identified at the 16th Annual Evidence and Technology Spine Summit may have FDA clearance for use for specific purposes only, or in restricted research settings. The FDA has stated it is the responsibility of the physician to determine the FDA status of each drug or device he or she wishes to use in clinical practice and to use these products in compliance with applicable law.

These disclosures are current as of January 8, 2020.

Range Key

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Abitbol, Jean-Jacques: Consulting: Nanovis (C); Royalties: Globus Medical (C), Nanovis (B); Scientific Advisory Board: St. Theresa Medical (advisory only); Stock Ownership: St. Teresa Medical (<1%).

Arnold, Paul M.: Board of Directors: AANS/CNS Joint Section on Neurotrauma (Nonfinancial), CSRS (Nonfinancial), LRSRS (Nonfinancial), SpineEx (1%); Consulting: Asterias (A, Outside 12-Month Requirement), Cereapdeics (C), Medtronic (B), Spine Wave (B); Research Support (Staff and/or materials): Evoke Medical, LLC (40%, Paid directly to institution/employer).

Berven, Sigurd H.: Consulting: Innovasis (B), Medicrea (C), Medtronics (C); Fellowship Support: Globus Medical (D); Grants: AO Spine (E, Paid directly to institution/employer), Globus (D, Paid directly to institution/employer); Private Investments: Green Sun Medical (50,000 Shares), Royalties: Stryker (F); Scientific Advisory Board: Globus Medical (Stock options), Speaking and/or Teaching Arrangements: Medtronic (B), Stryker Spine (B); Stock Ownership: Globus Medical (25,000 Shares), Providence Medical (2,500 Shares), Trips/Travel: Scoliosis Research Society (Travel Expense Reimbursement, Paid directly to institution/employer).

Brodke, Darrel S.: Royalties: Amedicca (D), Medtronic (B); Scientific Advisory Board: Vallum (A); Fellowship Support: AOSpine (E, Paid directly to institution/employer).

Brogan, Shane: Nothing to Disclose.
Buser, Zorica: Consulting: AO Spine (B), Xenco Medical (B); Research Support (Investigator Salary): SeSpine (F, Paid directly to institution/employer); Research Support (Staff and/or materials): SeSpine (F, Paid directly to institution/employer); Trips/Travel: AO Spine (Travel Expense Reimbursement).

Chen, Allen S.: Nothing to Disclose.


Colman, Matthew: Consulting: Alphatec Spine (B), Medicrea International (B), Spinal Elements (A); Fellowship Support: AO Spine (A); Grants: CSRS (D, Paid directly to institution/employer); Speaking and/or Teaching Arrangements: DePuy Synthes Spine (B), K2M (B)

Dalley, Andrew T.: Biomet/Zimmer/Lanx (D, Development of cervical fusion device); Consulting: K2M (Financial, Grant support, 100,000, Paid directly to institution/employer); Speaking and/or Teaching Arrangements: Medtronic (Financial, Consulting, 8000); Research Support - Staff and/or Materials: K2M (E, Grant for FEM project developed through the Dept of Bioengineering at the University of Utah, Paid directly to institution/employer); Relationships Outside the One-Year Requirement: Biomet (2008-15, Royalties, E, Development of a cervical fusion device).

Daubs, Michael D.: Board of Directors: AO Spine North America (B, Paid directly to institution/employer), Cervical Spine Research Society (Nonfinancial, Paid directly to institution/employer), Lumbar Spine Research Society (Nonfinancial, Paid directly to institution/employer); Other: The Spine Journal (B, Paid directly to institution/employer); Research Support (Investigator Salary): Pfizer (B, Paid directly to institution/employer); Royalties: Depuy Synthes (F, Paid directly to institution/employer).

DePasse, John Mason: Nothing to Disclose.

DeVine, John G.: Consulting: FacetLink (B), Globus (B), Spinal Elements (B), StartBox (B), Ulrich (D); Speaking and/or Teaching Arrangements: AO North America - AOSpine (B); Staff and/or Materials: Medtronic (E, Paid directly to institution/employer); Royalties: Depuy Synthes (F, Paid directly to institution/employer).

Diulus, Carrie A.: Trips/Travel: NASS (Financial, Reimbursement for travel expenses).

Dohring, Edward J.: Royalties: Stryker (D, Paid directly to institution/employer); Private Investments: Anzu (.03%); Board of Directors: NASS Secretary (Travel Expense Reimbursement); Research Support - Staff and/or Materials: Medtronic (B, Paid directly to institution/employer).

Donelson, Ronald G.: Stock Ownership: Chord Health (4.00%).

Fehlings, Michael G.: Consulting: Fortuna Fix (B).

Finkenberg, John G.: Other: Zimmer/Biomet (B).

Fortenberry, Katherine T.: Nothing to Disclose.

France, John C.: Nothing to Disclose.

Gause, Paul R.: Speaking and/or Teaching Arrangements: Medtronic (C).

Gerling, Michael C.: Nothing to Disclose.

Gidvani, Sandeep N.: Consulting: Xenco Medical (B), Seaspine (None), Spinal Balance (None), SI Bone (None), Nuvasive (None).

Ghogawala, Zoher: Board of Directors: Cervical Spine Research Society (Nonfinancial, Research Committee Chair, Registry Director), GN2.0-Nidus (66%), Joint Spine Section - AANS-CNS (Nonfinancial, Chair).

Grabowski, Gregory: Nothing to Disclose.


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Kauffman, Christopher P.: Consulting: Healthtrust (C); Other: Turning Point (Salary, Turning Point is a third party doing authorization for several different insurance carriers).

Kreiner, Scott: Speaking and/or Teaching Arrangements: Spine Intervention Society (Travel expenses).

Lahey, Donna M.: Speaking and/or Teaching Arrangements: NASS (B, Paid directly to institution/employer); Trips/Travel: NASS (Travel Expense Reimbursement, Paid directly to institution/employer).

Lawrence, Brandon Douglas: Board of Directors: AO Spine North America (Nonfinancial, Paid directly to institution/employer), Cervical Spine Research Society (Nonfinancial, Paid directly to institution/employer); Fellowship Support: AO Spine North America (E, Paid directly to institution/employer); Trips/Travel: AO Spine North America (B, Paid directly to institution/employer).

Liu, John C.: Consulting: Viseon (None); Trips/Travel: Nass (Travel Expense Reimbursement).

Long, William D.: Nothing to Disclose.

McCormick, Zachary: Board of Directors: Spine Intervention Society (Travel Expense Reimbursement).


Mroz, Thomas E.: Royalties: Stryker (F).

Muehlbauer, Eric J.: Nothing to Disclose.

O’Brien, David Reese: Nothing to Disclose.

Ohnmeiss, Donna D.: Board of Directors: NASS (Travel Expense Reimbursement); Other: Texas Back Institute Research Foundation (Salary).

Park, Paul: Consulting: Allosource (B, Outside 12-Month Requirement), Globus Medical (C), NuVasive (D); Grants: DePuy (B, Outside 12-Month Requirement, Paid directly to institution/employer), Pfizer (C, Outside 12-Month Requirement, Paid directly to institution/employer), Vertex (C, Outside 12-Month Requirement, Paid directly to institution/employer); Royalties: Globus Medical (E).
Patel, Alpesh A.: Royalties: Amedica (B); Stock Ownership: Amedica (<1%), Cytonics (<1%), Nocimed (<1%), Vital5 (<1%); Endoluxe (<1%); Tissue Differentiation Intelligence (<1%); Consulting: Amedica (None), Zimmer Biomet (B), DePuy Synthes (None), NuVasive (None), Kuros Biosciences (None); Board of Directors: Cervical Spine Research Society (Nonfinancial), Lumbar Spine Research Society (Nonfinancial); Scientific Advisory Board: Kuros Biosciences (None), Grants: Cervical Spine Research Society (A, Paid directly to institution/employer), NuVasive (D, Paid directly to institution/employer).

Pourtaheri, Sina: Nothing to Disclose.

Qureshi, Sheeraz A.: Board of Directors: Minimally Invasive Spine Surgery Group (Nonfinancial); Consulting: Globus (B), K2M (D, And Designer), Paradigm Spine (C), RTI (Nonfinancial, And Designer), Stryker Spine (D); Other: Healthgrades (B, Board member); Other Office: AAOS (Nonfinancial, Evaluations Committee), CSRS (Program Committee), CSRS (Survey Committee), NASS (MIS Committee), NASS (Value Committee); Private Investments: Avaz Surgical (None, 2.00%), Vital S (None, 2.00%), Scientific Advisory Board: Onpoint Surgical, (Nonfinancial), Zimmer (Nonfinancial), Speaking and/or Teaching Arrangements: Globus (Nonfinancial), Medtronic (Nonfinancial), Stryker (Nonfinancial).

Reiter, Mitchell F.: Private Investments: CreOsso (4%).

Reitman, Charles A.: Board of Directors: NASS (Travel Expense Reimbursement); Other: NASS (Nonfinancial); Scientific Advisory Board: Clinical Orthopaedics And Related Research (B, Paid directly to institution/employer).

Rivers, W. Evan: Nothing to Disclose.

Savage, Jason W.: Consulting: Stryker Spine (D), Wright Medical (B); Fellowship Support: AO Spine (E, Paid directly to institution/employer).

Schneider, Byron J.: Consulting: AIM Specialty (B), PDA (B); Speaking and/or Teaching Arrangements: NASS (A), SIS (A); Trips/Travel: AAPM&R (A); Scientific Advisory Board: Tennessee State Technical Advisory Committee Spine Episodes of Care (Nonfinancial).

Schneider, Philip L.: Royalties: Biomet (D); Consulting: Collagen Matrix (B).

Schofferman, Jerome: Nothing to Disclose.

Schroeder, Gregory Douglas: Board of Directors: CSRS, Clinical Spine Surgery (Nonfinancial), Consulting: Zimmer (C), Stryker (C), Advanced Medical (C), Medtronic (C); Trips/Travel: Aospine (C).

Shaw, Jeremy D.: Grants: Stryker Spine (Travel Expense Reimbursement, Educational Grant).

Simon, Jeremy Ian: Nothing to Disclose.

Skolasky, Richard L.: Board of Directors: North American Spine Society (Nonfinancial, Governance Committee, Chair Research Program Management, Chair Board of Directors, voting member); Other: International Society For Quality Of Life Research (Nonfinancial, Associate Editor for Quality of Life Research)."

Smuck, Matthew: Board of Directors: Spine Intervention Society (None); Consulting: Consultant & expert witness - State Farm (F), Spine Biopharma (Future Compensation Expected); Grants: Relevant Medsystems (F, Paid directly to institution/employer), ReWalk (E, Paid directly to institution/employer); Private Investments: Vivametrics (15.00%), Scientific Advisory Board: BlueJay Mobile-Health (Stock options), NuSpine (Stock options); Stock Ownership: BlueJay Mobile-Health (<1%), NuSpine (<1%); Trips/Travel: Spine Intervention Society, Board of Directors (B, Travel Expenses).

Spiker, W. Ryan: Consulting: NEXXT (B); Fellowship Support: AO Spine / Depuy Synthes (D, Paid directly to institution/employer).

Spina, Nicholas: Nothing to Disclose.

Sullivan, William J.: Board of Directors: NASS (Board of Directors, Executive Committee), Trips/Travel: NASS (B).

Swartz, Karin R.: Research Support (Staff and/or materials): Veterans Affairs Administration (C, Paid directly to institution/employer), Speaking and/or Teaching Arrangements: AANS/CNS (B, Travel expenses), NACCME (B, travel expenses), NASS (B, Travel expenses).

Trumeees, Eeric: Board of Directors: Seton Family of Doctors (No additional pay, part of base compensation); Other Office: AAOS Communications Cabinet (E); Research Support (Staff and/or materials): Dova Pharmaceuticals (A, Paid directly to institution/employer), Medtronic (C, Paid directly to institution/employer), Pfizer (E, Paid directly to institution/employer), Relevant (F, Paid directly to institution/employer), Stryker Spine (B, Paid directly to institution/employer), Vertex Pharma (D, Study cancelled, Outside 12-Month Requirement, Paid directly to institution/employer); Trips/Travel: AAOS (Travel Reimbursement).

Wagner Graham E.: Nothing to Disclose.

Wang, Jeffrey C.: Board of Directors: AOFoundation (C), Cervical Spine Research Society (Travel Expenses), North American Spine Society (Travel Expenses); Fellowship Support: AO Foundation (E, Paid directly to institution/employer); Private Investments: Bone Biologics (<1%), elecurot (1%); pearldiver (<1%), surgitech (<1%); Royalties: Amedica (B), Biomet (F), DePuy Synthes (C), SeaSpine (C).

Woods, Barrett: Consulting: Altus (D, Paid directly to institution/employer), Precision (B), Titan (D); Device or Biologic Distribution Group (Physician-Owned Distributorship): Altus (B); Speaking and/or Teaching Arrangements: Stryker (C).

Youssef, Jim A.: Board of Directors: Society of Lateral Access Surgery (SOLAS) (None, Past-president); Consulting: CTL/Amedica (A), Healthtrust (A), Nuvasive (D), Providence Medical (None), Seaside (None); Research Support (Staff and/or materials): Globus Medical (C, Paid directly to institution/employer), Medtronic (B, Paid directly to institution/employer), Nuvasive (D, Paid directly to institution/employer), Providence Medical (B, Paid directly to institution/employer), Seaside (C, Paid directly to institution/employer), SOLAS (C, Paid directly to institution/employer), Vertifex (B, Paid directly to institution/employer); Royalties: CTL/Amedica (C), Nuvasive (F), Osprey Biomedical (B, Outside 12-Month Requirement), Seaside (C); Stock Ownership: Nuvasive (G, 19,000 options), Nuvasive (8,000 shares), Providence Medical (None, 1,000 stock options).
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