ABSTRACTS OF ACC CONFERENCE PROCEEDINGS

PLATFORM PRESENTATIONS

Trunk neuromuscular control adaptations following a prolonged static flexion of the trunk

Jacques Abboud, Francois Nougarou, Martin Descarreaux

Objective: The purpose of this study was to identify adaptations in muscle activity distribution to spinal tissue creep in presence of muscle fatigue. **Methods:** Twenty-three healthy participants performed a fatigue task before and after a 30-minute session of passive spinal tissue deformation in flexion. Right and left erector spinae activity was recorded using large-array surface electromyography (EMGs). To characterize muscle activity distribution, the dispersion variable was used. During the fatigue task, EMG amplitude RMS, median frequency (MDF) and dispersion were compared before and after spinal creep. **Results:** Important fatigue-related changes in EMG MDF were observed during muscle fatigue. MDF values showed a significant main creep effect, with lower MDF values on the left side under the creep condition. A significant main creep effect on RMS values was also observed as RMS values were higher after creep deformation on the right side. A significant creep effect for x-axis dispersion values was observed, with higher dispersion values following the deformation protocol on the left side. Regarding y-axis dispersion values, a significant creep × fatigue interaction effect was observed on the left side. **Conclusion:** Combined muscle fatigue and creep deformation of spinal tissues leads to changes in muscle activity amplitude, frequency domain and patterns. (This is a conference presentation abstract and not a full work that has been published.)

Degenerative disc disease: regenerative effects of stem cell therapy

Aleisha Adeboyejo, Mark Erwin, Ajay Matta, Muhammed Zia Karim, Stanley Zhou

Background: Degenerative disc disease (DDD) is a pathobiological alteration of the cellular and extracellular matrices leading to deregulation of intervertebral disc homeostasis and resulting in both biomechanical and cellular failure. Currently, there is no curative treatment for DDD; however, there is growing interest in cell-based therapies as a potential regenerative approach. **Objective:** To determine the effects of transplanting bone mesenchymal stem cells (BMSCs), nucleus pulposus progenitor cells (NPPCs), and NPPCs pretreated in vitro with notochordal cell-conditioned medium (NCCM) into a preclinical degenerative disc rodent model. **Methods:** Immunohistochemical assays were used to qualitatively evaluate the effects of transplanting BMSCs, NPPCs, and NPPCs pretreated with NCCM into the nucleus pulposus of degenerated rat-tail discs. **Results:** Immunohistochemical assays demonstrated increased immune-reactive activity of both type II collagen and aggrecan in the transplanted intervertebral discs (IVDs) as well as a trend toward increased disc height, improved cellularity, and increased proteoglycan content. **Conclusion:** The qualitative histological results demonstrate that stem cells previously transplanted into the rat-tail IVD nucleus pulposus, especially the NPPCs pretreated with NCCM, confer a regenerative effect upon experimentally induced degenerated rat-tail discs. (This is a conference presentation abstract and not a full work that has been published.)

Computerized text analysis of emergent themes from responses to curricular change

Ayla Azad, Nadine Ellul, Marion McGregor, Brian Gleberzon

Objective: Learner's opinions on the introduction of new force-sensing table technology (FSTT) into technique classrooms were evaluated using centering resonance analysis, via Community Resource for Archiving Wireless Data at Dartmouth (CRAWDAD). The objective of this investigation was to determine if computerized text analysis could efficiently and appropriately reflect student responses. **Methods:** Students were asked 4 questions for which they could provide written answers. Text files were created, grouping responses for each year of study, classroom environment, and where appropriate, separated into pre- and the postintervention periods. Each file was uploaded into CRAWDAD, and influential noun phrases were identified. Ward's hierarchical clustering method was used to perform cluster analysis to determine if patterns could be seen by classroom, environment, and time. **Results:** Cluster analysis indicated no pattern with respect to year, FSTT condition, or time period per question.Primary word pairs for each of the 4 questions asked were "good-idea," "force-feedback," "force-good," and "time-FSTT." Responses were consistent and meaningful relative to questions asked. **Conclusion:** Computerized centering resonance analysis is a useful tool for efficient management of qualitative information from the student body. Results meaningfully summarized student feedback. Data indicate that students were overwhelmingly positive about the inclusion of FSTT into their classroom experience. (This is a conference presentation abstract and not a full work that has been published.)

A survey of perceived stress experienced by students attending full-time and full-time equivalent chiropractic degree programs

Phillippa Bates, Adrian Hunnisett, Christina Cunliffe

Introduction: The purpose of this study is to explore perceived stress levels of full-time equivalent (FTE) and full-time (FT) chiropractic degree students and the factors that may be related to any differences. **Method:** Following ethical approval, a cross-sectional study of the student population of a chiropractic college was undertaken. An online questionnaire was developed, expanded from previous studies, and distributed to both FT and FTE students via e-mail. Statistical analysis included a description of the responses from the 2 cohorts and further subanalysis by gender, age, and income. **Results:** The results indicated that older students were more affluent but rated themselves lower in terms of academic achievement. Younger students were understandably less affluent but were also less stressed in terms of employment, potentially as they were working less and more likely to live with their parents. Females reported higher perceived stress than males. **Conclusion:** Students reported marked degrees of stress in both courses. However, stressors were different between the 2 cohorts, and some consideration of these differences by the institution may inform a more targeted approach to student support. (This is a conference presentation abstract and not a full work that has been published.)

Non–weight-bearing and weight-bearing ultrasonography of select foot muscles in young, asymptomatic participants: a descriptive and reliability study

Patrick Battaglia, Ross Mattox, Brett Winchester, Norman Kettner

Objective: Determine the reliability of ultrasound when imaging select foot muscles in non–weight-bearing and weight-bearing postures and to describe the change in muscle size when weight-bearing. **Methods:** Participants were recruited after institutional board approval. Two examiners collected long- and short-axis ultrasound images of the abductor hallicus (AH), flexor digitorum brevis (FDB), and quadratus plantae (QP) in the non–weight-bearing and weight-bearing postures. **Results:** There were 26 participants (17 female) with a mean age of 25.5 ± 3.8 years and a mean body mass index of 28.0 ± 7.8 kg/m^2. Interexaminer reliability was excellent when measuring the muscles in short axis (intraclass correlation [ICC] > .75) and fair to good in long axis (ICC > .4). Intraexaminer reliability was excellent in both planes for each rater when measuring the AH and FDB. Rater 1 demonstrated excellent reliability in measuring the QP in short axis and fair-to-good reliability when measuring the QP in long axis. Rater 2 demonstrated fair-to-good reliability when measuring the QP in both planes. Weight-bearing did not reduce reliability. All muscles demonstrated a significant increase in cross-sectional area when weight-bearing. **Conclusion:** The ability to reliably image these muscles with ultrasound weight-bearing may permit greater understanding of

the pathophysiology in foot deformities and pain syndromes. (This is a conference presentation abstract and not a full work that has been published.)

Procedure selection and patient positioning influence spine kinematics during high-velocity low-amplitude spinal manipulation applied to the low back

Spencer Bell, Jay Triano, Kevin D'Angelo, Greg Kawchuk, Samuel Howarth

Background: Three-dimensional lumbar kinematics have not been described for the side-lying high-velocity low-amplitude (HVLA) spinal manipulation applied to the low back. **Objective:** To compare three-dimensional angular kinematics of the lumbar spine for 2 HVLA spinal manipulation procedures (lumbar spinous pull or push) and altered initial patient lower limb posture. **Methods:** Lumbar spine angular kinematic data were obtained from 6 HVLA procedures applied to 24 participants, directed toward the L4 vertebra. The 6 procedures reflected each combination of 2 variants of a diversified technique (pull and push) and 3 initial leg flexion angles (0°, 45°, and 90°). **Results:** Left axial rotation at the end of preload, and throughout the impulse, was greater for the pull. Left axial rotation velocity at the transition from the preload to impulse was greater for the pull with hip flexion at 0° and 45°. The pull also generated a greater maximum and lower minimum velocity. Axial rotation was lowest and maximum acceleration was greatest with hip flexion at 0°. **Discussion:** This investigation provides basic kinematic information to assist clinicians in their understanding of the similarities and differences between HVLA procedures in the lumbar spine, helping to guide patient-specific treatment based on clinical findings. (This is a conference presentation abstract and not a full work that has been published.)

Assessing the level of test anxiety in 1st-trimester chiropractic students

Judy Bhatti, Elissa Twist, Katherine Manley-Buser

Background: Many students with test anxiety (TA) experience emotional distress with thoughts of impending failure before and during high stakes tests. High TA and academic stressors in students can have detrimental effects on physical and emotional well-being. Educational intervention programs can help foster success in such students. **Objective:** Information gained from assessing students could identify the proportion of beginning students with TA and identify students who could benefit from an anxiety reduction intervention. **Methods:** A valid assessment instrument was administered to 1st-term students to assess TA. Scores of 25 to 50 on this instrument indicate moderate to extremely high TA. **Results:** The survey found 33% of the 1st-term students have moderate to extremely high TA. **Discussion:** With 33% of the entering students evincing moderate to extremely high TA there is a demonstrated need for evidence-based educational intervention for these students. **Conclusion:** An assessment instrument was administered to determine levels of TA among 1st-term students in a chiropractic program. The results showed that 33% of the students have moderately to extremely high levels of TA. Given the detrimental effects of TA on a student's academic performance, there is a demonstrated need for evidence-based educational intervention to increase academic performance and well-being. (This is a conference presentation abstract and not a full work that has been published.)

The effects of standardized patient performance by chiropractic interns on their reported empathy for their patients

Teresa Brennan, James Randazzo, Ali Rabatsky

Objective: Physician empathy has been shown to positively impact patient outcomes. Research has shown positive effects of enrolling health care students as standardized patient (SPs). These findings inspired our investigation into effective empathy training methods. Specifically we hypothesized that chiropractic student interns that perform as SPs in an OSCE setting will show a significant increase in empathy. **Methods:** Three cohorts of 3rd-year chiropractic interns that performed as SPs were studied. The SPs portrayed their case at a clinic entrance OSCE. Post performance, all participants were asked to complete a survey on their experience. The survey consisted of 4 statements scored using a 5-point Likert scale. **Results:** Students felt more empathetic after their participation in the exercise, with the majority of students agreeing with questionnaire statements. **Conclusion:** Senior doctor of chiropractic interns gained a greater capacity for empathy for their "real-world patients" after performing as an SP. (This is a conference presentation abstract and not a full work that has been published.)

Kinematic evaluation comparing internal frame and frameless backpacks: a pilot study

Jonathan Bryson, Lori Beth Bryson, Brent Russell

Objective: A preliminary study compared internal frame backpacks to frameless packs. This report describes the educational experiences of 2 student research associates (SRAs) and the challenges of learning to use biomechanical assessment equipment. **Methods:** The SRAs received training in the use of a MyoMotion inertial measurement unit motion capture system. Under the guidance of a faculty advisor, they developed a protocol and assessed 2 participants wearing loaded and unloaded backpacks while walking on a treadmill. Data were examined for maximal spinal regional angles and spatial orientation. **Results:** The sagittal plane data supported informal observations that the frameless packs cause a greater degree of "slumping" posture and require the wearers to use compensatory cervical extension to hold their heads upright. This effect was more pronounced for the female participant following an extended period of time. **Conclusions:** The procedures used in this study demonstrated posture and movement differences between the framed and frameless backpacks and appeared to be feasible for an expanded version of the study. (This is a conference presentation abstract and not a full work that has been published.)

Planning interdisciplinary interventions in low-resource environments using geographic information system technology

Brian Budgell, Altion Dafa, Victoria McInnis

Background: Many chiropractors and chiropractic institutions are now involved in initiatives in developing nations. Within the region of Tanzania where one such initiative is underway, there is no centralized source of information on other existing or planned health services projects to guide planning. **Objectives:** The purpose of this project was to map, as completely as possible with current resources, health services within 1 district in Tanzania. **Methods:** Using publicly available geographic information system data and geographical coordinates measured on site, health care facilities within 1 district were characterized and mapped. Types and densities of services were plotted for 1 representative village. **Results:** Most wards in the district lacked a facility with rudimentary laboratory diagnosis and overnight care. Most residents in the study village lived too far from a registered health facility to be able to travel there for care. Unregistered traditional healers were, relatively speaking, locally abundant. **Discussion:** Distance to facilities is a major barrier to receiving care, and for most rural villagers, traditional healers provide the most accessible form of care. **Conclusion:** In planning clinical initiatives in low-resource environments, substantial thought should be given to accessibility, for example, by locating facilities close to transportation corridors. (This is a conference presentation abstract and not a full work that has been published.)

The meaning of it all: evaluating knowledge of minimal clinically important difference (MCID) among chiropractic student interns

Rebecca Burkhalter, Mark Pfefer, Ike Woodroof

Objective: Outcome assessments are frequently used to establish baseline deficiencies and monitor patient progress during the course of chiropractic care. Commonly, student interns utilizing such assessments are unfamiliar with what magnitude of change is considered beneficial to the patient. The objective of this work was to identify gaps in intern knowledge of minimal clinically important difference (MCID). **Methods:** Student interns were given a survey to evaluate their knowledge of the MCID acronym, use of outcome assessments accessible in our electronic health system, and knowledge of MCID values corresponding to those assessments. **Results:** Nearly one-third of the interns correctly defined the MCID acronym, and approximately one-third of the interns knew at least 1 MCID value for the outcome assessments in the electronic health system. Surprisingly,

20% of the interns reported knowledge of at least 1 MCID value, but answered incorrectly pertaining to the MCID acronym. **Conclusion:** Student interns have a gap in knowledge of MCID values. Addressing this gap will improve their understanding of patient progress and inform their treatment decisions both in the outpatient clinic and in their practices following graduation. (This is a conference presentation abstract and not a full work that has been published.)

Kinetic gait assessment before and after chiropractic lower extremity adjustments

Marni Capes, Brent Russell, Michelle Oz, Ronald Hosek

Objective: This is an investigation of an individual with atypical walking gait, in that his right foot does not ordinarily have a heel strike. He had reported previous experiences of increased posterior contact for his right foot after chiropractic adjustments. This report describes an attempt to document and quantify what the participant has experienced qualitatively. **Methods:** Three sessions of adjustments were done, with gait recordings before and after the 1st and 3rd adjustments. The participant walked on a treadmill instrumented with force sensors under the treadmill belt; available data include vertical ground reaction forces and spatial and temporal gait parameters. Four 30-second recordings were recorded consecutively. The described sequence was performed before and after the 1st adjustment and again before and after the 3rd adjustment. **Results:** The participant again noticed a more posterior contact of his right foot following foot and ankle adjustments. Several of the spatial and temporal gait parameters matched his subjective experience and were more symmetrical after adjustments. **Conclusion:** The kinetic gait analysis methods in this study appear to quantify some effects of chiropractic adjustments that had been experienced subjectively by the participant. (This is a conference presentation abstract and not a full work that has been published.)

Trapezius fiber muscle analysis: a pilot inter/intraexaminer reliability study

Shaun Cashman, Charles Blum

Introduction: The trapezius fiber technique, a diagnostic/treatment method within sacro occipital technique (SOT), was first described by DeJarnette as a way of detecting and locating vertebral dysfunction through the presence of palpable nodules in the trapezius muscle. DeJarnette postulated that the specific position of a muscular nodule in the trapezius relates to a specific level of vertebral dysfunction. While this technique is widely utilized for various musculoskeletal conditions, little research has been conducted to date. Our aim was to evaluate the inter-/intraexaminer reliability in detecting these nodules in the trapezius. **Methods:** Institutional review board approval was granted by Macquarie University Ethics Review Committee, and 36-subjects were enrolled in an inter-/intraexaminer reliability study with 3 examiners proficient in SOT. **Results:** It was found that in 72% of cases there was a level of interexaminer agreement. In the intra-examiner study, there was faultless agreement in 56% of cases, rising to 89% for a minimum level of agreement. **Conclusion:** This study suggests that experienced practitioners have a clinically viable level of agreement in locating these nodules in the trapezius muscle. Greater research is indicated regarding trapezius fiber analysis and treatment, with studies investigating the validity of this outcome assessment tool. (This is a conference presentation abstract and not a full work that has been published.)

The effect of core muscle exercise for female shooting players on their performance

HyeRin Cho, HanSuk Jung, JooHyun Jam, InJun Kim

Introduction: The study was conducted to investigate the effect of core muscle training on the stability of aiming and improvement of performance and stroke ability in female shooting players. **Methods:** The subjects were 20 female athletes and the score, aiming time, SP10.0 muscle training exercise, and aim length were measured using a shooter training system (SCATT). **Results:** More subjects in the experimental group than in the control group showed the rise of score and SP 10.0, to reduce of the aiming length. It might be concluded that the core-trained subjects showed significantly higher stability of the muzzle than did those who used upper limb exercise. However, no change of the target time and further increased in the control group and the experimental group. **Discussion and Conclusion:** Core muscle training would help players in enhancing their performance by improving the aiming stability and shooting performance. The results of the study made a significant contribution to the preliminary data for efficient use of core muscle training. Therefore, more scientific and systematic core training should be continuously applied to female shooting players to maximize their performance. (This is a conference presentation abstract and not a full work that has been published.)

Creating an orientation for a clinical teacher

Katherine Clark, Ron Boesch, John Stites, Susan Larkin

Objective: Discuss the implementation of an orientation process for a clinical/academic college. Our chiropractic college clinic system has recently created an orientation process that consisted of 2 weeks of orientation broken down by the hour of administrative, human resources, and job-specific orientations. The purpose of this paper is to describe a revamped and expanded orientation for clinic faculty and outline its benefits. **Methods:** A formal orientation was developed to occur over a 2-week period. Three new clinic faculty went through this process. This orientation incorporated electronic health record training sessions and orientation to different departments and facilities, including radiology, rehabilitation, front desk functions, insurance, and laboratory. Sessions were organized for new hires on administrative processes, clinic policies, and scholarly expectations. **Results:** Interviews with new faculty having experienced this orientation were positive. Continued revision is planned. **Conclusion:** This was an initial attempt to improve the hiring and retention process of new hires for our system. The outcome has been positive, but more development of the individual process from the initial administrative meeting is needed. Overall, it appears to have been a benefit for the employees and the college. (This is a conference presentation abstract and not a full work that has been published.)

Thoracolumbar fascia thickness measured with diagnostic ultrasound and its correlation with weight and body mass index

Christina Claywell, Lindsey DiNicola, Bart Hand, Cory Kopas, Heather Lucas, Crystal Stegman, Daniel Haun

Background: Recent work has focused on the thoracolumbar fascia thickness using ultrasound imaging. **Objective:** The purpose of this study was to establish normal values for the thickness of the thoracolumbar fascia in a group of asymptomatic adults and to correlate these with height, weight, and body mass index (BMI). **Methods:** Seventy-four subjects (33 female) were included. Height and weight were obtained, and BMI was calculated. Thoracolumbar fascia thickness measurements were obtained at the L2/3 and L4/5 levels bilaterally using diagnostic ultrasound imaging. **Results:** The mean thickness of the thoracolumbar fascia was 2.6 mm (SD 0.7) at both the L2/3 and L4/5 levels bilaterally. There were no significant differences in thickness between male and female subjects. Significant correlations were seen between fascial thickness and weight, BMI, but not height in both male and female subjects. **Discussion:** The thickness values we report are similar to a previously published cadaveric study, but slightly different from a prior ultrasound study. **Conclusion:** There is a correlation between a subject's weight and BMI and their thoracolumbar fascial thickness. This study sets groundwork of normative values for other research concerning thoracolumbar fascia and low back pain. (This is a conference presentation abstract and not a full work that has been published.)

Biomechanical evaluation of a cervical intervertebral disc degeneration model: part 1—histological analysis

Christopher Colloca, Julia Kuliwaba, Brian Freeman, Robert Gunzburg, Mostafa Afifi Hegazy, Richard Hinrichs

Introduction: Large animal models have proven beneficial in studying lumbar intervertebral disc degeneration (DD), but they have not been extensively studied in the cervical spine. The objective of part 1 of this study was to develop and validate an ovine model of cervical spine DD histologically. **Methods:** Fifteen sheep received surgically induced disc injury to the midcervical spine via scalpel wound, and 15 animals received a sham neck surgery serving as controls. At minimum of 5 months follow-up, animals were biomechanically tested followed by postmortem histopathological analysis at the target site using a

previously validated DD grading system by a trained pathologist blinded to group allocation. A 2-sample t test examined group differences, and subgroup analyses were conducted using analysis of variance, $p < .05$. **Results:** In the disc lesion group, annular damage and tears were observed that were not similarly appreciated in the exposure control group, $F(1,28) = 11.54$, $p = .002$. Mild degeneration was observed in both groups, and overall DD grading did not reveal significant differences between groups. **Conclusions:** Annular injury to the ovine cervical spine produced pronounced annular changes that did not progress to extensive DD as has been observed previously in the lumbar spine. (This is a conference presentation abstract and not a full work that has been published.)

Biomechanical evaluation of a cervical intervertebral disc degeneration model: part 2—in vivo biomechanical testing

Christopher Colloca, Robert Gunzburg, Brian Freeman, Deed Harrison, Mostafa Afifi Hegazy, Richard Hinrichs

Introduction: The extent to which disc degeneration produces abnormal spinal motion patterns and forces in the cervical spine in vivo are unknown. The objective of part 2 of this study was to quantify and compare animals with disc lesions and normal control animals using a validated dynamic spinal stiffness assessment technique**. Methods:** Fifteen sheep who received surgically induced disc injury were compared to 15 animals who received a sham neck surgery, both a minimum of 5 months previously. All animals were biomechanically assessed at the level of the lesion using swept-sine mechanical loads from 0 to 20 Hz under load control to quantify dynamic dorsoventral (DV) spine stiffness (load/deformation, N/mm). The effect of disc lesion on stiffness was assessed using a 1-factor repeated measures analysis of variance comparing 32 mechanical excitation frequencies. **Results:** DV stiffness was found to be significantly increased in the cervical disc lesion group at 31 of 32 frequencies examined ($p < .05$). A nearly 2-fold increase in dynamic spinal stiffness was observed across mechanical excitation frequencies ($p < .05$). **Conclusions:** Cervical spine dynamic stiffness is dependent upon mechanical excitation frequency. Annular injury to the ovine cervical spine results in quantifiable functional increases in the cervical spine's dynamic stiffness. (This is a conference presentation abstract and not a full work that has been published.)

Biomechanical evaluation of a cervical intervertebral disc degeneration model: part 3—spinal manipulative therapy

Christopher Colloca, Robert Gunzburg, Brian Freeman, Deed Harrison, Mostafa Afifi Hegazy, Richard Hinrichs

Introduction: Cervical intervertebral disc disease (DD) is common in patients undergoing spinal manipulative therapy (SMT). To our knowledge, to date no research has quantified the in vivo motion response in normal or degenerated states. The objective of this study was to examine the cervical spine motion response during 2 SMT techniques to evaluate differences among and within animals with disc lesions and controls. **Methods:** Biomechanical responses of SMT were quantified in 15 animals with histologically confirmed cervical spine disc lesions and compared among 15 controls. Tri-axial accelerometers rigidly attached to adjacent vertebrae across the target evaluated the effect of disc lesion on spinal motion response and within groups during 2 SMT techniques (10 ms vs 100 ms). A $2 \times 6 \times 2$ repeated measures analysis of variance examined the effect of disc lesion and SMT force-time profile on spine motion response with significance set at $p < .05$. **Results:** SMTs resulted in decreased accelerations and displacements in the disc lesion group ($p < .05$), and SMT type significantly influenced spinal accelerations for both the dorsoventral and axial planes. **Conclusions:** Consistent with the cervical spine's increased spinal stiffness, cervical spine motion response during SMT was decreased in animals with disc lesions and was further influenced by SMT technique. (This is a conference presentation abstract and not a full work that has been published.)

Shoulder internal derangement and osteoarthritis in a 25-year-old female softball athlete

Stacey Cornelson, William Hogarth, Daniel Ault, Norman Kettner

Objective: Although osteoarthritis (OA) and internal derangement typically occur in the elderly population, a higher prevalence in younger overhead-throwing athletes is emerging. Diagnosis utilizing appropriate imaging modalities is crucial to optimize the treatment and outcomes of athletes. This case demonstrates OA and internal derangement of the shoulder resulting from years of overhead throwing in a collegiate softball player. **Clinical Features:** A thorough clinical examination and multiple imaging studies were performed. The patient's treatment plan included full spine diversified adjustments, cold laser therapy, Kinesio taping, and stretching and neuromuscular reeducation of the right shoulder. **Intervention and Outcome:** The patient reported a significant decrease in symptoms after 1 month though treatment was sporadic due to poor patient compliance. Magnetic resonance arthrogram, magnetic resonance imaging, radiography, and musculoskeletal ultrasound are the most common modalities used in the diagnosis of these conditions. **Conclusion:** Osteoarthritis and internal derangement occur in overhead throwing athletes, and the imaging modality or modalities are needed for timely and accurate diagnoses. Magnetic resonance arthrogram, magnetic resonance imaging, radiography, and musculoskeletal ultrasound are the most common modalities used in the diagnosis of these conditions. (This is a conference presentation abstract and not a full work that has been published.)

Assessing sound and vibration from zygapophyseal joints during motion and spinal manipulation: a feasibility study

Gregory Cramer, Preetam Bora, Kim Ross, Scott Selby

Objective: To assess novel methods used to localize zygapophyseal (Z) joint audible sounds (crepitus and cavitations) during normal lumbar motion and side-posture spinal manipulation therapy (SMT). **Methods:** This institutional review board–approved feasibility study used 5 healthy subjects aged 21 to 65 years. Subjects had 9 accelerometers and 1 specialized directional microphone applied to their lumbar region in a previously developed pattern that allowed specific localization of joint sounds. Each subject underwent full lumbar ranges of motion (ROM), lumbar SMT (left side = up side), and repeated full ROM, all while recordings were made from the accelerometers and microphone. Accelerometer and microphone data were assessed for cavitations and crepitus. **Results:** Vibration and acoustic methods were successfully implemented and provided complementary information that identified cavitations, crepitus, and verified artifacts. Ten cavitations and 1 crepitus were recorded from 7 joints (all left side). Three instances of multiple joint cavitations were identified (2 from 2 joints [L-L1/L2 and L-L3/L4] and 3 from 1 joint [L-L1/L2]). One cavitation, inaudible to subject and clinician, was identified from recordings. **Conclusions:** Accelerometers and microphone provided unique and complementary information. Assessing accelerometer and acoustic data could help deepen understanding of spinal mechanics and SMT. (This is a conference presentation abstract and not a full work that has been published.)

Comparing biomechanical parameters between 2 common low back spinal manipulation procedures

Kevin D'Angelo, Jay Triano, Spencer Bell, Greg Kawchuk, Samuel Howarth

Background: Innovative rigid linked-segment computer models have made it feasible to analyze low back kinetics during high-velocity, low-amplitude spinal manipulation (HVLA-SM) procedures. **Objective:** To determine if altering the type of low back HVLA-SM procedure and/or initial patient leg posture influences the axial rotation moment during the impulse phase in healthy patients. **Methods:** Twenty-four patients received a total of 6 HVLA-SM maneuvers in random order, representing all combinations of 2 similar procedures (lumbar spinous push and pull) and 3 initial lower extremity positions. All contact forces, patient upper body kinematics and inertial properties were used as input and processed in Visual3D software. Time-series data representing the low back axial twist reaction moment were analyzed. **Results:** The lumbar spinous pull procedure produced significantly greater maximum axial rotation reaction moments (mean difference = 9.4 Nm) during the impulse ($p = .001$). Conversely, the lumbar spinous push procedure produced a greater minimum (mean difference = 8.6 Nm) during the impulse ($p = .017$). **Discussion:** Two HVLA-SM procedures that differ primarily by the configuration and site of load application induce significantly different actions on and across the spinal tissues. More work of this

nature is necessary for future clinical application. (This is a conference presentation abstract and not a full work that has been published.)

Lumbar fusion surgery and clinical considerations for the chiropractor: a literature review

Clinton Daniels, Pamela Wakefield, Glenn Bub, James Toombs

Objective: Describe the clinical indications for lumbar fusion in degenerative cases, identify potential complications, and discuss the state of relevant chiropractic literature. **Methods:** The PubMed database was searched for articles related to lumbar fusion and/or arthrodesis and their incidence, procedures, complications, and postsurgical chiropractic cases. The bibliographies of articles discerned to be relevant were also reviewed. **Results:** Lumbar fusion procedures are regularly used treatments for an array of degenerative spinal conditions. Even with successful fusions patients commonly continue to experience chronic lower back pain and/or develop new symptoms several years after the operation and may present to chiropractic clinics. Despite increased utilization of fusion over the past several decades, the chiropractic literature is devoid of studies evaluating the safety and efficacy of managing this patient population. **Conclusions:** When evaluating postfusion patients, chiropractors should be cognizant of the appropriate clinical indications for fusion, aware of common surgical practices, and on alert for potential complications. Further research is needed to establish chiropractic best practices in treating postfusion lumbar pain. (This is a conference presentation abstract and not a full work that has been published.)

Outcomes of an interprofessional simulation curriculum

Lisa DeMarco, Karen Panzarella, Heather Ferro, Lynn Pownall, Andrew Case, Patricia Nowakowski, Maxine Stewart, Alice Duszkiewicz, Christine Verni, Mary Catherine Kennedy, Nicole Cieri, Colleen Dowd, Denise Dunford

Objective: Interprofessional education (IPE) is a method to create an environment that fosters interprofessional communication, an understanding of the roles/responsibilities of each profession, and the learning of skills to organize and communicate information for patients, families, and members of the health care team. By providing interprofessional education to health professional students, it is thought that when they enter the workforce they will have the necessary skills to function in a collaborative practice-ready environment. The study aims to demonstrate the methods used in developing IPE curriculum and faculty training and to identify learning objectives. **Methods:** The student survey assessed learning objectives including communication of roles and responsibilities, communication and organization of information, engagement of other health professions in shared patient-centered problem-solving, interprofessional assessment of patient status, and preparation of patients from transition of care to home. The faculty survey assessed faculty experience levels. **Results:** Student evaluation of IPE simulation experience revealed students believed they improved their interprofessional communication skills and understanding of health professional roles and responsibilities. Faculty feedback indicated a continued commitment to IPE; however, a need for additional training was identified. **Conclusions:** This paper can assist educational institutions in developing IPE. (This is a conference presentation abstract and not a full work that has been published.)

Validity of orthopedic tests to diagnose thoracic outlet syndromes: a diagnostic accuracy study

Ingrid Dober, Andre Bussieres, Gilles Bronchti

Objectives: The test accuracy of orthopedic tests commonly used to diagnose thoracic outlet syndromes (TOS) remains uncertain. This study examined the accuracy of 6 orthopedic tests in healthy subjects vs those diagnosed with a TOS. **Methods:** Subjects were recruited from chiropractic clinics in Quebec. Subjects underwent 6 orthopedic TOS tests, along with variations to simulate different test executions. Radial arterial blood flow (peak systolic velocity [cm/s]) was measured by echography Doppler at rest and for each test. Repeated-measures analyses of variance were conducted. **Results:** Twenty-nine healthy volunteers (mean age 29 years) and 7 TOS subjects (mean age 34 years) underwent testing. Post hoc tests (Bonferroni adjustments) revealed (1) a significant intragroup reduction of flow in both healthy and TOS groups in 4 of 6 orthopedic tests and (2) no between-group differences for any of the 6 tests. **Conclusion:** None of the 6 orthopedic tests were valid when considering only abolition of the radial pulse. Variations in the execution of the tests did not influence results. When considering the symptoms reproduction, tests used in isolation had high-false positive rates. Specificity increased when at least 4 provocative tests were used in combination. (This is a conference presentation abstract and not a full work that has been published.)

Access to first professional degrees in health sciences (with emphasis on chiropractic) for underrepresented populations: literature review

Scott Donaldson

Low enrollment of underrepresented populations in first professional health science education is well documented. There are fewer students of color, specifically African American and Hispanic students, studying in first professional degree programs than other graduate programs, including PhD programs. The typical access issues of cost and educational background do not explain the discrepancy in enrollment in these programs. This paper is a review of some of the available literature in an attempt to better understand the problem, solutions, and unanswered questions. (This is a conference presentation abstract and not a full work that has been published.)

Student perceptions of force-sensing table technology integration in the classroom: a controlled cohort study at Canadian Memorial Chiropractic College

Nadine Ellul, Ayla Azad, Brian Gleberzon

Objective: The objectives of this study were to (1) assess undergraduate students' perception of their experience during technique laboratory class time with or without the introduction of a force-sensing table (FST) training session and (2) assess students' perception of structured versus unstructured training involving the FST during technique laboratory classes at Canadian Memorial Chiropractic College. **Methods:** Students were surveyed as to their perceived confidence, perception of technique lab efficiency, how easy the FST was to use, and how satisfied they were with its use during normal laboratory sessions (no FST) or with structured or unstructured FST use. **Results:** Students consistently reported they were very confident in the delivery of a prone thoracic manipulation, and they reported they found the FST to be easy to use and were satisfied with it. Students who received structured FST instruction reported statistically significant increase in classroom experience, highest among year 1 students. **Conclusion:** Students perceived structured FST instruction resulted in the most efficient use of technique lab time. This may impact technique lab curricular design. (This is a conference presentation abstract and not a full work that has been published.)

The effect of spinal manipulative therapy on paraspinal skin-rolling tenderness in the thoracic spine

Glen Engel, Rachel Bentley, Stephanie Crawford, Katie Keung, Dennis Liu

Background: Pain reported during paraspinal skin rolling (PSR) has been correlated to nerve root irritation, but to our knowledge the effect of spinal manipulative therapy (SMT) on PSR tenderness in the thoracic spine has not been studied. **Objective:** This study was completed to determine if PSR tenderness is different in patients who receive thoracic SMT. **Methods:** First and 2nd year chiropractic students were recruited to participate. Subjects received a baseline PSR to assess for areas of tenderness. Perceived intensity of discomfort was measured using the Numerical Rating Scale 11 (NRS-11). The experimental group received SMT of the adjacent vertebral segment. The control group received no intervention. Using the NRS-11, subjects were asked a 2nd time to rate PSR tenderness. **Results:** The NRS-11 of the 2nd was compared to the initial PSR between the 2 groups directly by 2-sample methods and analysis of covariance. The analysis showed the difference between the means of the treatment and control groups (adjusted for baseline) was statistically significant at -0.86 ($p = .001$). The experimental group pain intensity reduction was estimated to be -0.86. **Conclusion:** The treatment group receiving SMT reported PSR tenderness that was

lower when compared to the control group. (This is a conference presentation abstract and not a full work that has been published.)

Comparison of spinal loads created by spinal manipulative therapy (SMT) and passive physiological movements

Martha Funabashi, Greg Kawchuk, Narasimha Prasad

Objectives: To compare forces and moments generated by spinal manipulative therapy (SMT) versus passive physiological movements (PPM) including lumbar flexion, extension, and left axial rotation. **Methods:** PPMs were applied to the lumbar spine of 12 porcine cadavers and posterioanterior SMT applied to the L3/L4 segment. The resulting vertebral kinematics were tracked by indwelling bone pins. Spinal segments were removed, mounted in a parallel robot with a 6-axis load cell, and the kinematics replayed robotically. The resulting peak forces and moments were analyzed with a repeated-measures multivariate analysis of variance. This study was approved by the local animal care and use committee. **Results:** Among 18 comparisons between SMT and PPM, 13 were not significant ($p > .05$), suggesting most forces and moments created by SMT are comparable to those of PPM. In the remaining comparisons, SMT created significantly greater anterioposterior forces vs PPMs, while SMT loading rate was always below published injury values. **Conclusion:** These results suggest that the SMT used here creates safe forces and moments, some of which are greater than PPM, but not in all axes. The resulting SMT unique loading profile may be the mechanism that confers SMT's clinical effect compared to loading created in daily activities. (This is a conference presentation abstract and not a full work that has been published.)

Physiological effects of reducing the vertebral subluxation complex with Bio-Energetic Synchronization Technique

Carla Gibson, Rick Sherkel, Ronald Hosek

Objective: To examine the effect on physiology and the vertebral subluxation complex in patients receiving care with the Bio-Energetic Synchronization Technique as compared to a control group receiving a placebo adjustment. **Methods:** Bilateral blood pressure and heart rate variability were assessed pre- and posttreatment as was cervical range of motion. Full spine thermal scan and surface electromyography, postural sway, and chiropractic evaluation with Thompson protocol and the SF-36 was performed. **Results:** Blood pressure trend line slopes, except for the left diastolic, showed negative values for participants but not for controls. The autonomic index showed a consistent 10-point increase pre- to posttreatment across all 6 visits, a value significant with $p < .001$. Clinical indications of the vertebral subluxation complex were evident in controls but not in subjects postintervention. Changes in secondary measures were not statistically significant. **Conclusion:** While significant changes were not seen for the variables measured, differences were seen between participants and controls. The most striking difference was seen in the autonomic index. Although this study was limited, the results were encouraging enough to warrant further work. (This is a conference presentation abstract and not a full work that has been published.)

Doctors of chiropractic working in private sector medical facilities: a descriptive survey

Christine Goertz, Stacie Salsbury, Elissa Twist, Virginia Smith, Anthony Lisi

Objective: To describe demographic, facility, and practice characteristics of doctors of chiropractic (DCs) working in private sector medical facilities. **Methods:** A descriptive on-line survey was used. **Results:** Our sample included 37 DCs who work in hospitals ($n = 15$), multispecialty ($n = 8$), ambulatory ($n = 6$), or other ($n = 8$) settings. Respondents were Caucasian (94%) and male (80%), with a mean age of 46 years and 6.6 years in their setting. Most DCs ($n = 25$) were employees and received a salary ($n = 22$). The mean number of DCs in each setting was 2.5 (range 1 to 8). Most DCs used the same health record as medical staff and worked in the same clinical setting. Over 60% reported comanagement of patients with medical staff. DCs received and made referrals to primary care, physical medicine, pain medicine, orthopedics, and physical/occupational therapy. While in most settings DCs were the primary provider of spinal manipulation ($n = 16$), in other settings ($n = 18$) spinal manipulation was offered by DCs, osteopathic or medical physicians, and physical therapists. **Conclusion:** DCs work in a variety of medical settings within the private sector, in proximity and collaboration with many different provider types. Chiropractic education may need to prepare students and DCs for success in these health care settings. (This is a conference presentation abstract and not a full work that has been published.)

Student perceptions concerning an innovative teaching strategy used to address the role of chiropractors as community health care advocates

Christopher Good

Background: Many groups believe chiropractors should become involved in community health care issues. **Objective:** Develop a teaching strategy involving a community health problem and survey student perceptions. **Methods:** A case study involving music volume in spin classes was presented. Students then identified a community health issue, accessed the literature, developed a data collection plan, and reflected on how to present the data to decision makers. A survey was distributed and analyzed. **Results:** Eighty-one percent responded. Forty-seven percent previously had been a community health care advocate (CHCA), and 100% believed they now could be. A majority believed confidence improved and that the assignment should be continued. Ninety-one percent believed they would be a CHCA in practice, and most enjoyed the assignment. Many felt it was good preparation for practice and made them think "outside the box." **Discussion:** Students observed change could be accomplished when supported by quality evidence and data collection. They developed unique problem-solving and scientific literature skills. Future studies would have students actually perform their plan and report on the results. **Conclusion:** Developing teaching strategies that help students gain the skills that allow them to improve their community's health is an important addition to chiropractic education. (This is a conference presentation abstract and not a full work that has been published.)

Transient osteoporosis of the hip—an uncommon differential variant in a chiropractic patient: a case report

Stephen Grand, Alivia Shoop

Objective: Establish the need to consider transient osteoporosis of the hip (TOH), versus avascular necrosis, as a possible diagnosis for hip pain of unknown origin. **Clinical Features:** The patient will present with localized pain and restricted motion, not unlike osteoarthritis. There may be no history of trauma, visible edema, or inflammation. It is usually found in 3rd trimester pregnant women and older men. This patient was a 55-year-old female, a weight lifter, with a history of degenerative changes of the spine and hip. **Intervention and Outcome:** Her physical activities were curtailed, and she received activator adjustments, soft tissue manipulations, low-level laser therapy, dietary modifications, and supplementation. Exercises were gradually included as her condition allowed. The patient responded well. **Conclusion:** Diagnosis of TOH allowed a better understanding of her needs and the prognosis and prevented the excess physical activities that might have injured her further. Chiropractic care and nutritional support may be a reasonable alternative to medical care for this disorder. (This is a conference presentation abstract and not a full work that has been published.)

Evaluation of a biological gradient between smoking and back pain in a large cross-sectional study of Americans

Bart Green, Claire Johnson, Jeff Snodgrass, Monica Smith, Andrew Dunn

Objective: To identify if there is a biological gradient associated with smoking cigarettes and the outcome of back pain in adult Americans. **Methods:** In this secondary cross-sectional data analysis of the 2012 National Health Interview Survey, a χ^2 test was used to assess for a difference in back pain prevalence among smoking groups. Mann-Whitney U test was used to assess for a difference in the number of cigarettes smoked between smokers with and without back pain. **Results:** Back pain was present in 9995 of the 34,241 cases (29%). There was an association between back pain and smoking status, χ^2 (2599, $n = 34{,}241$) = 546.3, $p < .001$. Back pain was estimated to be present in 36.9% of smokers, 33.1% of former smokers, and 23.5% of never-smokers. There was a statistically significant difference in the number of cigarettes smoked per day of those with back pain (Md = 13) and those without back pain (Md = 10), U = 2701065, $z = -3.70$, p

$< .001$, $r = .05$. **Conclusion:** Adult Americans with back pain show a biological gradient associated with exposure to smoking cigarettes. (This is a conference presentation abstract and not a full work that has been published.)

Integration of chiropractic services in military and veteran health care facilities: a systematic review of the literature

Bart Green, Claire Johnson, Clinton Daniels, Jason Napuli, Jordan Gliedt, David Paris

Objective: This literature review examined studies that described practice, utilization, and policy of chiropractic services within military and veteran health care environments. **Methods:** A systematic search of Medline, CINAHL, and Index to Chiropractic Literature were searched from inception through April 2015. **Results:** Thirty articles were included from the 3950 citations screened. Two clinical trials, 6 cross-sectional or observational studies, 4 surveys, 4 commentaries, 1 literature review, and 13 case reports are included in this review. There are descriptions of practice and utilization on a national level in the Veterans Administration and some clinical trials. Studies reporting utilization and policy show that chiropractic services are successfully implemented in various military and veteran health care settings and that integration varies by facility. Doctors of chiropractic that are integrated within military and veteran health care facilities manage common neurological, musculoskeletal, and other conditions; severe injuries obtained in combat; complex cases; and cases that include psychosocial factors. **Conclusion:** Chiropractors collaboratively manage patients with other providers and focus on reducing morbidity for veterans and returning military service members to active duty status. Patient satisfaction with chiropractic services is high. Preliminary findings show that chiropractic management of common conditions result in significant improvement. (This is a conference presentation abstract and not a full work that has been published.)

Correlation between student interview performance on a course-level integrated clinical skill examination and objective structured clinical examinations in a chiropractic program

Joseph Guagliardo

Objective: This retrospective study measured the correlation of student performance of simulated patient interview scores between a clinical skills course (CSC) and 2 objective structured clinical examinations (OSCEs). The hypothesis was that there would be an increase in student performance between the scores. **Methods:** A retrospective study that was approved by my institutions institutional review board was conducted on 539 students over 6 academic terms. Student's OSCE2 scores were compared to their OSCE1 and CSC scores, and correlation coefficients were calculated for the groups. A linear regression model was run in addition to identification of mean and standard deviations of the cohorts. A 1-way analysis of variance (ANOVA) was run to determine if there was variance among the cohorts. **Results:** There was little correlation noted between CET:OSCE1, OSCE1:OSCE2, and CET:OSCE2 with Pearson $r = 0.175$, 0.124, 0.122, respectively, and $p < .001$ for all groups. $R^2 = .030$, .015, and 0.15, respectively, suggesting poor prediction between groups. One-way ANOVA revealed no variance between groups $F = 16.9$, 8.38, and 8.39 and $p < .005$, respectively. **Conclusion:** Correlations were found to be low between the groups, which could identify poor student performance or flaws in the assessment system. More research could be done to explain student performance on these assessments. (This is a conference presentation abstract and not a full work that has been published.)

Testing an association between baseline resting pulse rate averages and short-term changes in resting pulse rates: a pilot study

John Hart

Objective: Resting heart (pulse) rate (RPR) may be a useful neurological assessment tool in chiropractic practice. However, the clinical significance of short-term changes in RPR remains unknown. The purpose of this study was to take an initial step toward understanding the clinical significance by comparing RPR changes between groups with lower versus higher baseline RPR, the latter considered as less healthy than the former. **Methods:** Seventy-three patients received an RPR measurement on 2 days within a 1-week period. RPR change in patients with lower versus higher baseline RPR was compared. **Results:** Mean RPR change in the low baseline group was −0.3 beats per minute (BPM) versus +4.4 BPM in the high baseline group. This between-group difference was statistically significant ($p = .02$) with a large effect size (of .57). **Conclusion:** In this pilot study, a higher RPR at baseline was associated with increased RPR change, whereas a lower baseline RPR was associated with a stable or reduced RPR change. A future study with a larger sample size is needed to better characterize both the natural variation of RPR over multiple repeated measurements and the clinical significance of short-term RPR changes in terms of predicting longer-term health outcomes. (This is a conference presentation abstract and not a full work that has been published.)

Use of the PRECEDE-PROCEED model to conduct a community needs assessment

Cheryl Hawk, Kim Rogers, Peter Szucs, Rosalia Messina, Will Evans

Objective: The purpose of this project is to conduct a community assessment focusing on health education needs to promote health, using the PRECEDE-PROCEED logic model. **Methods:** The needs assessment utilizes only the PRECEDE portion of the model to inform the later PROCEED process. PRECEDE has 4 phases of assessment: social, epidemiological, educational, and administrative. For social assessment, data were collected through surveys, focus groups, and key informant interviews. Secondary data were used for the epidemiological assessment. Educational and administrative assessments combine findings from the other phases along with information on policies and resources. **Results:** Social assessment—162 survey responses identified being too busy (35%); too great an availability of food, especially fast food (27%); lack of planning for healthy living (23%) as top reasons why it is hard to be healthy. Focus groups and interviews exploring these themes will be conducted in October 2015. Epidemiological assessment—The project neighborhood has greater racial/ethnic diversity, lower income, bimodal age distribution (children and older adults), and more mobility than some other areas within the county. **Discussion:** It appears possible for integrative health care providers to extend their field of endeavor to the community public health arena. (This is a conference presentation abstract and not a full work that has been published.)

Depressive symptoms in 1st-year chiropractic students

Shawn He, Niu Zhang

Background: Depressive symptoms have been reported from chiropractic students. However, the assessment of depressive symptoms has not been formally performed. This multiquarter anonymous study assessed depressive symptoms in several classes of the 1st-quarter chiropractic students. **Method:** The authors surveyed the 1st-quarter chiropractic students (356 students). Surveys included content from the Center for Epidemiologic Studies–Depression (CES-D) scale, measures for depression, as well as demographic content. Rates of reported major and minor depression were analyzed. Responses were compared by gender and ethnicity, academic degree, and ages. **Results:** A total of 342 1st-week chiropractic students who enrolled to the program responded, for an overall response rate of 96%. The average CES-D scale score was 16.55 (5.2 SD), indicating only moderate depression level. Based on categorical levels from the CES-D scale, 14% had probable major depression, and 39% had probable mild/moderate depression. There were no significant differences in depression by academic degrees, gender, ethnic groups, and age among students. **Conclusions:** Depression is an important issue for chiropractic students, even for the students who enrolled in the program in the 1st week. This study highlights the importance of continued study on mental health assessment, treatment, and education for chiropractic students. (This is a conference presentation abstract and not a full work that has been published.)

Core competencies of the certified pediatric doctor of chiropractic: results of a Delphi consensus process

Elise Hewitt, Lise Hestbaek, Katherine Pohlman

Objective: Utilizing the Delphi consensus process, this study created a set of minimum core competencies of a certified pediatric doctor of chiropractic (CPDC). **Methods:** An initial set of seed statements was compiled modeled upon competency documents used by organiza-

tions that oversee chiropractic and medical education. The members of the Delphi panel rated each statement based upon the RAND Corporation/UCLA Delphi methodology, reaching consensus when 80% of the panelists approved each segment. **Results:** The Delphi panel had 23 specialists in chiropractic pediatrics (14 females). Sixty-one percent of panelists had postgraduate certifications, 39% had additional graduate degrees, and 74% were faculty at a chiropractic institution and/or in a postgraduate pediatrics program. The panel represented 4 countries and had representation from all major stakeholder organizations within the specialty. The panel was given 10 statements with related substatements formulated by the study's steering committee. On all 3 rounds of the Delphi process, the panelists reached consensus; however, multiple rounds occurred to incorporate the valuable qualitative feedback received. **Conclusions:** A broad panel of chiropractic pediatric experts reached a high level of consensus and created the 1st profession-wide set of core competencies expected of the CPDC. (This is a conference presentation abstract and not a full work that has been published.)

Outcome measures in chronic migraine management: clinical use and potential cost savings, a case study

Nathan Hinkeldey, Kevin Percuoco, Laurie Hinrichs, Noelle Johnson, Michael Tunning

Objective: To describe integrative treatment of a patient with chronic migraines and to analyze a case where outcome measures provided quantified self-rated data substantiating the continuation of care. **Clinical Features:** The patient was a 44-year-old male referred to a hospital-based chiropractic clinic. The patient had a 26-year history of chronic migraines, worsened over the previous 5 years. He was followed by neurology and was receiving propranolol, sumatriptan, and quarterly injections of onabotulinumtoxinA treatment; however, he continued to have frequent migraines and missed work as a result. At the initial visit, he scored a 52/100 on the Headache Disability Index (HDI). **Intervention and Outcome:** The addition of chiropractic care in the form of cervical and thoracic manipulation, postural correction, and self-myofascial release resulted in significant improvement illustrated by a 36-point decrease in HDI score. **Conclusion:** This patient's treatment plan provided significant improvement and allowed discontinuation of the onabotulinumtoxinA with potential for a large cost savings. (This is a conference presentation abstract and not a full work that has been published.)

The evaluation of student perception of subject mastery when reviewing basic sciences utilizing active learning techniques

Aimee Hollander, David Straub

Objective: The purpose of this study is to evaluate student perception of subject mastery after taking a course utilizing active learning techniques to review the basic sciences. **Methods:** Students enrolled in a basic science review course where only active learning methodology was employed. Students took a pretest and posttest consisting of an equal number of questions from each category of NBCE 1. Students also took a personal assessment survey after both exams. Results from the exam and personal assessment survey were assessed. **Results:** The pretest survey indicated that students answered half the questions in each section correctly except in the lowest scoring section, chemistry. However, students scored below 50% in most sections. Posttest average scores increased by 11%, and students felt they knew about half the questions in each section. After both pretest and posttest, students felt it was difficult to recall specific knowledge to answer the questions correctly**. Conclusion:** Students improved recall when comparing pretest and posttest average scores. However students perceive the same success in various subject areas and express difficulty in recalling information after the course. (This is a conference presentation abstract and not a full work that has been published.)

Interexaminer reliability of the detection of vertebral subluxations using continuous measures and confidence levels

Kelly Holt, David Russell, Robert Cooperstein, Morgan Young, Matthew Sherson, Heidi Haavik

Objectives: The objective of this study was to use a continuous measures system combined with an assessment of examiner confidence to investigate the reliability of spinal motion palpation and a multidimensional approach to vertebral subluxation (VS) assessment. **Methods:** Two blinded examiners assessed 70 chiropractic patients and indicated which segment in each spinal region they thought was most restricted as well as which had the most subluxation findings and whether they were confident of their findings. A research assistant then measured the distance from the segment to standardized marks that had been placed on patients' spine, and agreement between examiners was assessed using intraclass correlation coefficients (ICC). **Results:** Interexaminer reliability of the multidimensional assessment of VS was fair to good in all regions of the spine (ICC .55–.61), and motion palpation was fair to good in the lumbar (.43) and thoracic regions (.66), but poor in the cervical region (.20). Examiner confidence did not significantly alter reliability findings. **Discussion/ Conclusion:** This study reports acceptable levels of agreement for the detection of VS throughout the spine and for motion palpation in the thoracic and lumbar spinal regions. (This is a conference presentation abstract and not a full work that has been published.)

Survey of students' perception of the Palmer preceptor program

Roger Hynes, Alana Callender, Rachelle Hynes

Introduction: The preceptorship functions as a bridge between the academic world and actual practice. The concept is not unique to chiropractic and is well-documented in other health care fields. Despite many chiropractic colleges sending students out on preceptorships, the activity is not documented in the literature. **Methods:** A web-based system called Survey Monkey was used to survey the opinions of participating former student externs. The survey asked about their perceived competence in various skills and asked opened-ended questions about their strengths and weaknesses. **Results:** A total of 64 former student externs participated in the survey. Former student externs had diverse responses as to their capabilities. **Discussion:** Externs perceived themselves to be academically qualified but felt they were weaker in the clinical application of procedures learned. They also reported they felt unprepared to run a business. **Conclusion:** Results from this survey suggest that the preceptor program can be beneficial to the Palmer chiropractic extern and may lead to an easier transition from the academic to the practice world. Further studies are necessary in order to establish standardized guidelines for preceptor programs. (This is a conference presentation abstract and not a full work that has been published.)

Association between musculoskeletal and cardiovascular conditions and physical activity among US stroke survivors

Claire Johnson, Bart Green

Objective: To evaluate the association of musculoskeletal and cardiovascular conditions with physical activity in US stroke survivors and estimate how many seek chiropractic care. **Methods:** For this cross-sectional, secondary data analysis, a logistic regression was performed using all stroke survivors in the 2013 National Health Interview Survey. American Health Association physical activity recommendations were tested for association with biological factors (age, sex, body mass index, race, musculoskeletal and cardiovascular conditions) and a subset of those who reported seeing a chiropractor in the previous year. **Results:** Not meeting the physical activity guideline was more likely for those who were 55 to 64 years of age (odds ratio [OR] = 2.4), 75 to 84 years (OR = 4.7), ≥85 years (OR = 8.1), and those with 1 or more cardiovascular diseases (OR = 1.6). Approximately 10.3% of stroke survivors sought chiropractic care in the past year and had similar characteristics to the whole sample. **Conclusion:** Age and cardiovascular disease are associated with inactivity in stroke survivors. Doctors of chiropractic have the opportunity to identify risk factors for physical inactivity and may help in reducing morbidity and mortality amongst stroke survivors. (This is a conference presentation abstract and not a full work that has been published.)

Analysis of antitobacco and smoking policy statements from major health professional associations in the United States

Claire Johnson, Bart Green

Objective: To analyze content of antismoking and tobacco policies among health professional associations in the United States. **Methods:** We inventoried 21 national health professional association websites

for publically available antitobacco and smoking policies. Policies were evaluated for quality, and content was categorized into themes. Chi square was used to ascertain differences in the number of available policies between provider groups and the Mann-Whitney U test was used to assess differences in amount of content in policies between groups. **Results:** Of 13 associations (62%) with publically available policies, 54% included problem statements, 31% provided evidence, 62% included strategy, and 77% had actionable steps. There was no significant difference in the number of policies between primary care professions and allied health/specialty professions, χ^2 (1, $n = 21$) = 1.2, $p = .27$. There was a significant difference in available content between these 2 groupings, U = 19, $z = -2.3$, $p = .02$, $r = .5$. **Conclusion:** Publically available antitobacco/smoking policies are available from many associations. Some policies are robust, but few policy statements met most quality criteria. This information may help inform future antismoking and tobacco policies for national chiropractic associations. (This is a conference presentation abstract and not a full work that has been published.)

A double dissociation: S1/M1 cortical thickness distinguishes paresthesia from pain-dominant carpal tunnel syndrome

Norman Kettner, Yumi Maeda, Jieun Kim, Hyungjun Kim, Stephen Cina, Cristina Malatesta, Jessica Gerber, Claire McManus, Alexandra Libby, Pia Mezzacappa, Leslie Morse, Joseph Audette, Vitaly Napadow

Objective: Paresthesia and pain-dominant subgroups are noted in carpal tunnel syndrome (CTS). Primary somatosensory/motor (S1/M1) neuroplasticity also characterizes CTS. We aimed to investigate whether structural brain neuroplasticity dissociates these subgroups. **Methods:** CTS subjects ($n = 59$) were evaluated with nerve conduction velocity (NCV). Symptom severity ratings allocated subjects into paresthesia-dominant or pain-dominant subgroups. Structural brain magnetic resonance imaging data were acquired at 3 tesla using multi-echo magnetization-prepared rapid gradient-echo T-1 weighted pulses, and gray matter cortical thickness was calculated across the entire brain. **Results:** CTS-paresthesia subjects demonstrated reduced NCV ($p = .05$) compared to CTS-pain subjects. In addition, cortical thickness in pre- and postcentral gyrus (S1/M1 hand area) contralateral to the more affected hand was significantly reduced (corrected $p < .05$) in CTS-paresthesia compared to CTS-pain. In CTS-paresthesia subjects, precentral cortical thickness was negatively correlated with paresthesia severity ($r = -.40$, $p < .05$) and positively correlated with median NCV ($r = .51$, $p < .01$), but not with pain severity. Conversely, in CTS-pain subjects, contralesional S1 ($r = .62$, $p < .05$) and M1 ($r = .61$, $p < .05$) cortical thickness was correlated with pain severity, but not median NCV or paresthesia severity. **Conclusions:** This double dissociation in somatotopically specific S1/M1 areas suggests a neuroanatomical substrate for symptom-based CTS subgroups and may lead to improved personalized therapeutic approaches. (This is a conference presentation abstract and not a full work that has been published.)

Using best practices to engage adult millennial learners in the large classroom

Lisa Killinger

Objective: Best practices in teaching adult millennial learners include the use of active learning strategies and technology. This project assesses students' opinions of the use of these tools in the large classroom. **Methods:** This mixed method project drew from 2 resources. First, a literature review on best practices in higher education of millennial learners was completed to formulate the teaching strategies used in this project. Second, the opinions of 3 cohorts of 3rd year chiropractic students ($n = 287$) were assessed related to the active learning activities (interactive, experiential, and technology-based activities.) Students rated these strategies' educational effectiveness as compared to passive learning (lecture format) for each of 3 activities. **Results:** Each of the 3 millennial student cohorts indicated strong preferences for active and experiential learning strategies utilized in their classroom (congruous with the educational best practice literature.) They also rated these activities as highly educationally valuable. Students were nearly unanimous in preferring to use their laptops, tablets, and phones to actively construct questions and find answers during classroom activities. **Conclusion:** The use of educational best practices was highly valued in the large classroom. (This is a conference presentation abstract and not a full work that has been published.)

Chiropractic management for a patient with failed back surgery syndrome: a retrospective case study

Kathleen Kinney

Objective: To describe the results of chiropractic care for a 27-year-old male patient suffering from failed back surgery syndrome. **Clinical Features:** A 27-year-old male who sustained multiple traumatic fractures with subsequent surgical lumbosacral fusion and multiple nerve ablation procedures sought chiropractic care for persistent, severe low back pain with bilateral leg pain and paresthesia. **Intervention and Outcome:** Weekly drop-assisted manual chiropractic adjustments were provided, along with posture and ergonomic training and spinal stabilizing orthotics. Within 18 weeks of care, thoracolumbar range of motion was restored to normal, and pain intensity was reduced from "severe" to "moderate." The patient was able to participate more fully in activities of daily living. Restful sleep increased from less than 3 hours per night to 6 hours per night. Presently the patient retains full and pain-free range of motion, he reports 7 to 8 hours of restful sleep per night, and experiences prolonged periods of pain rated less than 4 out of 10. **Conclusion:** Conservative chiropractic care can be effective in the treatment of low back and leg pain associated with failed back surgery syndrome. (This is a conference presentation abstract and not a full work that has been published.)

Integrative acupuncture and chiropractic care versus either alone for low back pain: a randomized controlled trial

Anupama Kizhakkeveettil, Kevin Rose, Gena Kadar, Eric Hurwitz

Introduction: Acupuncture and chiropractic care are among the most popular complementary and alternative (CAM) therapies used for low-back pain (LBP) management. They have both been shown to be effective, as has an integrative approach to LBP care. **Objective:** To evaluate the effectiveness of an integrative care model combining chiropractic and acupuncture therapies vs each therapy alone for patients with LBP. **Design:** Patients were randomized in this pilot study to (1) acupuncture, (2) chiropractic, or (3) combined acupuncture and chiropractic care groups. **Setting:** A CAM university health center. **Patients:** Subjects were 101 adult patients with LBP. **Intervention:** Treatments were provided over 2 months by licensed chiropractors and acupuncturists. **Outcome Measures:** Roland-Morris LBP Disability Questionnaire and 0 to 10 numeric rating scales for LBP. **Results:** Participants in all 3 groups experienced clinically meaningful improvements in the primary outcome measures. No between-group differences in outcomes were apparent. **Conclusion:** The combination of acupuncture and chiropractic care did not lead to outcomes better than either therapy alone in this pilot study. A collaborative, integrative treatment plan developed between practitioners may have netted better results. (This is a conference presentation abstract and not a full work that has been published.)

Effectiveness of preventive and treatment interventions for primary headaches in the workplace: a systematic review of the literature

Arnaud Lardon, Marie Pier Giard, Cherine Zaim, Nadege Lemeunier, Martin Descarreaux, Andree-Anne Marchand

Objective: The purpose of this literature review is to critically analyze the benefits of occupational therapies and interventions targeting headache pain and disability as well as work-related outcomes in the working environment. **Methods:** A search of the literature was conducted in PubMed, Medline, Cochrane library, CINHAL, and Embase using terms related to headache, workplace, and occupational health. The Cochrane Collaboration's risk of bias assessment tool and the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) system were used to assess internal validity of included studies and rate quality of evidence relative to each outcome. **Results:** Fifteen articles were included in the systematic review. None of them was classified as low risk of bias according to the Cochrane collaboration's tool for assessing risk of bias. This systematic review found preliminary low-quality evidence suggesting that exercise program and acupuncture can prevent pain and disability in workers

with headaches. **Conclusion:** Few studies have assessed secondary prevention or therapeutic interventions conducted at work. Studies with more rigorous designs and methodology are needed to provide further evidence of the effectiveness of workplace-based headache management. (This is a conference presentation abstract and not a full work that has been published.)

Spinal manipulation alters processing within the prefrontal cortex: a brain source localization study

Dina Lelic, Imran Khan Niazi, Kelly Holt, Mads Jochumsen, Paul Yielder, Bernadette Murphy, Asbjorn Mohr Drewes, Heidi Haavik

Objectives: Studies have shown decreases in N30 somatosensory evoked potential (SEP) peak amplitudes following spinal manipulation (SM) of dysfunctional segments in subclinical pain (SCP) populations. This study sought to verify these findings and to investigate underlying brain sources that may be responsible for such changes. **Methods:** Nineteen SCP volunteers attended 2 experimental sessions, SM and control, in random order. SEPs from 62-channel EEG caps were recorded following median nerve stimulation (1000 stimuli at 2.3 Hz) before and after either intervention. Peak-to-peak amplitude and latency analysis were completed for different SEP's peak. Dipolar models of underlying brain sources were built by using the brain electrical source analysis. Two-way repeated measures analysis of variance was used to assess differences in N30 amplitudes, dipole locations, and dipole strengths. **Results:** SM decreased the N30 amplitude by 16.9 ± 31.3% ($p = .02$), while no differences were seen following the control intervention ($p = .4$). Brain source modeling revealed a 4-source model, but only the prefrontal source showed reduced activity by 20.2 ± 12.2% ($p = .03$) following SM. **Conclusion:** A single session of SM of dysfunctional segments in SCP patients alters somatosensory processing at the cortical level, particularly within the prefrontal cortex. (This is a conference presentation abstract and not a full work that has been published.)

Differences in force development rate of HLVA based on computation method

Steven Lester, David Starmer, Gregory Ruhr, Dominic Giuliano, Brynne Stainsby, Natalie Labelle, John Triano

Objective: The purpose of this project was to determine if there is a difference in slope calculated based on defined end points (eg, baseline to peak) versus slope as the middle one-third of baseline to peak. **Methods:** The participants took part in a cohort study designed to elucidate the effectiveness of force tables in the technique curriculum. This study is making secondary use of the collected data to examine biomechanical parameters associated with performance of spinal manipulation. **Results:** Strong significance was found on statistical analysis by paired 2-tailed *t*-test with $t\,(564) = -50.096$, $p = .0001$. The mean difference (−1036.54, 95% confidence interval [CI] [−1105.24, −1021.82]) represented a large effect size, $d = -1.02$. After a 6-week training intervention, significant differences were still observed between the 2 measures for speed $t\,(471) = -43.899$, $p = .0001$. The mean difference (−944.72, 95% CI [−987.01, −902.43]) also represented a large effect size, $d = -1.00$. **Conclusion:** The method of determining slope in rate-of-rise to peak impulse force during high-velocity low-amplitude procedures differ significantly. The present study brings forth a new idea into the assessment of performance. (This is a conference presentation abstract and not a full work that has been published.)

Trends in the use of chiropractic services in the Department of Veterans Affairs

Anthony Lisi

Objective: To quantify use and trends in US Department of Veterans Affairs (VA) chiropractic services. **Methods:** This was a cross-sectional analysis of VA administrative data, sampled from the 1st record of chiropractic workload in VA, through August 31, 2015. **Results:** From October 1, 2005, through August 31, 2015, the total number of patients seen each year in VA chiropractic clinics increased from 4052 to 34,791 (759%), and the number of annual chiropractic visits increased from 20,072 to 143,875 (617%). The total number of VA chiropractic clinics grew approximately 8.9% per year (from 27 to 62), and the number of chiropractor clinician employees grew approximately 21.3% each year (from 13 to 85). The typical VA chiropractic patient is male, between the ages of 45 and 64 years. Codes assigned to VA chiropractic patient visits indicate that patients are most commonly seen for low back (59.2%) and neck (24.3%) conditions and most commonly receive chiropractic spinal manipulation (49.5%) and evaluation and management (21.2%) services. **Conclusion:** Use of chiropractic services in VA has grown dramatically over more than a decade. This may have relevance not only within VA but also to the US chiropractic profession at large. (This is a conference presentation abstract and not a full work that has been published.)

Timing of chiropractic intervention in nonsurgical spine care: an economic analysis

Melissa Lo, Wade Bannister

Objective: Measure the economic impact of earlier engagement of chiropractors in treating nonsurgical spine-related disorders (SRDs). **Methods:** Episodes of care at least 30 days in duration relating to nonsurgical SRDs were extracted from claims data of a large commercial insurer. Using the date of 1st engagement of a chiropractor, 4 groups were defined: episodes where chiropractic care commenced on the episode's 1st day, between days 1 and 7, between weeks 2 and 5, and between weeks 6 and 13. We compared the 1st group against each of the other 3. Propensity score models were developed to account for population differences, and generalized linear models were utilized with inverse propensity weights to compare total episode cost. **Results:** Using 1,124,573 episodes, statistically significant reductions in total episode cost was associated with earlier chiropractor involvement. Specifically, an estimated $991 reduction was associated with involvement in the 1st day as compared to the 1st week, an estimated $662 reduction when compared to involvement in weeks 2 to 5, and an estimated $441 reduction when compared to involvement in weeks 6 to 13. **Conclusion:** Earlier engagement of chiropractors may be associated with reductions in cost of care for nonsurgical SRDs. (This is a conference presentation abstract and not a full work that has been published.)

Dosage of treatment for cervical pain by field doctors using cervical flexion distraction

Dana Madigan, Jerrilyn Cambron, Jennifer Dexheimer, Marturi Ram Gudavalli, James Cox

Objective: Determine the number of chiropractic visits neck pain patients undergo until reaching maximum medical improvement (MMI) defined by a 100% reduction in pain, return to preinjury state, or reaching 3 months of care. **Methods:** Certified flexion-distraction chiropractors completed all usual treatment for new patients presenting to their clinics with neck pain. Data were collected through surveys filled out by the patient and clinician every visit until the end of care or for 3 months. **Results:** At 103 initial patient visits, neck pain was described as constant (65.0%) and aching (78.6%), with an average numerical pain rating scale of 5.5. Initial presentation was described by clinicians as nonradicular (54.4%), located at C5 (81.6%) and C6 (75.7%), and most commonly diagnosed as segmental dysfunction (61.2%) and degenerative disc disease (60.2%). MMI was reached in 60 of 97 cases (61.9%), with those having 100% reduction in pain ($n = 26$, 26.8%) on average attending 9 visits (range 2–23) to reduce pain from 4.6 to 0.2. **Conclusion:** Approximately 9 visits are required for MMI in new neck pain patients; however, there was a wide range of treatment visits demonstrating a need for further studies on dosage. (This is a conference presentation abstract and not a full work that has been published.)

The effectiveness of the Impulse iQ adjusting instrument compared to ischemic compression in the treatment of upper trapezius myofascial trigger points in participants with nonspecific neck pain

Alistair Makowe, Desiree Varatharajullu

Objective: To determine the effectiveness of the Impulse iQ adjusting instrument (IAI) compared to ischemic compression (IC) for the treatment of upper trapezius muscle myofascial trigger points (MFTPs). **Methodology:** This study was a randomized single-blinded clinical trial consisting of 40 participants. Participants received 3 treatments over a 2.5-week period. Neck pain level was determined

using a numerical pain rating scale, lateral flexion was determined by a cervical range of motion goniometer (CROM), and pain pressure thresholds (PPTs) were measured with an algometer. Activities of daily living were assessed using the Canadian Memorial Chiropractic College Neck Disability Index. **Results:** Repeated measures analysis of variance testing examined the intragroup effect of time and intergroup effect of treatment. Profile plots assessed direction and trends of the effects. Intragroup analysis revealed that all groups responded positively to treatment, with no significant time-group interaction. A higher rate of improvement for IAI with respect to algometer readings was seen; however, this difference was statistically insignificant. **Conclusion:** Neither IC nor the IAI was more effective with respect to pain perception and CROM. The IAI was more effective on PPT. Therefore, both therapies can be used in the treatment of MFTPs. (This is a conference presentation abstract and not a full work that has been published.)

Effects of practice variability on spinal manipulation learning

Andree-Anne Marchand, Laura Mendoza, Claude Dugas, Martin Descarreaux, Isabelle Page

Objective: Evaluate the effects of practice variability on chiropractic students' capacity to deliver spinal manipulations (SMs) of a targeted peak force. **Methods:** Forty students participated in an evaluation session including either a variable or a constant practice protocol of 45 SMs. SMs were delivered on a computer-connected device that recorded force-time profiles. Ten SMs of a 350-N peak force target were performed before practice, immediately following, and 2 days after. Mixed-design analyses of variance were used to assess the effect of practice type on SMs biomechanical parameters and on the constant, absolute (AE), and variable (VE) errors. **Results:** The practice period led to significantly more accurate ($FAE(2,76) = 6.17$, $p < .01$) and consistent ($FVE(2,76) = 3.90$, $p = .02$) performances at postintervention assessment regardless of practice type. Among biomechanical parameters, preload force was higher at the retention assessment than at baseline ($F(2,76) = 6.53$, $p < .01$), while rate of force application significantly decreased between baseline and retention assessment ($F(2,76) = 4.10$, $p = .02$). **Conclusion:** This experimental study showed that 1 session of SM practice including feedback leads to an increase in SMT peak force accuracy and consistency. This improvement is reached whether or not the practice period included variable practice. (This is a conference presentation abstract and not a full work that has been published.)

Soluble factors obtained from the notochordal cell–rich intervertebral disc nucleus pulposus regenerate the degenerative disc: a preclinical animal model proof of principal study

Ajay Matta, Muhammad Zia Karim, Stanley Zhou, William Mark Erwin

Background and Objective: A biological therapy that could rescue the nucleus pulposus (NP) from degeneration would revolutionize the treatment of the degenerative disc disease (DDD). Here we demonstrate that conditioned medium developed from the notochordal cell (NC)–rich nonchondrodystrophic (NCD) canine NP ("NCCM") can rescue the NP in a preclinical rat-tail model of DDD. **Methods:** We induced DDD in 12-week-old female Wistar rat-tails using image guidance and needle puncture injury. Then 4-weeks postinjury we injected 8 μL of NCCM into the injured discs of 5 animals or equal volumes of PBS in 5 control animals. We then evaluated the effects of NCCM using immunohistochemistry and Western blotting. **Results:** PBS-treated rat-tail discs degenerate and assume a degenerative, fibrocartilaginous phenotype, whereas NCCM-injected discs suppress proinflammatory markers and preserve NC and stemness markers as well as increased collagen type II and Sox9. **Discussion and Conclusions:** For the first time, to our knowledge, we demonstrate that a single injection of NCCM can restore the healthy cellular phenotype of the degenerative disc and demonstrate anabolic effects upon the NP ECM. The necessary and sufficient factors contained within NCCM could be harnessed within a minimally invasive biological therapy for the treatment of DDD. (This is a conference presentation abstract and not a full work that has been published.)

Sonographic diagnosis of distal intersection syndrome and subsequent rupture of the extensor pollicis longus tendon

Ross Mattox, Patrick Battaglia, Norman Kettner

Objective: The purpose of this case report is to describe the value of musculoskeletal ultrasound (US) in diagnosing both distal intersection syndrome (DIS) and rupture of the extensor pollicis longus (EPL) tendon in the same patient. **Clinical features:** A 37-year-old patient presented to a chiropractic physician for evaluation of a painful bump of unknown etiology on the dorsolateral aspect of her nondominant wrist. **Intervention and outcome:** US demonstrated tenosynovitis distal to Lister's tubercle of the EPL tendon and of the extensor carpi radialis tendons, consistent with DIS. Immobilization therapy was employed, during which time the patient suffered rupture of the EPL tendon. Follow-up US examination confirmed this additional diagnosis. Characteristic US findings of DIS and EPL rupture were observed. Surgical intervention was required and the patient is currently recovering. **Conclusion:** Although EPL rupture is relatively common in the literature, DIS is rare. In this case, US provided the initial diagnosis of DIS and confirmed the clinical diagnosis of EPL rupture in the same patient. This case therefore underscores the value of US as a widely available, cost effective, and dynamic imaging modality for evaluation of wrist complaints. (This is a conference presentation abstract and not a full work that has been published.)

Chiropractic care in a system dynamics model for minimizing opioid abuse for chronic nonmalignant pain patients

Marion McGregor, Alexandra Nielsen, Chadwick Chung, Mark Fillery, Wayne Wakeland, Silvano Mior

Objective: The present study focuses on the influence of including chiropractic as alternative care in a system dynamics model of opioid prescribing and long-term outcomes. **Methods:** Canadian population-based data were retrieved from on-line nationwide statistical data sources and published literature to describe variables of interest from 1995 to 2015. System dynamics modeling techniques were used to modify a US-based previously published model of medical opioid use and abuse to include chiropractic at the outset. **Results:** Modeled data projected 1719 opioid-related deaths and 256,900 opioid-dependent individuals for 2015. Implementation of the chiropractic care choice over 15 years resulted in a decrease of opioid-related deaths to 1142. Similarly, a decline in the incidence of opioid-dependence to a level of 173,400 individuals was observed. Difference of proportions tests were highly significant for both outcome variables ($p < .0002$ in each case). **Conclusion:** In this preliminary model, the effect of a policy change to increase utilization of a chiropractic care choice resulted in a statistically significant reduction ($p < .0002$) in the proportion of the population whose death could be attributed to opioid use. In addition, the model projected a dramatic decrease in the number of addicted individuals ($p < .0002$). (This is a conference presentation abstract and not a full work that has been published.)

The health benefits of L-arginine: an umbrella review of meta-analyses

Marc McRae

Objective: L-arginine is a semiessential amino acid that is the substrate for nitric oxide production by vascular endothelial and immune cells. Nitric oxide production by these cells is essential for blood pressure regulation, immune regulation, and wound healing. However, there is much discrepancy in the literature when it comes to randomized controlled studies, and so this umbrella review of published meta-analyses was performed to examine the efficacy of L-arginine's role as a therapeutic agent. **Methods:** A PubMed search to July 31, 2015 was conducted using the following search strategy: (meta OR systematic) AND (arginine). Only English language publications were retrieved that provided quantitative statistical analysis of outcomes on blood pressure and immune function. **Results and Conclusion:** Seven meta-analyses were retrieved into this umbrella review and show significant positive benefits for reducing systolic and diastolic blood pressure in hypertensive adults, reducing diastolic blood pressure in pregnant women with gestational hypertension, reducing the length of time in hospital for preoperative surgery patients, and 2 of the 3 meta-analyses showed a 40% reduction in the incidence of hospital-

acquired infections. (This is a conference presentation abstract and not a full work that has been published.)

The long and short of it: the C6 spinous process masquerade

Linda Mullin, Susan Esposito, Ronald Hosek, Nicole Poirier, Karima Cooper

Objective: The spinous process (SP) of C7 is used as a beginning point for counting vertebral levels. It is described as stationary under a bifid C6 SP that will "disappear" on extension palpation. However, SP morphology is variable and may impact accuracy of level identification. **Methods:** Three chiropractors, experienced in cervical extension palpation techniques, viewed 100 A-P and lateral cervical radiographs. Interexaminer reliability was investigated as they recorded the most cephalad SP that was nonbifid and of sufficient length so as to likely palpate as the stationary SP on extension palpation. **Results:** A Fleiss κ value of 0.873 was calculated, which is considered to be almost perfect agreement. The C7 vertebral level was reported for 60 subjects with all the remaining subjects (40) reported at the C6 level. The 3rd examiner reported 58 subjects at the C7 level and 42 subjects at the C6 level. No other vertebral levels were reported. **Conclusion:** The C6 SP can frequently have the length and shape that is traditionally and uniquely assigned to the vertebra prominens. This may account for the poor validity in studies using static and extension palpation to identify C7. (This is a conference presentation abstract and not a full work that has been published.)

Resolution of perineal numbness following arthroscopic hip surgery utilizing chiropractic intervention and soft tissue mobilization: a case report

Harold Olson, Andrew Zetocha, Courtney Olson

Objective: The purpose of this case report is to describe and discuss the resolution of perineal numbness ness in a 31-year-old female status post right hip arthroscopy with labral repair through chiropractic intervention and soft tissue mobilization. **Clinical Features:** A 31-year-old female presented to a chiropractic clinic with 7 weeks of ongoing perineal numbness following right hip arthroscopic surgery with labral repair. The patient reported lack of sensation during urination, sexual intercourse, and with the insertion/removal of female hygienic products into the vagina. **Intervention and Outcome:** Conservative care included myofascial release to the psoas and obturator internus muscles as well as instrument-assisted soft tissue mobilization over the obturator internus. Manual manipulation to the pelvis was also performed. The patient reported complete resolution of perineal numbness after 3 chiropractic sessions. **Conclusion:** This case report describes a patient who was suffering from a postoperative neural injury causing numbness to the perineal region. With conservative chiropractic intervention, full resolution of the symptoms was achieved. To our knowledge, this is the first case report demonstrating the effectiveness of chiropractic intervention combined with manual therapy to treat perineal numbness following hip surgery. (This is a conference presentation abstract and not a full work that has been published.)

Changes in adjustment force, speed, and direction factors in chiropractic students after 10 weeks undergoing standard technique training

Edward Owens, Hosek Ronald, Linda Mullin, Lydia Dever, Stephanie Sullivan, Brent Russell

Objective: To assess the force profiles of high-velocity low-amplitude (HVLA) thrusts delivered to a mannequin on a force platform by naïve student volunteers given only verbal instructions. **Methods:** In this institutional review board–approved study, student volunteers untrained in adjusting delivered a series of adjustments to a mannequin on a force platform. Participants performed 3 light, 3 normal, and 3 heavy thrusts on 5 listings specifying contact point, hand, and direction. Force profiles were analyzed for speed and amplitude, consistency and force discrimination. Two recording sessions occurred 10 weeks apart. **Results:** Sixteen participants (11 females, 5 male) completed the study. Peak forces ranged from 880 to 202 N for heavy thrusts and 322 to 66 N for light thrusts. Thrust rate was from 8.1 to 1.8 N/ms. Average coefficients of variability (CV = STD/mean) at each load level (initial/final) were as follows: heavy: 0.17/0.15, normal: 0.16/0.15, and light: 0.20/0.20, with 0 as ideal. A force ratio measured students' abilities to distinguish heavy from normal and light thrusts. The heavy/normal ratio (initial/final) was 1.35/1.39 and the light/normal ratio was 0.70/0.67. **Conclusion:** Naïve students are somewhat consistent in performing mock HVLA adjustive thrusts and are able to discriminate between light and heavy loads. (This is a conference presentation abstract and not a full work that has been published.)

Amplitude and topographical representation of the neuromuscular response to spinal manipulation in participants with chronic low back pain do not differ from healthy participants

Isabelle Page, Francois Nougarou, Martin Descarreaux

Objective: To compare the neuromuscular response amplitude to spinal manipulation therapy (SMT) as well as the topographical response representation between healthy participants and participants with chronic low back pain (cLBP). **Methods:** Four SMT force-time profiles (peak forces ranging from 75 to 225 N) were delivered by an apparatus to the L3 spinous process of 25 healthy participants and 26 participants with cLBP. Lumbar neuromuscular responses were recorded using large surface electromyography arrays. Between-group differences in the dose-response relationship between SMT forces and neuromuscular response amplitudes, as well as the topographical response representation, were assessed using mixed model analyses of variance. **Results:** A main effect of SMT force on neuromuscular responses was observed [$F(3,147) = 11.75$, $p < .001$], indicating a rise in response amplitudes with increasing SMT forces. However, there was no between-group differences in the dose-response relationship [$F(1,49) = 2.81$, $p = .10$] or the topographical representation of neuromuscular responses ($p > .05$). Higher neuromuscular response amplitudes were observed in the vicinity of the contacted vertebra. **Conclusion:** The neuromuscular response amplitude to SMT does not differ between participants with and without cLBP. Studies are needed to assess the clinical implication of the regional neuromuscular response generated by a SMT. (This is a conference presentation abstract and not a full work that has been published.)

Investigating the scalability and dimensionality of the Dundee Ready Educational Environment Measure: a Mokken scale analysis

Per Palmgren, Ulf Brodin, Gunnar Nilsson, Klara Laksov

Objective: The aim of this study was to investigate the psychometric properties of the Swedish version of the Dundee Ready Educational Environment Measure (DREEM) in a sample of undergraduate physiotherapy students. **Methods:** Using a convenience sample of students ($n = 222$), the psychometric properties of the putative subscale structure in the DREEM was tested. Scalability and dimensionality was assessed by means of Mokken scale analysis. **Result:** Analysis of the item response rate displayed no major concerns, and subscales demarcated no considerable floor or ceiling effects. SPL showed moderate scalability, while the SPA scalability was weak but marginally moderate. SPT, SASP, and SSSP exhibited very weak scalability. The a priori subscales could not be supported, and an explorative AISP partitioned the items into 2 or 3 Mokken scales, with the exception of SASP. Two subscales displayed ρ values $<.70$. **Conclusion:** Our analysis could not provide definitive support for the psychometric properties of the Swedish version of the DREEM in a sample of undergraduate physiotherapy students. Removal of certain items and the reformulation of negatively phrased statements (so that all items are unidirectional) could enhance the internal construct validity of the putative model. (This is a conference presentation abstract and not a full work that has been published.)

Perceptions of the value of formative assessment tasks as students progress through their undergraduate chiropractic education

Laura Pendleton, Adrian Hunnisett, Christina Cunliffe

Introduction: Formative assessment is considered a major tool in the progress of student learning. The purpose of this study was to gauge the current use of the directed learning diary (DLD) as a formative assessment tool. **Method:** Following ethical approval, a cross-sectional survey was undertaken of all students and staff in a chiropractic college. The survey examined student opinions of the

value of the DLD in subject knowledge and examination preparation. Staff were asked about DLD relevance, marking habits, and regularity of setting. **Results:** A total of 153 students and 10 staff took part in this research. The DLD is believed to be increasingly valuable as a formative assessment tool, and for progressing subject knowledge, however was not considered valuable for preparing students for examinations. Staff consider that the DLD is a relevant tool and that marking and feedback was given on each DLD set. Student responses did not match this, suggesting that only 29% of DLDs contained feedback, raising questions about expectation of feedback. **Conclusion:** This study supports previous research regarding the value of formative assessment tasks in progressing subject knowledge. The need for a greater level of tutor feedback was identified. (This is a conference presentation abstract and not a full work that has been published.)

Evaluation and comparison of patient safety dimensions and quality improvement items at chiropractic teaching clinics

Katherine Pohlman, Maeve O'Beirne, Silvano Mior, Haymo Thiel, Craig Jacobs, Anthony Tibbles, Martha Funabashi, Sunita Vohra

Objective: To survey current patient safety attitudes/opinions and quality improvement areas at 2 chiropractic teaching clinics. **Methods:** We modified the Agency for Healthcare Research and Quality Patient Safety Culture survey to assess 12 safety dimensions and 3 quality areas. Interns and clinicians at Anglo-European Chiropractic College (AECC) ($n = 149$) and Canadian Memorial Chiropractic College (CMCC) ($n = 209$) were invited to participate. **Results:** Response rate was 57.5% ($n = 225$). Those at AECC had lower scores for teamwork (61%), overall administrative perception (42%), communication openness (36%), and leadership support score (38%) ($p < .05$). CMCC had a higher score for overall clinical perception (85%), but a lower score for staff training (32%). Work pressure/pace had high scores from all respondents. Similar rates were found between AECC and CMCC for medication not being updated, effective information exchange with all except insurance companies, functioning equipment, and timely, patient-centered, effective, and equitable care. **Conclusion:** Work pressure/pace, a common area of concern and a major contributor to medical errors, was identified as an area of strength. Between institutions, there were several differences found, likely due to differences in cultures and institutional organization. Identifying areas of improvement may help to target patient safety training at healthcare educational institutions, something which is currently not well documented. (This is a conference presentation abstract and not a full work that has been published.)

Improvement in ultrasound vascular measurements following atlas orthogonal adjustments in a patient with bow hunter's syndrome

Robert Rectenwald, Roy Sweat

Objective: To discuss the results of vascular flow and spinal alignment improvement in a case of bow hunter's syndrome (BHS) following treatment with atlas orthogonal (AO) chiropractic adjustments. **Clinical Features:** The 39-year-old female patient was diagnosed with BHS after injury in a motor vehicle collision. The patient declined surgical treatment. Symptoms of transient vision loss (TVL) with head rotation and hand numbness persisted. **Intervention:** Chiropractic examination included diagnostic ultrasonography of the vertebral arteries (VA) and cervical spine radiography. Treatment consisted of adjustments of the cervical spine utilizing the AO technique protocol based on radiographic analysis. **Outcome:** Testing was performed after the 1st adjustment. VA vascular speed and volume was improved by 8.2% in the left VA and 22.2% in the right VA. Alignment of cranium and cervical spine was improved 72%. Symptoms were improved moderately. After 9 adjustments over a 6-week period, TVL was completely resolved. The patient remained asymptomatic at 3, 6, and 12 month visits. **Conclusion:** AO chiropractic adjustments may offer an effective, noninvasive treatment option in cases of posttraumatic BHS. Posttreatment VA hemodynamics improvement, measured by ultrasonography, is a predictor of a good prognosis. (This is a conference presentation abstract and not a full work that has been published.)

Abbreviated progressive relaxation therapy as a potentially valuable augmentation to chiropractic for treatment of musculoskeletal pain: a pilot study

Chandra Ricks, Adrian Hunnisett, Christina Cunliffe

Introduction: Awareness is increasing for chiropractors and patients that stress can create or exacerbate musculoskeletal pain. Stress management may be beneficial within chiropractic treatment. This study investigated the feasibility of implementing abbreviated progressive relaxation therapy (APRT) as an adjunct to chiropractic, focusing on stress and pain reduction. **Method:** Following ethical approval, a randomized controlled trial was designed with 41 subjects with musculoskeletal pain divided into a chiropractic control ($n = 20$) and APRT plus chiropractic intervention ($n = 21$). Perceived stress and pain levels were assessed pretreatment, posttreatment and next follow-up visit. **Results:** The intervention group demonstrated a highly significant reduction in stress levels pre-/posttreatment ($p < .001$) and significant stress reduction when compared to the control group ($p < .05$). The intervention group demonstrated a highly significant variation in pain level at the 3 assessment points ($p < .001$), with a sharp drop in pain levels pre- and postintervention ($p < .01$). Chronic musculoskeletal pain patients in the intervention group showed highly significant reduction in pain levels ($p < .001$) and significant changes for acute musculoskeletal pain patients ($p < .05$). **Conclusion:** Clear clinical benefits, in line with other research, suggest APRT is an appropriate stress management strategy. Future research is warranted to explore clinical benefits with sustained APRT. (This is a conference presentation abstract and not a full work that has been published.)

Multimodal treatment of an 18-year-old collegiate soccer player with a grade 2 medial collateral ligament tear

Todd Riddle, Michael Tunning, Thomas Hyde, Dale Richardson

Objective: This case study describes the management of a collegiate athlete with a grade 2 or 3 medial collateral ligament (MCL) tear. **Clinical Features:** An 18-year-old male soccer player presented with an initial diagnosis of a grade 2 or 3 MCL tear confirmed on magnetic resonance imaging. He presented with significant pain and tenderness as well as functional deficits. **Intervention and Outcomes:** A multimodal approach to the patient's rehabilitation included instrument-assisted soft-tissue mobilization, strengthening, proprioception, and laser. Through the course of 4 weeks, the pain reduced to 0/10 and function returned to the point the athlete was cleared to play in competition. **Conclusion:** A multimodal, functional approach to rehabilitation of a grade 2 or 3 MCL tear was utilized. The patient experienced quick results and a return to play within 4 weeks of the initial injury. (This is a conference presentation abstract and not a full work that has been published.)

Chiropractic and respiratory therapy: an essential professional collaboration

Robert Rowell, Josefina Torres

Introduction: Chiropractors see patients with respiratory conditions yearly. The most frequently seen conditions are chronic obstructive pulmonary disease (COPD), asthma, emphysema, and sleep disorders. The purpose of this study was to investigate chiropractic awareness of respiratory therapy and whether or not comanagement of patients was common. **Methods:** A literature search of PubMed, Ebsco Host, and the Index to Chiropractic Literature was conducted using the search terms "chiropractic," "respiratory therapy," and "respiratory therapist" in multiple combinations. **Results:** A single reference to the comanagement of a patient with chiropractic care and respiratory therapy was found. Furthermore, the 2015 NBCE Practice Analysis lists the interprofessional referrals from chiropractors and to chiropractors. Respiratory therapy is not listed. **Discussion:** Respiratory therapy is a profession that assists in the diagnosis and treatment of patients with respiratory diseases such as asthma, COPD, emphysema, and obstructive sleep apnea. **Conclusion:** Chiropractors do not seem to refer patients to respiratory therapists. With education about the education, qualifications, and services provided by respiratory therapists, chiropractors are more likely to make such referrals. This may result in better diagnostic services and management for chiropractic patients with respiratory diseases. (This is a

conference presentation abstract and not a full work that has been published.)

The effect of force feedback training on students learning flexion-distraction technique

Robert Rowell, Ram Gudavalli, Steven Silverman

Introduction: The objective was to compare 2 groups of students: 1 received traditional training and the other received traditional training plus force feedback. **Methods:** Participants were randomly allocated to 2 groups. Measurements of students' forces were taken before training, and after force feedback training. Students rated the helpfulness of the training and the comfort of the force transducer. **Results:** Thirty-one students were enrolled. Both groups delivered similar forces at baseline. Group 1 students' subsequent force measurements were higher after force feedback training. Group 2 students' forces were unchanged. Group 2 students were trained with force feedback for the 2nd week of the class. Group 2 forces were higher after feedback and similar to group 1. Students rated the training as either very helpful or somewhat helpful. Students also experienced discomfort as a patient and a student-doctor due to the force transducer that was used. **Discussion:** Students who received force feedback training were able to learn to deliver higher forces, while those who did not receive force feedback did not. **Conclusion:** Force feedback helped students deliver forces closer to the desired force level and to learn this faster than students who were not trained with force feedback. (This is a conference presentation abstract and not a full work that has been published.)

Integration of chiropractic within the UK National Health Service: a survey of medical and chiropractic professionals

Joanne Rule, Adrian Hunnisett, Christina Cunliffe

Introduction: The Any Qualified Provider (AQP) scheme is available as a route to procure chiropractic services within the UK National Health Service (NHS). This research sought to understand the views and attitudes of general medical practitioners (GPs) and chiropractors toward integration of chiropractic and professional integration within NHS England. **Method:** Following ethical approval, a cross-sectional survey of chiropractors ($n = 376$) and GPs ($n = 500$) from 2 distinct geographical areas were surveyed regarding their current practice and their views on the NHS integration of chiropractic. **Results:** Overall, 42% of chiropractors would like to treat patients within the NHS, but over 25% were unaware that chiropractic services may be procured through AQP. Some 47% of GPs would refer their patients for chiropractic treatment if it were available locally within the NHS, but 65% of GPs were unaware that chiropractic services may be procured via AQP. **Conclusion:** Chiropractors would like to offer chiropractic services within the NHS, and a significant proportion of GPs would use chiropractic. However, there is a lack of awareness amongst chiropractors and GPs that chiropractic services may be procured via the AQP route. This highlights a need for cross-professional education to improve availability of chiropractic in the UK. (This is a conference presentation abstract and not a full work that has been published.)

Kinetic and kinematic analysis of walking gait, before and after chiropractic care, following 5th metatarsal fractures

Brent Russell, Kathryn Hoiriis, Ronald Hosek, Michael Weiner

Objective: This is a report on a prospective investigation of the kinetic and kinematic analysis of walking gait for a 62-year-old female patient following healed left proximal 5th metatarsal fractures. **Methods:** The patient's walking gait was evaluated with a force sensor instrumented treadmill and a MyoMotion inertial measurement unit motion capture system. Recordings were made precare and at 2 intervals following chiropractic care. Data were analyzed for spatiotemporal gait parameters, vertical ground reaction forces, and maximum joint angles for hip, knee, and ankle. **Results:** Self-selected walking speed substantially increased as did step length and single support time. Increased symmetry was seen in peak ground reaction forces, hip extension, knee flexion, and ankle dorsiflexion. **Conclusion:** The postinjury kinematic and kinetic data allowed for quantification gait patterns and changes during recovery. Identification of atypical parameters, force patterns, and asymmetries can be used to personalize treatment and guide return to normal physical activities. This case is part of an ongoing investigation of gait analysis as an outcome measure of chiropractic care. (This is a conference presentation abstract and not a full work that has been published.)

Multimorbidity, musculoskeletal complaints, and pain characteristics of older adults with low back pain: a secondary analysis from a randomized controlled trial

Stacie Salsbury, William Alexander, James Boysen, Julie Hartman, Janice Hubbard, Elissa Twist, Robert Vining, Christine Goertz

Objective: To describe comorbidities and musculoskeletal conditions of older adults who participated in a randomized clinical trial for low back pain (LBP). **Methods:** We conducted a secondary data analysis of an institutional review board– approved study. Participants were age $\geq$65 with LBP lasting $\geq$1 month. Research record abstraction included self-reported history, exam findings, clinical diagnoses, and radiology reports. Descriptive statistics are presented. **Results:** Participants ($N = 217$) were 73.7 (6.9) years old, male (63%), and white (92%) with LBP lasting $\geq$1 year (69%). Ninety-eight percent reported $\geq$1 LBP triggers, typically functional activities. A mean of 23 (7) (range 7–42) comorbidities were documented, including overweight/obesity (85%), atherosclerosis (62%), hypertension (59%), hearing loss (44%), cataracts (32%), fatigue (29%), gastroesophageal reflux (25%), cancer (24%), shortness of breath (24%), sleep apnea (22%), diabetes (20%), memory loss (16%), dizziness (16%), depression (15%), and stroke (5%). Musculoskeletal complaints included LBP (98%), neck pain (53%), and hip pain (53%), knee (14%) or hip replacements (7%), laminectomy (6%), and spinal fusion (2%). Radiology revealed spinal degeneration (98%), osteoporosis (81%), and spinal curvature (60%). **Conclusion:** Older adults participating in a chiropractic study had significant multimorbidity that may influence clinical management and create opportunities for interprofessional collaboration. (This is a conference presentation abstract and not a full work that has been published.)

Chiropractic student attitudes toward team-based learning

William Sherrier, Ali Rabatsky, Teresa Brennan

Objective: Despite strong support of group learning and testing in the classroom, recent evidence suggests students have a tendency to place less value on these methods in favor of more traditional approaches. We suspected that chiropractic students may feel the same, but their attitudes toward team-based learning (TBL) have never been quantified. **Methods:** Two consecutive cohorts of chiropractic students enrolled in a course that used weekly TBL activities completed an adaptation of the Value of Teams Survey at the end of the term. **Results:** Statistical analysis revealed that students do value the TBL process and that their perception of TBL improved as the course progressed. **Conclusion:** These results were similar to those found in other medical education studies where the value of TBL was realized with well-informed instruction and when allowed to evolve over time. (This is a conference presentation abstract and not a full work that has been published.)

Neurogenic claudication secondary to spinal epidural lipomatosis: a case report

Keith Silcox, Clinton Daniels, Glenn Bub, Pamela Wakefield

Objective: Neurogenic claudication describes symptoms that are most commonly brought on by degeneration of the lumbar spine resulting in central canal stenosis. This case report presents neurogenic claudication due to the less common cause of spinal epidural lipomatosis—the proliferation of nonencapsulated adipose tissue around the spinal cord. **Clinical Features:** A 63-year-old male U.S. Marine Corp veteran presented to the chiropractic clinic with neurogenic claudication, but without bony central canal stenosis on lumbar computed tomography. **Intervention and Outcome:** The patient completed a trial of chiropractic care with transient beneficial gains after 7 appointments, however no durable improvement in neurogenic claudication symptoms was achieved. An magnetic resonance image was recommended at this point, which revealed spinal epidural lipomatosis at the L5/S1 level. The patient was referred for pain management with a potential future referral for consultation with neurosurgery. **Conclusion:** This case presents an uncommon cause of neurogenic claudication and provides a review of spinal epidural lipomatosis. Further, it outlines a potential limitation of computed tomography to rule out central canal stenosis from the differential

diagnosis. (This is a conference presentation abstract and not a full work that has been published.)

The determination of health literacy among patients in a chiropractic teaching clinic using the Newest Vital Sign

Edward Smith, Mark Pfefer, Rebecca Burkhalter, Angela Segovia

Objective: This study seeks to assess the health literacy receiving care at our outpatient chiropractic clinic, with an eventual goal of ensuring appropriate communication of health information to our patients in the future. **Methods:** The Newest Vital Sign (NVS) tool was utilized to assess health literacy among randomly selected patients visiting the chiropractic outpatient clinic for care. **Results:** Across the entire cohort of participating subjects (46), the average NVS score was 4.15 of a possible total of 6, corresponding to "adequate" health literacy (as indicated by a score of 4 or greater). When evaluated based on age (3 groups: age 21–40, age 41–60, age 61–80), all participants in the 21 to 40 group had "adequate" health literacy, compared with the 41 to 60 group (3 had "possibly inadequate" health literacy, score = 2) and the 61 to 80 group (9 had "possibly inadequate" health literacy; 3 had "likely inadequate" health literacy, score = 1). **Conclusion:** Our study identified 30% of our outpatient population have "likely inadequate" or "possibly inadequate" health literacy. Consideration of a patient's health literacy may foster more productive provider-patient interactions. (This is a conference presentation abstract and not a full work that has been published.)

TENS inhibits inflammatory cytokine synthesis in neuronal cell cultures

Guy Sovak, Brian Budgell

Background: Transcutaneous electrical nerve stimulation (TENS) is a noninvasive nonpharmacological treatment method that is widely used for the management of musculoskeletal pain. However, the cellular mechanisms by which TENS produces its effects are largely unexplored. **Objective:** The objective of the current study was to investigate the effects of TENS on proinflammatory cytokine synthesis in a neuronal cell line. **Methods:** NGF differentiated PC12 cells in culture were exposed to TENS at parameters similar to those used in clinical practice. Cytokine concentrations in cell lysate were measure prior to and following TENS stimulation. Additionally, immunofluorescence microscopy was used to map the cellular distribution of p65, a transcription factor that regulates cytokine synthesis. **Results:** TENS is associated with downregulation of the proinflammatory cytokines TNF-α, IL-1β, and IL-6 and promotes the cytoplasmic sequestration of the p65 transcription factor. **Conclusion:** These results suggest that one of the mechanisms of action of TENS is the downregulation of proinflammatory cytokines. (This is a conference presentation abstract and not a full work that has been published.)

Conservative care of concussions: a systematic review

Brynne Stainsby, Colin Johnston, Kayla Mayberry, Elyse Mahony, Jonathan Okrainetz, Brendan Rae

Objective: To evaluate the evidence relating to the treatment of sport-related concussion, with regard to manual therapies and physical and/or cognitive rest. **Methods:** A literature search was performed, using predefined search terms, to gather all relevant evidence relating to the management of acute or subacute sport-related concussion in individuals aged 10 and older. Searches were performed though the EBSCO databases (AMED, CINAHL, Cochrane, Medline, Rehabilitation & Sports Medicine, and SPORTDiscus), PubMed, and the Index to Chiropractic Literature. Studies were accepted for this review if they met the defined inclusion criteria and satisfied the SIGN criteria. **Results:** After reviewing the 410 articles identified during the initial search, a total of 2 articles met the inclusion criteria and satisfied the SIGN criteria to be eligible for review. **Discussion:** The evidence from the 2 included randomized controlled trials suggest that prolonged rest following a sport-based concussion is of no more benefit than earlier return to activity; however, there is an indication that manual therapy may be more beneficial than rest in the recovery of acute or subacute concussion. **Conclusion:** This review highlights the need for high-quality research and evidence for the efficacy of various treatments for sport-based concussions. (This is a conference presentation abstract and not a full work that has been published.)

The effects of spinal manipulation on vertical jump height: a pilot study

Brynne Stainsby, Dhanbir Dulay, Porter Brown, Wesley Drew Smith

Objective: To investigate whether spinal manipulation can increase a person's vertical jump height. **Methods:** Forty-two asymptomatic male subjects, aged 21 to 30, performed 6 vertical jumps. After the 1st 3 jumps, each participant received a high-velocity low-amplitude spinal manipulation that targeted the L4-L5 spinal segments. Each participant then performed 3 more vertical jumps. Each jump was measured with a jump mat, and the jump height was recorded in centimeters. Data were analyzed to determine if jump height was greater after spinal manipulation was received. **Results:** This study had a 100% completion rate. The average of all of the jumps before manipulation (54.22 cm) was higher than the average of all the jumps after manipulation (54.05 cm) by only 0.1679 cm. The difference was not statistically significant. **Discussion:** There was slight decrease in the average of vertical jump height after spinal manipulation was received, but the decrease was not statistically significant. Proposed mechanisms that may have caused this result are decreased sympathetic neural arousal and fatigue of the ATP-PC system. **Conclusion:** This pilot study did not suggest improvement in vertical jump height following manipulation. Further research is warranted that considers fatigue, and a more controlled environment. (This is a conference presentation abstract and not a full work that has been published.)

Examining different methods of integrating force-sensing table technology into the classroom: quantitative analysis

David Starmer, Steven Lester, Natalie Labelle, Gregory Ruhr, Dominic Giuliano, Brynne Stainsby, Marion McGregor

Purpose: To gather quantitative information related to different methods by which force-sensing table technology (FSTT) could be embedded in the classroom. **Methods:** A controlled cohort study was conducted with pre- and postperformance measurements of student's ability to provide a thoracic manipulation with a target total peak force of 400 N before and after 8 weeks of instruction. Students were grouped based on their method of instruction received (no FSTT control group-CG, structured FSTT group-SG, or unstructured FSTT self-directed group-UG) and based on their correction level ("major" correction-M, "No Major" correction needed) based on their performance on their previous technique exam. **Results:** Pre- and postmeasurements were collected on 534 subjects (SG = 86; UG = 93; CG = 355). There was no significant difference between the groups by intervention ($p = .83$), by correction level ($p = .77$), or by interaction of both ($p = .28$) at baseline testing. There were significant differences between groups by intervention ($p = .00$), by correction level ($p = .01$), and by interaction of both variables ($p = .00$) at follow up. The greatest improvement was observed in the SG. **Conclusion:** A structured instructor-lead approach to classroom integration of FSTT led to the greatest acquisition of skill. Qualitative research is needed to help understand why this trend was observed. (This is a conference presentation abstract and not a full work that has been published.)

Creating the teaching track of a workshop for CAM educators in evidence-based clinical practice

John Stites, Amy Minkalis, Renee DeVries, Dana Lawrence, Cynthia Long

Objective: The purpose of this paper is to describe the development, implementation, and outcomes of a 3-day conference for complementary and alternative medicine (CAM) educators on teaching evidence-based clinical practice (EBCP). **Methods:** A survey 6 weeks prior to the program influenced its development and organization. Plenary sessions provided foundational principles. Large group lecture and facilitated small group sessions were used. In small groups each participant prepared a teaching module. Groups had a facilitator and a number of consultants assisting. Specific teaching modules were provided, but groups had the autonomy to redirect the learning experience. A 2nd survey was obtained at the end of the conference. **Results:** The preconference survey showed that respondents varied greatly in backgrounds and skill levels. The postsurvey indicated a high level of satisfaction, with all classifying the conference as good or outstanding. **Conclusion:** A unique EBCP conference for educators in

diverse CAM professions was developed. The postworkshop survey results indicated a high degree of satisfaction with the program. Educators from a variety of disciplines with a wide variety in knowledge and expertise indicated that the conference was valuable and met their needs. (This is a conference presentation abstract and not a full work that has been published.)

Association of venous leg ulcers with ankle range of motion in a socioeconomically disadvantaged population attending chiropractic mobile clinics in the Dominican Republic

Patricia Tavares, Victoria Landsman, Nathalie Gomez, Ariel Ferreiras Martinez, Ramon Lopez

Objective: To determine whether there is an association between the stages of chronic venous insufficiency (CVI), specifically venous leg ulcers, and ankle range of motion (ROM) in a socioeconomically disadvantaged population in the Dominican Republic. **Methods:** CVI classification was determined using the clinical portion of the CEAP (Clinical severity, Etiology, Anatomy, Pathophysiology) method. The legs of participants attending mobile chiropractic clinics across the Dominican Republic were assessed for clinical signs of CVI and venous ulcers. Ankle ROM was then measured, and photographs of the legs were taken. **Results:** The 6 clinical stages of CVI were divided into 3 groups: normal legs (baseline), no ulcer CVI, and ulcer (healed and active) CVI. About 30% relative reduction in ROM was observed between the ulcer group and the baseline group, which translates into approximately a 13° decrease in ROM in the regression analysis adjusted for age and gender. **Discussion:** Analysis of the data from a large-scale population base showed a statistically significant decrease in ankle ROM for participants with active and healed leg venous ulcers compared to baseline. **Conclusion:** The association between ankle ROM and venous leg ulcers has been confirmed for the study population. (This is a conference presentation abstract and not a full work that has been published.)

Variability of case mix for students on clinical placement: a prospective survey of New Zealand students' experiences evaluating preparedness for pediatric case management

Angela Todd, Matthew Carroll, David Russell, Eleanor Mitchell

Purpose: Identify, by age and number, the patients New Zealand College of Chiropractic students managed on clinical placement in Rarotonga and compare their perceptions of practice preparedness before and after. **Hypotheses:** Outreach programs provide a broad case mix of patients, and students managing more than 5 children have improved preparedness in chiropractic pediatrics. **Methods:** Students on clinical placement in Rarotonga completed deidentified pre- and postplacement surveys assessing pediatric practice preparedness. Students tallied the patient numbers, age, and technique(s) used per visit. On completion of the program, all students did the preparedness survey again at the New Zealand College of Chiropractic in Auckland. Results were tabulated and analyzed using paired *t* tests and analysis of variance. **Results:** Of those who participated, 24.1% of students before compared to 82.1% after placement, felt prepared for practice with children. Students providing care to more than 6 children under 10 years and 9 children in total felt prepared for managing children. **Conclusion:** Chiropractic clinical placement provides a broad case mix of patients and techniques applied, and students who felt prepared for pediatric case management after the placement had managed an average of 6 or more children under 10 years of age and more than 9 children in total. (This is a conference presentation abstract and not a full work that has been published.)

Building an academy of educators: a needs assessment of selected faculty educators

Michael Tunning, Dustin Derby, Kelly Krell-Mares, Michelle Barber

Background: Professional demands have led to health care educator specialization in research and/or patient care. The academy movement is one avenue that attempts to bring prestige and importance back to improved instruction. **Objective:** The authors performed a needs analysis of selected faculty at 3 chiropractic colleges to assess the need for, and willingness to participate in, an academy of educator program. **Methods:** An expert-developed, pretested survey was deployed using SurveyMonkey. The study utilized descriptive statistics (ie, analysis of variance and regression analysis) to address 3 research questions related to an academy of educators program. **Results/Discussion:** The study achieved a 53% response rate and found that an overwhelming majority of chiropractic faulty (89%) reported a need for an academy of educators. That the study found no significant differences between faculty rank or years of experience concerning the need for and participation willingness signals the potential for wide acceptance of the program. **Conclusion:** A structured approach, such as an academy, to professional teaching development may create many positive outcomes for an institution. Faculty educators are willing to engage in an efficient program that may improve teaching methods as well as create opportunities for collaborative working relationships. (This is a conference presentation abstract and not a full work that has been published.)

Adequacy of cleaning protocols for instrument-assisted soft tissue mobilization devices used in a teaching clinic

Shannon Vandaveer, Mark Pfefer, Jon Wilson

Objective: Instrument-assisted soft tissue mobilization (IASTM) techniques are commonly used by manual therapists to treat soft tissue injuries. Because of the prolonged and direct skin contact associated with IASTM techniques, there is concern over contamination of instruments and risk of blood-borne pathogen exposure. The aim of this study was to assess the presence of pathogenic bacteria on IASTM instruments used in 1 outpatient teaching clinic and to assess adequacy of current cleaning protocols. **Methods:** IASTM instruments, cases, and emollient jars were randomly sampled. Samples were transferred to tryptic soy broths and incubated at 37° centigrade for 48 hours. Cultures were inoculated onto tryptic soy agar, anaerobic blood, and mannitol salt agar plates for identification of bacterial type. **Results:** Positive bacterial growth occurred, and methicillin-resistant bacteria were identified on multiple instruments, cases, and emollient jars. Standard quick wiping of the instruments with disinfecting towelettes was not successful for controlling methicillin-resistant *Staphylococcus aureus*. **Conclusion:** Maintaining disinfected IASTM instruments is crucial as this study demonstrated they could be a vector for pathogenic bacteria. Using prescribed protocols are successful in disinfecting the instruments. (This is a conference presentation abstract and not a full work that has been published.)

Polyostotic fibrous dysplasia: mimic of malignancy

Federico Villafane, Alicia Yochum, Aimee Jokerst, Norman Kettner

Objective: This case report emphasizes that polyostotic fibrous dysplasia (FD) can go unnoticed and become symptomatic at a later age. **Clinical features:** A 53-year-old female presented complaining of low back pain that started 3 years ago after a fall on ice. The physical examination produced lumbar pain on flexion and extension. **Intervention and Outcomes:** The patient underwent radiographic examination, which demonstrated an oval geographic osteolytic lesion at the left ilium along the sacroiliac joint margin. Due to the aggressive osteolytic appearance, magnetic resonance imaging of the pelvis with contrast was obtained for additional characterization. There were 3 additional lesions that also enhanced within the left femoral neck extending to the greater trochanter. Due to the suspicious appearance, needle biopsy was performed. The pathologic findings in combination with the radiographic appearance confirmed the diagnosis of polyostotic FD. **Conclusion:** This case demonstrated a rare aggressive appearance of polyostotic FD located in the left innominate and the left proximal femur that prompted a diagnostic imaging work-up and biopsy for suspected skeletal malignancy. These lesions may therefore require careful evaluation by an experienced team of physicians, radiologists, and pathologists to ensure proper diagnosis and treatment. (This is a conference presentation abstract and not a full work that has been published.)

Motion capture analysis of students performing side posture set up and thrusts on a mannequin: a pilot study

Mike Weiner, Brent Russell, Annie Bishop, Ronale Hosek

Objective: A chiropractic adjustment is a physically demanding skill. Improper adjusting technique has been linked to injury in chiropractic practitioners. Because instruction can be subjective, this pilot study investigates motion capture as an objective assessment of postures and movement patterns during an adjustment. **Methods:** Three chiroprac-

tic students were recorded during lumbosacral side posture mock adjustments on a mannequin utilizing MyoMotion inertial measurement unit sensors. The postures before and during the maximal thrust were recorded and interpreted in terms of lumbar and thoracic flexion, extension, lateral bending, and axial rotation, as well as roll, pitch, and yaw. **Results:** Differences and similarities of adjustment postures and movements for the 3 participants were successfully documented for most measures. Yaw values suffered from magnetic interference and were deemed invalid. **Conclusion:** This pilot study suggests motion capture as a feasible approach for assessment of posture and movement patterns of chiropractors performing adjustments. These methods may contribute to a further understanding of adjustment mechanics, injury prevention, and objectivity in student instruction. (This is a conference presentation abstract and not a full work that has been published.)

Faculty use and perceptions of barriers to using available institutionally provided educational technology: a case study using Rogers' diffusion of innovation theory

Jon Wilson, Mark Pfefer, Marina Mangano

Objective: Chiropractic education is continually challenged by a need to incorporate innovations, usually in the form of technology. Although there is evidence of technology being used for education in chiropractic literature, there is a paucity of information related to the diffusion of innovations. This study presents a simple model, based on Rogers' diffusion of innovation theory, which can be used to inform chiropractic educational institutions about factors affecting innovation diffusion. **Methods:** An electronic survey was designed to measure faculty use of currently available institutionally provided educational technology and perceptions of barriers to using this technology. Descriptive statistics were performed. **Results:** Findings from this case study indicate an environment generally supportive of innovation diffusion. A few noted exceptions were lack of training related to software use and incorporating technology in teaching. **Conclusion:** Educational institutions should have a published institutional technology plan, and information from studies such as this one should be used to inform the process of documenting this plan. Further studies regarding educational technology diffusion in chiropractic education are needed. (This is a conference presentation abstract and not a full work that has been published.)

Attitudes toward the basic science courses of students entering chiropractic college

Shari Wynd, Martha Friesen

Objectives: To determine the differences in attitude toward the basic sciences in students entering their 1st trimester of a chiropractic college when compared to their upper trimester cohorts. **Methods:** Chiropractic students entering 1st, 5th, and 8th trimester were given a survey with 6 statements regarding each basic science course and were asked to indicate the level to which they agreed with each statement. A "Total Attitude Score" was determined by adding all of their attitude responses across all basic science courses. **Results:** There were no significant differences in "Total Attitude Score" between the pooled trimester 1 (84% $\pm$ 3%), the fall 2014 trimester 5 (81% $\pm$ 3%), and the pooled trimester 8 (81% $\pm$ 2%); however, the summer 2014 trimester 5 had a significantly lower "Total Attitude Score" when compared to all other trimesters (62% $\pm$ 3%) ($p < .05$). **Conclusions:** Entering trimester 1 students tended to have a higher positive opinion than their trimester 5 and 8 counterparts; however, this trend was not found to be statistically significant. As paired data are collected, we hope to identify changes in individual students' attitude as they progress through the program. (This is a conference presentation abstract and not a full work that has been published.)

Use of chiropractic terminology and perception of chiropractic's identity: a survey of chiropractic students and faculty at Canadian Memorial Chiropractic College

Sina Yeganeh, Ida Aghigh, Jillian Babin, Farah Ashhadi, Brian Gleberzon, Carmel Bachar

Introduction: The objective of this study was to survey students and faculty at Canadian Memorial Chiropractic College and determine how likely they were to use certain chiropractic terms, as well as their perception of chiropractic's identity and defined role in health care. **Methods:** An online questionnaire was emailed to all year 2, 3, and 4 students and a convenient sample of faculty. **Results:** Overall, most students opined that chiropractic was best defined as a neuromusculoskeletal profession and as primary care. Students stated they were most likely to use the terms "impingement" and "joint dysfunction," that they were less likely to use the terms "spinal malalignment" and "spinal lesion" and unlikely to use the terms "disease," "innate intelligence," or "vertebral subluxation." Respondents indicated they would use some terms with patients or colleagues but not with medical doctors or in legal proceedings. Responses from faculty were similar. **Conclusions:** At Canadian Memorial Chiropractic College, respondents' perception of chiropractic's identity, health care role, and their use of certain chiropractic terms were very consistent, although it differs considerably from studies conducted at other chiropractic colleges. (This is a conference presentation abstract and not a full work that has been published.)

The effects of altered biomechanics on the presence of bone marrow edema and low back pain

Alicia Yochum, Gary Guebert, Jeff Thompson, Terry Yochum, Kim Christensen, Norman Kettner

Objective: This study investigated the relationship between induced overpronation and bone marrow edema (BME) within the lower lumbar spine, sacroiliac joints, hip, knee, and ankle/foot joints. Altered biomechanics, the development of pain, and disability were also evaluated. **Methods:** Twenty-two qualified and consented participants were randomized into experimental (17) and control groups (5). A pronation-inducing wedge (9/16 inches) was worn in the right shoe of the experimental group for 4 weeks. Every 2 weeks, magnetic resonance imaging (MRI), a numerical rating scale (NRS), and photographs of biomechanical overhead squat postures were performed. After 4 weeks of daily wear, the device was removed and follow-up examination was done (MRI, NRS, Oswestry disability scale, and biomechanical photographs) after 2 additional weeks. **Results:** Four participants developed bone marrow edema (2 foot, 2 lumbar spine). All participants in the experimental group developed low back pain, while 76% developed pain in the lower extremity. Oswestry Disability Index scores ranged from 6% to 58%. All participants had preexisting functional biomechanical faults. Statistical significance ($p < .01$) was found in the NRS and Oswestry Index. **Conclusion:** Altered biomechanics of the foot can propagate through the kinetic chain causing pain and disability in the lower back with BME. (This is a conference presentation abstract and not a full work that has been published.)

Does requiring students to justify answer changes during collaborative testing enhance academic performance?

Niu Zhang, Charles Henderson

Objective: Three hypotheses were tested in a chiropractic education program: (1) Collaborative exams during a course would enhance student performance on a noncollaborative final exam administered at the end of term compared to students given traditional (noncollaborative) exams during the course; (2) requiring reasons for changing answers during collaborative topical exams would further enhance performance on the final exam; (3) there would be a differential question-type effect on the final exam, with greater improvement in comprehension question scores compared to simple recall scores. **Methods:** Two hundred twenty-three students participated in the study. Students were assigned to 1 of 3 study cohorts: (1) control—a traditional, noncollaborative exam format; (2) collaborative exam only—a collaborative format, not requiring answer change justification; and (3) collaborative exam with justification—a collaborative exam format, but requiring justification for answer changes. **Results:** Collaborative examination with justification enhanced academic performance. **Conclusion:** We conclude that test collaboration with the requirement that students explain the reason for making answer changes is a more effective learning tool than simple collaboration that does not require answer change justification. Moreover, this effect is greater for the more challenging comprehension-type questions than simple recall questions. (This is a conference presentation abstract and not a full work that has been published.)