**Appendix A. Team Physician Pain Management Survey: Rio 2016 Olympic Games**

This survey was conducted in August 2016 during the Rio Olympic Games. The aim of the survey was to inform the participants of the IOC Consensus Meeting on Pain Management in Elite Athletes to:

* Enable a better understanding of clinical practices relating to pain management in elite athletes;
* Help to understand the effect of the WADA Prohibited List on pain management practices;
* Assess the need for new athlete and physician education.

All National Olympic Committee Team Physicians were invited to participate and a total of 107 physicians completed the survey. The survey was announced at the Team Physician Meeting in the Olympic Village on the day before the Opening Ceremony of the Games, and participants were asked to complete the survey by the end of the Games on 21 August. The responses were collected anonymously and participation in the study was voluntary.

The survey was available in English (64 responses), French (15 responses), Spanish (13 responses), and Russian (15 responses). All data have been translated to English for this report. Short descriptive summaries of the results of each question are provided as a guide; however, the intention of this survey was to provide information to be used by the expert participants of the IOC Consensus Meeting, as additional data related to their specific areas of expertise.

A more comprehensive discussion paper and data analysis is planned following the IOC Consensus Meeting. Suggestions for interpretation of the results and further in-depth analysis are invited. Contact contributor for this survey is Mark Stuart markcstuart@gmail.com

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**Methods**

The survey was developed and reviewed in collaboration with members of the 2016 IOC Consensus Meeting on Pain Management in Elite Athletes, and representatives from the medical department at WADA. Prior to the Games it was validated and tested by physician members of the IOC Medical and Scientific Commission Games Group.

The survey was announced at the Team Physician Meeting in the Rio 2016 Olympic Village on the day before the Opening Ceremony of the Games, and all 721 team physicians were invited to participate. Participants were asked to complete the survey before the end of the Games on 21 August 2016. The responses were collected anonymously and participation in the study was optional. The survey was available in English, French, Spanish, and Russian.

The question topics covered:

1. Clinical and sport-specific specialties of physician respondents

2. Prevalence of analgesic or anti-inflammatory medication in athletes

3. Factors influencing prescribing

4. Considerations when forming a pain management treatment plan for an athlete

5. Types of pain or anti-inflammatory medications commonly prescribed

6. Analgesic use during competition

7. Non-pharmacological interventions for pain management

8. Factors when selecting NSAIDs for athletes

9. Dose prescribed immediately prior to competition

10. Length of NSAID prescribing

11. Pain prophylaxis immediately before competition

12. Attitudes to risks of concurrent analgesic prescribing

13. Impact of the WADA Prohibited List on analgesic prescribing

14. Effect of opioid-related analgesics on performance enhancement

15. Comparison of analgesia classes for performance continuation

16. Further education and information

**Results**

A total of 107 of the 721 (15%) physicians registered as attending the Olympic Games as part of a team completed the survey (64 responses in English; 15 French; 13 Spanish; 15 Russian).

1. Clinical and sport-specific specialties of physician respondents

The largest specialty group was general sports-medicine in the primary care setting (58%), followed by orthopaedic specialists (20%) and emergency medicine specialists (15%). Most physicians (88%) stated they treated athletes across more than one sport, with 12% of physicians stating they only treated athletes from one sport.

This spread of sports of the athletes that were under the care of the physicians generally also reflected the population size of the athletes competing in these sports at the Rio 2016 Olympic Games. 66% of physicians treated athletes competing in athletics and 59% of physicians treated athletes competing in swimming. The next most common sports that physicians worked with were cycling (37%) and boxing (37%).

2. Prevalence of analgesic or anti-inflammatory medication use

39% of respondents reported routine use of either oral, topical or injectable analgesic or anti-inflammatory medication in up to 10% of athletes; 37% in 11-30% of athletes; 24% in 30-100% of athletes.

3. Factors influencing prescribing

The physicians were asked to indicate the importance they placed on various clinical and performance-related factors when prescribing pain or anti-inflammatory medications to the athletes they treat.

*Pain or inflammation from an existing injury*

50% of physicians consider pain and inflammation the most important factors when prescribing analgesics or anti-inflammatory drugs.

*Prevention of pain or inflammation during training or competition*

36% of physicians consider *prevention* of pain and inflammation to be the least important factor when prescribing analgesics or anti-inflammatory drugs; only 7% consider *prevention* to be very important when prescribing.

*Prevention of delayed-onset muscle soreness (DOMS) following training or competition*

57% of physicians consider *prevention* of DOMS to be the least important factor when prescribing analgesics or anti-inflammatory drugs; only 4% consider *prevention* of DOMS to be very important when prescribing.

*Performance or endurance improvement during competition*

66% of physicians consider *performance or endurance improvement* to be the least important factor when prescribing analgesics or anti-inflammatory drugs; 6% consider *performance or endurance improvement* to be very important when prescribing.

4. Considerations when forming a pain management treatment plan for an athlete

The physicians were asked to indicate the importance they placed on the following clinical and performance-related factors when forming a treatment plant for the athletes they treat.

*General pain management*

81% of physicians consider *pain management* to be *important* or *very important* when forming a treatment plan for an athlete.

*Decreasing pain during competition or training*

61% of physicians consider *the reduction of pain during competition or training* to be *important* or *very important* when forming a treatment plan for an athlete.

*Ensuring performance continuation during competition or training*

56% of physicians consider *the ability to ensure continuation of competition or training* to be *important* or *very important* when forming a treatment plan for an athlete.

*Impact on performance*

45% of physicians consider *the impact on performance* to be *important* or *very important* when forming a treatment plan for an athlete. Interestingly, 23% consider the *impact on performance* to be *not important*.

*Impact on physical recovery*

68% of physicians consider *the impact on recovery* to be *important* or *very important* when forming a treatment plan for an athlete.

*Enabling rehabilitation exercises*

71% of physicians consider *the ability to enable rehabilitation exercises* to be *important* or *very important* when forming a treatment plan for an athlete.

5. Types of pain or anti-inflammatory medications commonly prescribed

The following table shows the numbers of physicians reporting prescribing of specific medications within the last 12 months.

*Table: Which pain or anti-inflammatory medications have you prescribed to athletes in the last 12 months?*

Oral NSAIDs are the most commonly prescribed analgesic and anti-inflammatory medications in athletes, with diclofenac, ibuprofen, naproxen and ketorolac being the most frequent prescribed medications within this class.

Paracetamol is also one of the most frequently prescribed analgesic for athletes. Tramadol is the most prescribed opioid-type analgesic drug, which may be potentially linked to the fact that it is one of the few opioid analgesic drugs that are not prohibited on the WADA 2016 List of Prohibited Substances and Methods.

6. Analgesic use during competition

The physicians were asked what their preferred analgesic or anti-inflammatory medication would be for administration to athletes immediately before they competed in an event, or for administration during competition. The responses for the preference of medication relating to the range of pain intensities can be summarised as follows, and illustrated in the table below.

*Mild pain during, and immediately before competition*

Oral NSAIDs and paracetamol are preferred by most physicians.

*Moderate pain during, and immediately before competition*

Oral NSAIDs and paracetamol are also most frequently used for moderate pain. Topical NSAIDs are also used for *moderate pain* more commonly than in mild or severe pain. In comparison, injectable NSAIDs and anaesthetics are still used for moderate pain but to a much lesser extent.

*Severe pain during, and immediately before competition*

Injectable NSAIDs are preferred most for *severe pain* than mild or moderate pain, and are used more frequently than opioid drugs or local anaesthetic injections for severe pain. However, local anaesthetic injections are preferred more for *severe pain* than opioid drugs. In general, oral opioid drugs are reserved primarily for s*evere pain* in athletes.

7. Non-pharmacological interventions for pain management

The physicians were asked what non-pharmacologic measures they would prefer to recommend to competing athletes, immediately before or during competition. Preferred interventions for the treatment of mild, moderate and severe pain were recorded, and are illustrated in the table below.

*Mild and moderate pain*

Physical therapy was identified as the most preferred non-pharmacological treatment for pain. It was preferred primarily for mild and moderate pain treatment, rather than severe pain. Of the physical therapy interventions, massage was preferred for mild pain treatment more than severe pain, and acupuncture was broadly used similarly across the full spectrum of pain intensities.

*Severe pain*

Electrical stimulation therapy and spinal manipulation were primarily preferred for severe pain. Surgical interventions were exclusively preferred only for severe pain treatment.

Trigger point therapy and myofacial release was preferred mostly for the treatment of severe pain.

8. Factors when selecting NSAIDs for athletes

Physician participants were asked to rank the importance, from least to greatest, of the various factors that contribute to their selection of NSAIDs for athletes. The most important considerations reported were side effects, pain severity, comorbidities, and duration of therapy. Cost and social issues were the least important factors. The availability of drugs at the point of care appears to significantly influence selection of NSAIDs.

*Table: How important are the following factors when selecting NSAID medications?*

9. Dose prescribed immediately prior to competition

When prescribing analgesia or anti-inflammatory medications immediately prior to an athlete competing, 87% of physicians prescribe according to the manufacturer’s recommended dose; 12% prescribe between 30 – 50% higher than the manufacturer’s recommended dose.

*Table: When prescribing anti-inflammatory medications to athletes immediately prior to competition, what dose do you typically prescribe?*

10. Length of NSAID prescribing

The duration of treatment prescribed by most physicians was within the recommended duration of therapy provided by most manufacturers. The majority of physicians prescribe NSAIDs for a short duration between 1 and 5 days. 31% usually prescribe NSAIDs for a short 1-3 days course; 42% usually a 3-5 days course. However, 21% of physicians noted that they prescribe NSAIDs for longer than 1 week.

11. Pain prophylaxis immediately before competition

Physicians were asked how often they would normally prescribe analgesia immediately before the athlete competes, with the intention of preventing potential pain that might be experienced during competition, 48% of physicians stated they *never* prescribe analgesia as prophylaxis before competition, but the responses indicate that the practice of prophylactic analgesic prescribing does occur in elite athletes. 5% of physicians *often* prescribe analgesia before competition; 11% sometimes; and 36% rarely prescribe analgesia to prevent pain during competition.

*Table: How often would you prescribe analgesia immediately before competition to prevent pain that might be experienced during competition?*

12. Attitudes to risks of concurrent analgesic prescribing

Participants were asked whether they think there were any significant additional risks associated with prescribing different classes of pain medications concurrently; for example, concurrent prescribing of opioid analgesics with NSAIDs, or multiple NSAID use. Most physicians (68%) indicated that concurrent use of different classes of pain medications posted significant risks. However, 20% of physicians *did not* think there are significant risks associated with such concurrent prescribing; 12% indicated they were not sure of specific risks.

13. Impact of the WADA Prohibited List on analgesic prescribing

The team physicians surveyed were asked whether the classification of “Narcotics” on the WADA List of Prohibited Substances and Methods constrained their prescribing of these drugs for legitimate therapeutic use.49% of physicians considered the presence of these narcotics analgesic drugs on the WADA Prohibited List to constrain their ability to prescribe these drugs.

*Table: Does the classification of “Narcotics” on the WADA List of Prohibited Substances and Methods constrain your prescribing of these drugs for legitimate therapeutic use?*

14. Effect of opioid-related analgesics on performance enhancement

A number of opioid-related medications are permitted to be used by competing athletes, and are not currently listed on the WADA List of Prohibited Substances and Methods. Examples of currently permitted opioid-related analgesics include tramadol, codeine, and dihydrocodeine.

Physicians were asked whether weaker opioid medications such as tramadol or codeine can be performance enhancing in healthy, non-injured athletes when used for moderate to severe pain, or if used for pain prevention. The intention of this question was to explore whether analgesics were being used prophylactically for pain relief during competition, where there was no current injury present.

The majority (61%) of physicians indicated that they *do not* think that opioid medications for moderate to severe pain could be performance enhancing in healthy, non-injured athletes. However, 18% indicated they could be performance enhancing.

*Table: Do you think that opioid medications for medium to severe pain (such as tramadol or codeine) can be performance enhancing in a healthy, non-injured athlete?*

15. Comparison of analgesia classes for performance continuation

Physicians were asked their opinion on whether they considered various analgesia regimens might be effective in allowing an injured athlete to continue to compete in an event.

*Simple analgesics*

88% of physicians consider *simple analgesics* (such as paracetamol or NSAIDS) to be effective *either always or sometimes* to allow an injured athlete to continue to compete in an event.

*Opioids for moderate to severe pain*

65% of physicians consider *opioids for moderate to severe pain* (such as tramadol or codeine) to be effective *either always or sometimes* to allow an injured athlete to continue to compete in an event.

*Opioids for severe pain*

79% of physicians consider *opioids for severe pain* (such as morphine) to be effective *either always or sometimes* to allow an injured athlete to continue to compete in an event.

*Analgesic adjuvants*

67% of physicians consider *analgesic adjuvants* (such as gabapentin) to be effective *either always or sometimes* to allow an injured athlete to continue to compete in an event.

16. Further education and information

*Support requirements of physicians*

Physicians were asked whether they would personally benefit from additional support to help them to appropriately prescribe analgesia to athletes. The majority (70%) of physicians indicated they would benefit specifically from additional teaching, prompts or reference tools to help them prescribe analgesia to athletes.

*Educational resources for athletes*

The majority (84%) of physicians indicated that the athletes they treat would benefit from new educational material on the safe and effective use of analgesics and anti-inflammatory drugs.

**Appendix B. Key Terminology**

Pain Definitions

*Pain*: An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage.1

*Nociplastic/algopathic/nocipathic pain*: Pain in the absence of an identifiable noxious stimulus, inflammation, or neural damage. Individuals with this pain have clinical and psychophysical findings (hypersensitivity) that suggest altered nociceptive function despite no clear evidence of tissue damage or disease or lesion of the somatosensory nervous system. Examples: fibromyalgia; myofascial pain; complex regional pain syndrome without associated nerve injury. 2

*Inflammatory pain:* A type of nociceptive pain that results from the activation and sensitization of nociceptors by inflammatory mediators. This pain is common in acute traumatic sport injury with associated swelling and inflammation. 3

*Neuropathic pain*: Pain resulting from a lesion or disease in the somatosensory nervous system. This pain is common in Paralympic athletes with spinal cord injury. Examples: thalamic stroke; diabetic neuropathy; spinal cord injury pain; complex regional pain syndrome with nerve injury. 1 2

*Nociception*: The neural processes of encoding and processing noxious stimuli (thermal, chemical, pressure).1

*Nociceptive pain*: Pain clearly associated with tissue damage or inflammation. 1 2 Examples: acute ankle sprain.

Injury Definitions

*Acute traumatic injury*: Injury caused by a single event that leads to a singular macrotrauma on previously health tissue. The injury often results from participation in sport and not from faulty training or biomechanics.4

*Chronic degenerative condition*: A condition that may form a continuum with overuse injuries. Degenerative conditions may develop independent of sport injury, but may equally develop as a result of prior acute or repetitive overuse injuries.5

*Kinetic Chain Continuum*: The kinetic chain continuum is the mechanical linkages of body segments that allows for the sequential transfer of forces and motions when performing a task. 6 7

*Macrotrauma*: Trauma from a singular event that results in a clinical injury. Examples of injuries from macrotrauma include acute ankle sprains and acute joint dislocations.4

*MIcrotrauma*: Trauma that does not lead to an acute clinical injury. Microtrauma refers to subclinical stresses and/or tearing of muscle fibres, connective tissue, tendons and bones. Repetitive microtrauma without tissue recovery can lead to clinical injury. Examples of injuries from microtrauma include tendinopathies and stress fractures.8 9

*Overuse injury*: Injury from repetitive submaximal loading of the musculoskeletal system when inadequate rest has not allowed structural adaptation to occur. Injury may result from repetitive microtrauma imposed on otherwise healthy tissue or repeated application of lesser force to already damaged tissue.8 10

*Subacute recurrent injury*: Injury is an incident of the same type and at the same site linked to an index incident, which occurs after an athlete’s return to full function and participation from the index recordable incident. The most common site of recurrent injury is the ankle.5

Anti-Doping Definitions

*Prohibited List*: Substances or methods that are banned by the World Anti-Doping Agency (WADA). The Prohibited List includes substances that are banned at all times plus substances that are banned only during competition.11

*Therapeutic Use Exemption (TUE)*: Approval for an athlete to take a medication that is on the Prohibited List. A TUE is granted by a committee that reviews medical documentation submitted on behalf of the athlete that specifies the need to take a banned medication.12

*World Anti-Doping Agency*: A foundation initiated by the International Olympic Committee to promote, coordinate and monitor the fight against drugs in sports.12

**Appendix C. Core Principles of Making a Diagnosis in Elite Athletes in Pain**

When an athlete with pain presents to a clinician, the clinician should first obtain a clear history and perform a careful examination to search for an injury that serves as the inciting event of pain.13 The history addresses: the mechanism of injury, previous similar injuries, and other pertinent injuries that are relevant to sport participation; associated features such as swelling, numbness and weakness, a sense of instability; and any previous treatment for the pertinent injury and its results.13 It is important to note if the injured athlete continued unimpeded in competition or practice, continued with some restriction, or was unable to continue sport participation following the injury and/or inciting event.14 15 Other important historical features include general health; training history; equipment use; technique; periodization; psychological factors, nutrition, sleep; and, the importance of the sport to the athlete.16

The pain history should assess the nature of the initial incident which produces pain (although pain may begin without a clear inciting event or injury).17 Sometimes the incident leading to pain is associated with psychological trauma (e.g., severe multi-person trauma), which can influence recovery and may need to be addressed during treatment to optimize outcomes.18 19 Pain should be quantified (e.g., using a numerical rating scale with anchors of 0 being no pain and 10 being the most severe).20 The location of pain is important, and can range from well-localized to diffuse.13 Pain duration should be noted as acute, sub-acute, or chronic. Finally, the nature of pain should be defined, including the quality of pain (sharp, dull, burning, stabbing), aggravating factors, alleviating factors, and interference with activities.13

The physical exam begins with an inspection of the athlete, including gait and general movement, while noting any evidence of deformity, asymmetry, bruising, swelling, skin changes and muscle wasting.13 Range of motion should be tested actively and passively, and any abnormal patterns of movement or aggravation/alleviation of pain noted. Palpation should address soft tissue resistance and tenderness, muscle tone, thickening, trigger points and muscle length and asymmetry;13 precise areas of pain; and areas proximal and distal to pain. Joint testing should include both physiological and accessory movements. Ligament testing should note laxity and associated pain.13 Strength testing should include the affected and unaffected side; muscle weakness may occur as a result of injury or may be a predisposing factor toward injury.21 Neural tension testing should be performed when appropriate (e.g., straight leg raise, slump test). A biomechanical evaluation may reveal insight into the mechanism of injury, especially overuse injury; this could include evaluation of forefoot and rearfoot varus and valgus, ankle equinus, tibial alignment, lower limb alignment, excessive pronation and supination, and abnormal pelvic mechanics.22 Sport-specific considerations should include an evaluation of technique; an assessment of equipment, especially proper fit and up-to-date certification, is important in determining if equipment is a source of injury.23

To address kinematics and biomechanical factors, the kinetic chain continuum should be addressed. The kinetic chain continuum has been described as the mechanical linkages of body segments that allows for the sequential transfer of forces and motions when performing a task.6 Essentially, the kinetic chain continuum constitutes a complex motor unit. A breakdown in the kinetic chain continuum results in a variation in muscle control, inadequate muscle strength, improper muscle activation patterns, impaired function, and a decrement in performance coupled with increased risk of injury.7 Assessing the kinetic chain continuum as part of the diagnostic evaluation helps clinicians to correlate how one pathology can lead to another, meaning that the clinical assessment must look beyond the injured body part.24 25 For example, chronic ankle instability and dysfunction may lead to an impaired kinetic chain continuum in generating force and function in overhead sports (tennis serve, baseball pitch, volleyball), with resultant overuse injury to the shoulder. 25 Assessing the shoulder alone does not address the core kinematic and biomechanical factors involved in the shoulder injury.

The history and physical exam provide the foundation for treating an athlete, but the diagnosed injury may not be the primary source of pain. For example, an athlete may suffer with a lumbar herniated disc, but the primary source of pain may be associated lumbar multifidus spasm.26 Thinking holistically will help to provide more comprehensive and appropriate treatment, which includes: (1) why the injury occurred, with consideration of training, periodization, and parental/societal pressures; (2) appropriate, short-term use of analgesic medication; and (3) rehabilitation that addresses injury management, including the kinetic chain continuum, and is consistent with core principles of pain medicine.

**References for Appendices A-C**

1. Loeser JD, Treede RD. The Kyoto protocol of IASP basic pain. Pain 2008;137:473-7.
2. Kosek E, Cohen M, Baron R, et al. Do we need a third mechanistic descriptor for chronic pain states? Pain 2016;157:1382-6.
3. Vardeh E, Mannion RJ, Woolf CJ. Toward a mechanism-based approach to pain diagnosis. J Pain 2016;17:S2:T50-69.
4. Steindler A. Kinesiology of the Human Body: Under Normal and Pathological Conditions. Springfield, IL:Charles C Thomas Pub Ltd, 1955.
5. Yang J, Tibbetts AS, Covassin T, et al. Epidemiology of overuse and acute injuries among competitive collegiate athletes. J Athl Train 2012;47:198-204.
6. Chu SK, Jayabalan P, Kibler WB, et al. The kinetic chain revisited: new concepts on throwing mechanics and injury. PM&R 2016;8:S69-77.
7. Seroyer ST, Nho SJ, Bach BR, et al. Shoulder pain in the overhead throwing athlete. Sports Health 2009;1:108-20.
8. Paterno MV, Taylor Haas JA, Myer GD, et al. Prevention of overuse sports injuries in the young athlete. Orth Clin N Amer 2013;44:553-64.
9. DiFiori JP. Evaluation of overuse injuries in children and adolescents. Curr Sports Med Rep 2010;9:372-8.
10. DiFiori JP, Benjamin HJ, Brenner J, et al. Overuse injuries and burnout in youth sports: a position statement from the American Medical Society for Sports Medicine. Clin J Sports Med 2014;24:3-20.
11. The World Anti-Doping Code International Standard: Prohibited List January 2017.
12. World Anti-Doping Code. Montreal, Canada: Agency WA-D, 2015.
13. Brukner P, Khan K. Clinical Sports Medicine, 5th ed. McGraw Hill, Australia, 2016.
14. Prien A, Mountjoy M, Miller J, et al. Injury and illness in aquatic sport: how high is the risk? A comparison of results from three FINA World Championships. Br J Sports Med 2017;51:278-83.
15. Mountjoy M, Junge A, Benjamen S, et al. Competing with injuries: injuries prior to and during the 15the FINA World Championships 2013 (aquatics). Br J Sports Med 2015;49:37-43.
16. Ivarsson A, Johnson U, Anderson MB, et al. Psychosocial factors and sport injuries: meta-analyses for prediction and prevention. Sports Med 2017;47:353-65.
17. Bahr R. No injuries, but plenty of pain? On the methodology for recording overuse symptoms in sports. Br J Sports Med 2009;43:966-72.
18. Moseley Gl, Butler DS. 15 years of explaining pain – the past, present and future. J Pain 2015;16:807-13.
19. Hansen GR, Streltzer J. The psychology of pain. Emerg Med Clin N Amer 2005;23:339-48.
20. Hawker GA, Mian S, Kendzerska T, et al. Measures of adult pain. Visual Analog Scale for Pain (VAS Pain), Numeric Rating Scale for Pain (NRS Pain), McGill Pain Questionnaire (MPQ) Short-Form McGill Pain Questionnaire (SF-MPQ), Chronic Pain Grade Scale (CPGS), Short Form-36 Bodily Pain Scale (SF-36 BPS), and Measure of Intermittent and Constant Osteoarthritis Pain (ICOAP). Arth Care Res 2011;63:240-52.
21. Suchomel TJ, Nimphius S, Stone MH. The importance of muscular strength in athletic performance. Sports Med 2016;46:1419-49.
22. Plastaras CT, Rittenberg JD, Rittenberg KE, et al. Comprehensive evaluation of the injured runner. Phys Med Rehab Clin N Amer 2005;16:623-49.
23. Salam RA, Arshad A, Das JK, et al. Interventions to prevent unintentional injuries among adolescents: a systematic review and meta-analysis. J Adolescent Health 2016;59:S76-87.
24. Kibler WB, Ludewig PM, McClure PW, et al. Clinical implications of scapular dyskinesis in shoulder injury: the 2013 consensus statement from the ‘Scapular Summit.’ Br J Sports Med 2013;47:877-85.
25. Van der Hoeven H, Kibler WB. Shoulder injuries in tennis players. Br J Sports Med 2006;40:435-40.
26. Min JH, Choi HS, Ihl Rhee W, et al. Association between radiculopathy and lumbar multifidus atrophy in magnetic resonance imaging. J Back Muscul Rehab 2013;26:175-81.