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# Poster Presentations

*Award eligible Posters 1-12 are shown in Paper Session 7, Abstracts 35 to 46.*

## P-13

### **Preliminary Results with New Botulinum Toxin A (BoNTA) in Refractory Detrusor Overactivity in Spinal Cord Injured (SCI) Patients**

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**Objective:** Evaluate the effectiveness of new botulinum toxin A (BoNTA) used through intradetrusorial injections in treatment of neurogenic detrusor overactivity in SCI patients. **Participants/methods:** 20 SCI patients refractory to antimuscarinic therapy and in intermittent catheterization have been considered. These patients have been assessed with urodynamics and ultrasound in the 3 weeks before treatment and with urodynamic control 3/4 weeks after (particularly studied Maximum Cystometric Bladder Capacity/MCBC and Maximum Bladder Pressure/MBP). 300 units of German BoNTA (Xeomin Merz) diluted in 20 mL (20 injections, 1 mL/each, sparing the trigon) used for intradetrusorial injections; indwelling Foley catheter for 24 hours. **Results:** MCBC and MBP have been considered before and after treatment, compared with same assessments obtained in 374 effected treatments using 300 units of the American BoNTA or 750 units of the English one. Among 20 included patients, 7 have reached a bladder capacity equal or

higher than 500 mL and 5 with a capacity between 400 and 500 mL. **Conclusion:** This preliminary study has pointed out that effectiveness of the German BoNTA is similar to the American and the English ones. This evidence is significant, because German BoNTA, lacking in complexing proteins, even if used in high doses and for repeated injections, should not lead to antibodies creation, which is the cause for resistance to treatment (as it happens with toxins used till now). This fact opens a great application field to this new BoNTA for SCI patients: repeated injections of BoNTA in several sites are often advised for this kind of patient (focal treatment of muscular spasticity and neurogenic detrusor overactivity).

## P-14

### **What Is Wrong with the Assessment of Spasticity: The Method Itself or the Way the Method Is Used or the Results Are Interpreted?**

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**Objective:** To determine factors causing inconsistency in assessing spasticity. **Design:** Online survey and on-site interview. On-site results were checked with on-site examination. **Participants/methods:** 50 SCI patients (T2-T12) without complications were selected. Complete:incomplete = 31:19. M:F = 33:17. Mean age = 28. Mean time of collection data = 7 years after injury. Of the 50 patients, 9 were in-patients who were

interviewed by the second author, while the remaining 41 filled in an online form. The patients graded their spasticity from 0 to 4 based on their turning performance in bed in the morning. The grading system was designed by the second author for nonprofessionals. The results were compared with those in the evening after exposure to various factors. These 9 in-patients were cross-examined on-site by the first author, a senior rehabilitation physician using Modified Ashworth Scale (MAS). The assessment process was blind between authors. The results were sent to the third author for final analysis. **Results:** The results of the simple grading corresponded with MAS. Of the 9 in-patients, 6 received intensive passive movement. All of them had obvious decrease of spasticity. Other factors are listed in **Table 1**. Due to different activities and changing internal and external environment between morning and evening, the results were diversified.

**Table 1.** Number of patients under various influences

	Winter	Chill	Emotion	Smoking	Alcohol	Evening v morning
Increase	31	37	25	9	6	8
Decrease				1	10	14
No change	19 <sup>a</sup>	11	23	20	16	25
Uncertain		2	2			3
Irrelevant				20	18	
<b>Total</b>	<b>50</b>	<b>50</b>	<b>50</b>	<b>50</b>	<b>50</b>	<b>50</b>

<sup>a</sup> Most stayed inside at 21° to 23°C.

**Conclusion:** Whatever the method, assessments of spasticity at a single time point without taking into account activities and internal and external environment are unreliable. Of all factors, low temperature seems to increase spasticity most consistently and significantly.

## P-15

### Significance of Upper Tract Abnormalities Identified on Ultrasound During Follow-Up of Neurogenic Bladder Patients

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**Objectives:** The patients with spinal cord injury require life long follow-up for management of the neurogenic lower urinary tract dysfunction (NLUTD). There is

no single investigation for following up this group of patients. Generally, ultrasound (USS) imaging of the renal tract is the baseline study that dictates the sequence of further investigations. However, the predictive value of this examination to detect lower urinary tract abnormalities in NLUTD patients is not known. We present our experience with USS-identified upper tract abnormalities. **Patient/ methods:** We retrospectively analysed the abnormalities identified on routine follow-up USS of renal tract of our patients with NLUTD over a 2-year period. All patients subsequently underwent MAG3 renograms and videourodynamics (VCMG). We evaluated the relationship of upper urinary tract abnormality on USS to the findings of VCMG and MAG3. **Results:** We identified 27 patients who had upper urinary tract abnormality on USS. The mean age was 46 years (range,18-82), male to female ratio was 3:1. 22 patients had spinal cord injury, 3 spina bifida, 1 transverse myelitis, and 1 post-sacrectomy. 8 patients had hydronephrosis, and 19 had dilatation/fullness of collecting system. 4 of 8 (50%) had upper urinary tract obstruction proven on MAG 3 scan, while 1 had vesicoureteric reflux on VCMG. 2/19 (10.5%) with dilatation/fullness had obstruction on MAG3. while 4/19 (21%) had vesicoureteric reflux on VCMG. 5/8 (62%) with hydronephrosis and 6/19 (31%) patient with dilatation/fullness had an abnormality. Overall, 11/27 (41%) had some abnormality of the renal tract. **Conclusions:** We conclude that an abnormal ultrasound of the renal tract in asymptomatic patients with NLUTD is reflective of a renal tract abnormality in almost half the patients. Hence, we suggest that these abnormalities should be followed up with both VCMG and MAG3 scans.

## P-16

### Suprapubic Catheter Insertion in Spinal Cord Injured Patients: Our 1-Year Experience

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**Patients/methods:** A retrospective analysis identified 45 spinal cord injury (SCI) patients who had suprapubic catheter (SPC) inserted over a year. The procedure was performed as a day case under appropriate anaesthesia. We used Seldinger technique (MediPlus) in all patients and ultrasound guidance in patients with previous abdominal surgery. We evaluated the problems

encountered during the procedure and postoperative complications. **Results:** The mean age was 54 years (range, 15-88). Male to female ratio was 2.75:1, levels of SCI were as follows: cervical, 28; thoracic, 9; lumbar, 5; other, 3. All procedures were completed successfully. Ultrasound guidance was utilised in 12 cases. It was challenging to position the patients and fill small contracted bladders especially in females with patulous urethras. 4 cases had haematuria post operatively and 1 required bladder washout. 3 patients developed urinary tract infection and 2 had autonomic dysreflexia. All patients returned for successful first change of SPC to our hospital in 6 weeks. 8/45 (18%) had SPC re-insertion because of the SPC could not be replaced by district nurses. **Conclusions:** SPC insertion in SCI patients is challenging. This should be performed under controlled conditions in theatre. There is a high re-insertion rate that seems to be related to the change of SPC in the community.

## P-17

### Neurological Complications of Aging with Chronic Spinal Cord Injury

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**Objective:** (1) Increase awareness of neurological complications of chronic spinal cord injury (SCI) affecting quality of life in the elderly. (2) Assess the prevalence of neuropathic pain and spasticity in geriatric and adult patients with chronic SCI. (3) Determine the relationship of these complications to age and to time post SCI. **Design:** Retrospective cross-sectional study. **Participants/methods:** 112 patients with chronic SCI seen in outpatient rehabilitation clinic from January 2006 to December 2008. Medical records were evaluated for a documented diagnosis of neuropathic pain or spasticity and for prescription of a medication used to treat either of these problems. Subjects were assessed by age (<30, 30-44, 45-59, ≥60 years) and by time post injury (0-1, 2-5, 6-14, ≥15 years). **Results:** 4.5% and 9.8% of the total study population received a formal diagnosis of neuropathic pain and spasticity respectively, whereas 39.3% and 37.5% of the subjects were prescribed medications for treatment of these complications. Prevalence of medication use for neuropathic pain and spasticity were greatest amongst the age group ≥60 years (53.8% and 69.2%, respectively), and prevalence positively correlated with age ( $R^2 = 0.88$  and  $R^2 = 0.67$ ). Prevalence of neuropathic

pain prescription frequency decreased with time post injury, and there was no trend in prevalence of spasticity. **Conclusion:** Neuropathic pain and spasticity are common neurological complications of chronic SCI; however formal diagnosis of these problems is underdocumented. Age and number of years living with chronic SCI may influence the occurrence and severity of neurological complications of SCI. Physicians should be aware of the changes in these problems with age, properly document their diagnoses, and adjust medications in order to improve quality of life in the elderly population.

**Support:** Nothing to disclose

## P-18

### Anatomical Analysis of Cervical Posterior Fusion (Roy-Camille Lateral Mass Screw) with Enhanced Cervical CT Scan

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**Objective:** There are several screwing techniques to attain cervical fusion such as pedicle screw, lateral mass screw, facet screw, and transarticular and laminar screw. Each screwing technique has advantage and disadvantages. For cervical screwing, the most important aspect should be safety to avoid severe morbidity. As for lateral mass, screwing by Roy-Camille's technique was a very safe screwing method. All screws were inserted in the appropriate site without any complications such as spinal cord, nerve root, and vertebral artery (VA) injury in our department. Many authors have described technique variations to improve its mechanical competence and anatomic safety. But there was no literature reported about anatomical analysis with enhanced cervical CT. The main purpose of this study was to clarify the safety of the Roy-Camille lateral mass screwing technique using anatomical analysis with enhanced cervical CT scan. **Methods:** We selected 20 Japanese patients who had cervical posterior fusion (Roy-Camille lateral mass screwing technique) and were evaluated with enhanced cervical CT scans. We measured angle and depth from entry point to VA, the ideal depth for bicortical screwing of cervical lateral mass. **Results:** The mean angles from the entry point to the VA were 7 degrees medial (screwing angle was 10

degrees lateral), the depth from the entry point to the VA was more than 14 mm, and the ideal depth for bicortical screwing was about 11 mm. **Conclusion:** Results of this study reconfirm the safety of Roy-Camille lateral mass screwing technique.

## P-19

### Categorization of Pain Complaints from Spinal Cord Injury Patients According to Bryce-Ragnarsson Pain Taxonomy

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**Objective:** This study is designed to objectively categorize and evaluate degree of pain using Bryce-Ragnarsson pain scale and Visual Analogue Scale. **Design:** Prospective paper surveys. **Participants/methods:** SCI patients who currently were in admission or in outpatient department of university hospitals and rehabilitation hospitals were interviewed and answered questionnaires verbally. **Results:** Among the total 45 SCI patients, 18 patients were paraplegic and 27 patients were tetraplegic. 21 patients were complete injury and 24 patients were incomplete injury. 93.7% of male patients and 84.6% of female patients complained of pain. According to the Bryce-Ragnarsson pain taxonomy, the most common type of pain complaints was below level-neuropathic-central (type 14), followed by above level-nociceptive-mechanical or musculoskeletal (type 1), at level-nociceptive-mechanical or musculoskeletal (type 6), and then at level-neuropathic-central (type 8). Patients experiencing type 14 experienced pain during 6.4 days a week and 6.6 in VAS scale on average. Patients experiencing type 1 experienced pain during 5.9 days a week and 6.3 in VAS scale on average. 65.3% of tetraplegic patients and 82.3% of paraplegic patients currently were taking medications for pain. Most common type of medication was anticonvulsants, followed by anti-depressants, NSAIDS, and then narcotic medications. Among the patients taking medications, 87.1% of patients experienced pain relieve and mostly in 1 to 2 of VAS scale. **Conclusion:** Many of SCI patients experienced not only neuropathic pain but also other types of pain such as musculoskeletal pain. Also, after the treatment, most of patients experienced some degree of relief of pain, however that degree of improvement is very minimal and not sufficient.

## P-20

### Alterations in Electromyography Parameters During the Late Stage of Traumatic Spinal Cord Injury

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**Objective:** To study possibilities of using EMG-parameters for objectiveness of rehabilitation efficiency in late traumatic SCI. It was necessary to reveal whether the electromyography parameters alter in the course of rehabilitation in late traumatic SCI and whether these alterations correspond to other objective evidence. **Methods:** We examined 18 patients aged 18-50 years, with time after injury between 4 months and 5 years and neurological deficit A, B, and C according to ASIA classification, admitted to our centre for rehabilitation in 2008. Before and after rehabilitation (4 weeks apart), each patient had neurological examination determining motor score, locomotor capacities assessment (balance in standing and sitting, walking function) according to Potekhin's scale, electromyography, H-reflex, and M-response. The examinations were conducted by different specialists who did not know dynamics of other parameters. **Results:** Different EMG-alterations were noted in 14 patients with time after injury from several months to 3 years: in 12 subjects, H-reflex altered; in 14 cases, M-response altered. Motor score increase was noted in 3 cases. Locomotor capacities improved in 14 patients and remained the same in 4 cases. The EMG-parameters increase was followed by augmentation of motor score and locomotor capacities. H-reflex rose in 3 patients, the locomotor score increased in all cases, and motor score increased in one case. M-response increased in 8 patients including 7 cases with enhancement of locomotor skills; motor score augmentation was registered in 2 patients. For comparison, M-response decreased in 6 cases including only 2 patients with locomotor score increase; motor score did not change. **Conclusion:** Locomotor enhancement is reliably more relevant in patients with registered M-response increasing within a rehabilitation course.

## P-21

### Bladder Recovery and Nerve Regeneration in Complete Spinal Cord Transected Rats Treated with a Peripheral Nerve Graft, Acidic Fibroblast Growth Factor, and Chondroitinase ABC

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**Objective:** To study central neuronal regeneration and/or plasticity for recovery of efficient micturition. **Design:** The effects of peripheral nerve grafts (PNG) and acidic fibroblast growth factor (aFGF) combined with ChondroitinaseABC (ChABC) on bladder reflexes after complete spinal cord transection (ST, T8) in adult rats were studied. **Method:** Rats were divided randomly into 4 groups: (1) sham control (laminectomy only), (2) ST only, (3) PNG+aFGF, (4) PNG+aFGF+ChABC. 2 injections of ChABC were made near the rostral and caudal stumps of the spinal cord. Voiding behavior was recorded for 18 hours using metabolic cages. Retrograde tracing was used to evaluate the regeneration from supraspinal neuronal populations and then spinal cords were collected to conduct immunocytochemistry (ICC). **Result:** The metabolic cage study demonstrated that the PNG+aFGF+ChABC group had less voiding volumes per micturition and a higher frequency of voiding than both PNG+aFGF and ST only groups. In addition, both PNG+aFGF and PNG+aFGF+ChABC groups showed significantly lower bladder weight than the ST only group. ICC studies demonstrated in both PNG+aFGF and PNG+aFGF+ChABC groups that 5-hydroxytryptamine (5-HT) positive fibers had extended into the bridge, across the distal PNG–spinal cord interface and beyond. Apparent synapses were made by the regenerating axons. In addition, retrogradely labeled neurons were found in Barrington's nucleus and the D-region in the PNG+aFGF+ChABC group. **Conclusion:** The improvements in bladder reflexes might have been due to a newly formed supraspinal control via nerve regeneration.

## P-22

### An Objective Case Controlled Study: Does Cervical Muscle Adaptation in Male Rugby Players Aged 13-18 Occur When Compared to Age Matched Controls?

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**Objective:** Rugby is a physical game, the most catastrophic injury of which is the cervical spine injury (CSI), resulting in tetraplegia or even death.<sup>1</sup> The adolescent cervical spine is affected in 60% to 80% of spinal cases compared to only 30% to 40% in adults.<sup>2</sup> A childhood cervical injury is associated with up to a 75% mortality.<sup>3</sup> The biomechanics of children may play a role in the incidence of CSI. Currently the Rugby Football Union (RFU) guidelines differentiate between age alone and not strength. The primary outcome goal is to investigate the cervical strength of adolescent rugby playing individuals versus age matched controls. Secondary outcome measures included measurement of cervical range of movement and cervical circumference. **Design:** A prospective, objective, case controlled study against weight, height, and age matched controls. **Participants/methods:** Queen Mary's University of London ethical approval was granted. Rugby players were evaluated for their strength, using isometric contraction until eccentric failure. **Results:** Cervical circumference and strength is significantly stronger in rugby players versus age matched controls and also in 17- to 18-year-old rugby players compared with their 14- to 16-year-old counterparts ( $P < .05$ ). The difference in strength is not just age related but also sport specific as 17- to 18-year-old controls were not significantly stronger than 14- to 16-year-old rugby players ( $P > .05$ ). **Conclusion:** The results indicate that rugby players go through cervical adaptation and are stronger than age matched controls and increase in age alone does not produce increase cervical strength. Urgent RFU regulations need to be addressed before the coming season to make sure U16 players are not playing for U18 teams unless they have both sufficient strength and skill.

#### REFERENCES

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## P-23

### YIPES: Youth Injury and Prevention Education at Shepherd

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**Objective:** To educate young people on the dangers of catastrophic injuries (specifically resulting in spinal cord and brain injuries). At Shepherd, we see an average 116 teenagers (12-18 years old) in our center per year. These teenagers have sustained a spinal cord or head injury. Many of these teens are seen in the summer when the prevalence of high-risk activities increases. This program is focusing on the education of 3 such high-risk activities: diving, skim-boarding, and ATV use. The success of the program relies on using Facebook, YouTube, MySpace, chat rooms, and other media to educate teens on the dangers of these activities. YIPES uses an "in your face" approach by showing graphic videos portraying the dangers. By utilizing the above media outlets, large volumes of individuals are exposed at a rapid pace. Most important, those who have been injured become the spokespersons to those who are the next injury waiting to happen. Additional programs for prevention education include community outreach efforts such as guest lecturing to Masters of Public Health students at Emory University and presenting at a local County Board of Health meeting. Collaboration with local high school students empowers these students to promote awareness and prevention within their own schools. Additionally, we have integrated a 3-week course of study into the science curriculum of a local school system. This is a pilot program in one county, geared toward 11 and 12 year olds.

## P-24

### The Effect of Age at Injury on Outcomes in Adults with Pediatric-Onset SCI

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**Learning objectives:** To understand the effect of age at injury on health outcomes; to determine whether effect of age differs between individuals with paraplegia and those with tetraplegia; and to identify outcomes that may be the target of intervention or serve as a resiliency factor. **Objective:** To examine the effect of age at injury on outcomes in young adults with pediatric-onset spinal cord injury (SCI). **Design:** Cross-sectional, follow-up survey. **Participants/methods:** Individuals ages 24-30 ( $M = 25.5$  years,  $SD = 1.7$ ) who sustained a SCI prior to age 18 ( $M = 13.6$ ,  $SD = 4.5$ ; range, 0-18) completed a structured telephone interview. Factors assessed included: living and driving independently, college degree, employment, marriage, having children, pressure ulcers, urinary tract infections, spasticity, wrist, elbow or shoulder pain, participation (Craig Handicap Assessment and Reporting Technique- CHART), health related quality of life (Short Form-12 Health Survey [SF12]), and life-satisfaction (Satisfaction with Life Scale [SWL]). **Results:** 77 individuals injured during childhood (0-12 years; 52% male, 30% tetraplegia) and 268 individuals injured during adolescence (13-18 years; 66% male, 58% tetraplegia) participated in this study. Being injured during childhood was significantly associated with more wrist pain ( $P < .05$ ), higher SF12 physical scores ( $P < .001$ ), higher SWL ( $P < .05$ ), higher CHART economic ( $P < .05$ ) and total ( $P < .05$ ) scores. Due to the predominance of paraplegia in the childhood group and tetraplegia in the adolescent group, groups were analyzed by injury level. Within the paraplegia group, those with childhood injuries ( $n = 54$ ) scored higher on SF12 physical ( $P < .01$ ), CHART economic ( $P < .01$ ) and total scores ( $P < .05$ ) than the adolescent group ( $n = 112$ ). Within the tetraplegia group, those with childhood injuries ( $n = 23$ ) were more likely to have children ( $P < .05$ ) than the adolescent group ( $n = 156$ ). **Conclusion:** Age at injury had limited effect on outcomes during early adulthood. Difference between groups, however, suggested that individuals injured during childhood have better outcomes than those injured during adolescence.

**Support:** Shriners Hospitals for Children

## P-25

### Exploring Parental Ethnotheories in the Development of Resilience in Children

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**Objective:** Determine parental ethnotheories and behaviours associated with the development of resilience in children. **Design:** Mixed-method design: qualitative and quantitative methodology. **Participants/methods:** 2 groups of participants: 1 group of parents of young children and 1 group of parents of young children with a spinal cord injury. A qualitative interview was used to determine parental ethnotheories regarding the development of resilience in children. A 15-minute parent-child interaction was videotaped and then quantified by using a coding system developed from the qualitative interviews. **Results:** Quantitative analyses of actual behaviour was combined with the qualitative elaboration of parental ethnotheories regarding resilience in children. The relationship between parental beliefs and their translation into parent-child interactions was explored, including group differences. **Conclusion:** The results are discussed in terms of the role of professionals in creating and determining parental ethnotheories that enhance the development of resilience in children with spinal cord injuries.

## P-26

### Clinical Application of the Wheelchair Skills Program: Objective Testing and Training Methods

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**Objective:** Outline the wheelchair skills class design including the Wheelchair Skills Program's testing and training methods as well as wheelchair maintenance. **Design:** We have adapted components of the Wheelchair Skills Test and Training Program at [www.wheelchairskillsprogram.com](http://www.wheelchairskillsprogram.com) for our inpatient clients. We have found that the Wheelchair Skills Test (WST) is a reliable and valid method to test power and manual wheelchair users and their caregivers on 32 items. Also, our training methods incorporate the Wheelchair Skills Training Program (WSTP) on a certified obstacle course. The client and caregiver also

attend the Wheelchair Maintenance component of the class to learn wheelchair maintenance. **Participants/methods:** 2 case studies: a client with paraplegia in a manual wheelchair and a client with tetraplegia in a power wheelchair. The WST was administered at initial evaluation. The WSTP was incorporated for each client into several training sessions and the WST was again administered at discharge. **Results:** The clients in the 2 case studies achieved a significant improvement in percentage of items passed safely on the WST at initial testing to time of discharge. **Conclusion:** With a reliable and valid wheelchair skills testing and training process, a rehabilitation center can objectively provide a comprehensive plan of care for patients who will be wheelchair users and caregivers. We present in this poster our process of testing and training specific manual and power wheelchair skills.

## P-27

### Interaction of Posture and Function: A Case Report

Jennifer D. Hastings, PT, PhD, NCS

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**Objective:** This is a case report to illustrate how change in the adjustment (set-up) of currently used equipment resulted in very meaningful and immediate change in functional ability for an individual with tetraplegia. **Design:** Single case presentation. **Participants/method:** The single subject is a young man with SCI for 2.5 years with C6 motor function on the right and C7 on the left. He is a full-time power wheelchair user who is able to transfer only with moderate assistance. The presentation will provide the key parameters of the original equipment configuration and the key measurements from a physical examination. The author will then show the configuration after adjustment with explanation of the rationale behind the configuration change, highlighting the postural interaction with functional ability. **Results:** Improved postural alignment; improved comfort; new ability to transfer into bed on *same* day as changes. Now requiring only assist with legs; prior to seating change, required dependent lift transfer for bed. The dynamic position promoted by optimal postural support allows for maximal functional mobility. The initial posterior pelvic tilted position *blocked* the ability for this individual to move out of his chair. **Conclusion:** Custom specified and properly adjusted seating equipment is critical for outcomes in persons with SCI. The physical examination will direct the selection of the seating parameters for optimal postural alignment.

## P-28

### **The Differences in Self-Esteem, Function, and Participation Between Adults with Low Motor Tetraplegia Who Use Power or Manual Wheelchairs**

*Jennifer Hastings, PT, PhD, NCS, Yvette Griffiths, PT, Christina Hamilton, PT, and Hillary Robins, PT*

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**Objective:** The purpose of the study was to explore the differences between manual or power wheelchair users in terms of self-esteem, function, and participation in persons with similar motor level of spinal cord injury. **Design:** Descriptive cross-sectional study with a single data collection. **Participants/methods:** Participants were a convenience sample of adults with C6 and C7 tetraplegia due to spinal cord injury (SCI) who are 2 or more years post injury. 30 participants: 18 manual chair users and 12 power chair users. Demographics and 3 outcome measures were collected: Rosenberg Self-Esteem Scale (RSES), Spinal Cord Independence Measure III (SCIM III), and the Craig Handicap Assessment and Reporting Technique (CHART). Scores for each questionnaire were compared between groups of manual and power wheelchair users using a multivariate analysis of variance (MANOVA). **Results:** There were no significant differences between manual or power chair users regarding age, time since injury, or length of initial rehabilitation stay. Significant difference was seen between groups ( $F = 2.677, P = .038$ ). Multivariate analysis showed the differences to be in the SCIM III ( $F = 11.088, P = .003$ ), and CHART subcategories Physical ( $F = 7.402, P = .011$ ), Mobility ( $F = 12.894, P = .001$ ), and Occupation ( $F = 5.174, P = .031, P = .031$ ). **Conclusion:** Manual wheelchair users demonstrated better physical function and mobility and had a higher employment rate than power wheelchair users based on the SCIM III and CHART in this sample of adults with C6 or C7 motor level tetraplegia.

## P-29

### **Length of Inpatient Rehabilitation Stay Following a C6-C7 SCI and the Effects on Wellness, Function, and Community Participation**

*Jennifer Hastings, PT, PhD, NCS, Kelly C. Gillespie, SPT, Rachel V. Harris, SPT, and Michael R. Murphy, SPT*

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**Objective:** To examine how the length of stay (LOS) in an inpatient rehabilitation setting affects long-term outcomes for people with a C6 or C7 spinal cord injury (SCI). LOS in the United States has steadily declined 61% in the last 35 years. The hypothesis is that a longer LOS will result in fewer re-hospitalizations and increased functional ability, wellness, and community participation. **Study design:** Descriptive cohort study. **Participants/methods:** A convenience sample of adults with C6 or C7 SCI resulting from either traumatic or nontraumatic causes were recruited via and snowballing through online SCI forums, flyers posted in community, and referrals. 3 outcome measures, the Rosenberg Self-Esteem Scale, Craig Handicap Assessment and Reporting Technique (CHART), and Spinal Cord Independence Measure III (SCIM III) and a demographic survey were given to each participant. Data was entered and analyzed using SPSS 17. **Results:** 39 subjects returned surveys. Median LOS was 150 days. Highest functional scores were noted in 1980s, with a steady decline in both LOS and functional outcomes in subsequent decades. No statistically significant correlations were found between LOS and functional outcomes, however strong trends between functional outcomes and longer LOS were noted. **Conclusions:** Despite the lack of a strong correlation between the outcome measures and LOS, the study showed the highest outcome scores in the participants injured in the 1980s just prior to the statistically significant decrease in LOS at which point both SCIM III and CHART outcomes decreased.

**Support:** None



## P-30

### Walking Index for Spinal Cord Injury (WISCI) Reliability in Patients with Acute Spinal Cord Injury (SCI)

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**Objective:** The WISCI has been recommended as an ambulation measure for SCI patients. However, reliability has been evaluated only in chronic SCI patients. As in the Mindwalker Project, the WISCI has been chosen as one of the outcome measures. The aim of the study is to assess the intra- and interrater reliability of the WISCI in patients with acute lesions. **Study design:** Reliability study. **Patients/methods:** Inclusion criteria include a history of traumatic SCI, motor incomplete status (American Spinal Injury Association [ASIA] Impairment Scale [AIS] C or D), and a motor level of C4 to L1 inclusive. Patients were examined at the WISCI level at the time of early mobilization following injury during inpatient hospitalization and at the maximum level which was judged safe by the therapist. Patients were examined by 2 different therapists on 2 different days. Inter- and intrarater reliability were assessed by intraclass correlation coefficient. **Results:** 16 patients (all males; all with traumatic lesions; age  $44.9 \pm 18.9$  years; mean distance from the lesion  $45.7 \pm 18.4$  days) were studied. All patients had an AIS grade D except 1 with AIS C; 12 patients had a cervical lesion, 1 thoracic and 3 lumbar. The median WISCI level was 5 (interquartile range 3). All patients showed increases of 1 to 11 WISCI levels from baseline. Interrater reliability was between 0.98 and 0.99. Intrarater reliability was between 0.98 and 1. **Conclusions:** Present data demonstrated for the first time that the WISCI is valid and reliable in acute SCI patients.

## P-31

### Attitude Towards Brain-Computer Interface Technology Among Veterans with Spinal Cord Injury

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**Objective:** Describe veteran's perception of how spinal cord injury (SCI) impacts ability to perform activities of daily living and whether brain-computer interfaces (BCIs) have the potential to increase function and improve their quality of life. **Design:** Paper-based survey. **Participants/methods:** Military veterans with SCI completed a survey related to: (1) demographics, (2) nature of SCI, (3) self-reported functional independence measurement (FIM-SR) motor subscore, (4) priorities for functional recovery, and (5) knowledge/opinions of BCI. **Results:** 57 veterans (21 tetraplegia; 36 paraplegia) were recruited at the 2010 National Veterans Wheelchair Games. Mean FIM-SR motor subscores (possible range, 13-91) were  $50.8 \pm 25.1$  for individuals with tetraplegia and  $71.8 \pm 13.2$  for individuals with paraplegia. Restoration of bladder/bowel function and walking were important functional priorities among all respondents. Restoration of arm/hand function was important for individuals with tetraplegia. 82% of respondents indicated that they would use a BCI to assist with daily activities. In particular, brain-controlled functional electrical stimulation (FES) technology was frequently cited as being potentially very helpful. Independent operation was the most important BCI design characteristic and training time was the least important. Even though more than 70% of respondents indicated that noninvasiveness was a very important design characteristic, more than half indicated that they would definitely, or very likely, consider having surgery to implant BCI electrodes. **Conclusion:** Veterans with SCI feel that BCI technology that can be operated independently may be useful for assisting with activities of daily living.

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those of the authors and do not reflect the official policy or position of the Department of Veterans Affairs, Department of the Army, Department of Defense, or the United States government.

## P-32

### Functional Implications of Corticospinal Tract Impairment After Spinal Cord Injury

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**Objective:** We previously showed that measurement of highest toe elevation during walking is a simple objective measure of footdrop and reflects the impairment of the corticospinal tract (CST) in persons with spinal cord injury (SCI). To determine if this measure has functional relevance in ambulation capacities, we correlated it with clinical tests. **Design:** Data were collected in a research laboratory and a physiotherapy department. **Participants/methods:** 24 individuals with SCI (ASIA Impairment Scale D) and 17 controls were recruited. Foot drop was determined during treadmill gait by measuring the highest toe elevation during swing phase with a kinematic system. CST function was assessed in sitting position by measuring the motor-evoked potentials (MEP) induced in tibialis anterior (TA) by transcranial magnetic stimulation. Clinical tests performed were 10-meter, 6-minute, Timed Up and Go (TUG), Walking Index for Spinal Cord Injury (WISCI), Berg Balance Scale (BBS), and Lower Extremity Motor Score (LEMS). **Results:** Amplitude and latency of MEP evoked in SCI participants were correlated to toe elevation, participants with lower toe elevation having longer latencies and lower amplitudes. Toe elevation was also significantly correlated to TUG, 10-meter, and 6-minute tests. No correlation was observed between toe elevation and WISCI, BBS, or LEMS. **Conclusions:** These results suggest that highest toe elevation which is directly correlated with impairment of CST is also functionally relevant as it correlates with speed and endurance of walking.

**Support:** Canadian Institutes of Health Research, Danish National Research Foundation, Elsass Foundation, Bevica Foundation

## P-33

### Effects of Backrest Elevation of Transport Stretcher/Gurney on Sacral Interface Pressure

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**Objective:** To study the effects of backrest elevation of Gurney on sacral interface pressure. **Design:** Prospective study. **Participants/methods:** 30 healthy volunteers underwent pressure mapping to assess sacral interface pressures and sensing area (area with pressure >32 mmHg). Subjects were tested on a hospital gurney with 15° increments of the backrest from 0° to 75°. All subjects were evaluated in a supine position on a pressure map on a gurney. Pressure mapping was done with a FSA 4D mapping system. Subjects' reported their own weight. Results were analyzed using repeated measures ANOVA and general linear regression controlling for subject weight. **Results:** 20 subjects were female and 10 were male. Age ranged from 23 to 61 years. Weight ranged from 110 to 302 lbs. The mean pressure increased significantly at 45° (29 mmHg; CI: 13-44), at 60° (61 mmHg; CI: 45-76), and at 75° (76 mmHg; CI: 61-92) compared to backrest at 0°. The sensing areas significantly increased at 30° (16 cm<sup>2</sup>; CI: 9-23), 45° (26 cm<sup>2</sup>; CI: 20-33), 60° (45 cm<sup>2</sup>; CI: 39-52), and 75° (56 cm<sup>2</sup>; CI: 49-63) compared to the 0° backrest position. **Conclusion:** Peak sacral pressures were significantly elevated above the capillary closing pressure of 32 mmHg when lying on the gurney. Elevating the gurney backrest increases peak sacral pressures and sensing area. Further studies are needed to determine if elevated interface pressure and sensing area increases the incidence of pressure ulcers when lying on the gurney.

**Support:** National Institute of Disability and Rehabilitation Research: US Department of Education (H133N060017)

## P-34

### Robotic Treadmill Training Does Not Improve Timed Measures of Ambulatory Function in Chronic Motor Incomplete Spinal Cord Injury: A Pilot Controlled Clinical Trial

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**Objective:** To assess the effectiveness of robotic treadmill training (Lokomat) exercise in improving functional gait speed in chronic motor incomplete spinal cord injury (MISCI).

**Design:** Prospective randomized, controlled trial of 3 months of robotic treadmill training exercise versus a stretching control paradigm. **Participants/methods:** Individuals with MICSCI between C4 and L1, at least 1 year post injury, and capable of at least household ambulation. 8 participated in 3 months of 3 times weekly robotic treadmill training and 4 participated in 3 months of a home stretching program followed by crossover. Participants underwent 10-meter walk testing and 6-minute walk testing at baseline, at midpoint, and at conclusion. 10-meter walks were performed at least twice at each time point. **Results:** No improvement was seen in the speed of ambulation measured over 10 meters or the distance walked over 6 minutes in subjects who underwent the 3 month Lokomat training. There was no significant difference between the treatment group and the controls in these outcome measures. **Conclusion:** Robotically assisted treadmill training does not improve self-selected ambulation speed as measured by standard clinical laboratory testing techniques. This lack of detectable effect might be due to the fact that the primary goal of this treatment trial was to improve cardiovascular fitness and not gait speed.

**Support:** This study was funded by a Department of Veterans Affairs Rehabilitation R&D Service Merit Review Award B4027I.

## P-35

### Short- and Long-Term Effects of Kinesiotaping on Spasticity, Balance, and Walking in Chronic Incomplete Spinal Cord Injury Subjects

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**Objective:** KinesioTaping Method (TNM) is an intervention widely used in sports and recently applied in different pathologies. It theoretically provides extended soft tissue manipulation to prolong the benefits of manual therapy and can reduce the H-reflex in subjects with spasticity. At present no clinical studies address its effects in spinal cord injury (SCI) patients. The objective of this study is to evaluate short- and long-term effects of TNM on spasticity, balance, and walking in SCI subjects. **Design:** Observational study. **Participants/methods:** Short- (24 hours) and long-term (30 days) effects of TNM have been evaluated in 10 subjects with chronic incomplete SCI (time from lesion > 400 days). TNM has been applied every 5 days to soleus and gastrocnemius muscles, with a decompressive technique. The following data have been collected and statistically compared before after treatment: passive/active ankle range of motion (ROM), Modified Ashworth Scale, Spasm Frequency and Reflex Scale, Global Pain Scale, Berg Balance Scale, 6-Minute Walking Test, 10-Meters Walk Test, and Timed Up and Go. Weight distribution and balance performance were assessed respectively with a baropodometric and stabilometric platform. For gait assessment, kinematic spatio-temporal parameters were collected using a 2-dimensional motion system. **Results:** After TNM application results of short- and long-term evaluation showed a significant reduction of spasticity, clonus, and spasms and an increment in active/passive ROM. Furthermore, baropodometric and stabilometric parameters, walking speed, and step length were significantly improved after treatment. These results have been confirmed by an improvement of clinical scales and time tests. **Conclusion:** TNM seems to be a valid therapeutic technique for reducing spasticity, pain, and spasms and for improving balance and locomotion in SCI patients.

## P-36

### The Effects of Functional Electrical Stimulation Cycling Exercise on Neurogenic Bowel in Patients with Spinal Cord Injury

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**Objective:** To evaluate the usefulness of functional electrical stimulation cycling exercise (FESCE) as a noninvasive method to stimulate the bowel function in patients with spinal cord injury (SCI). **Design:** A prospective before-after trial. **Participants/methods:** A total of 32 patients with SCI and bowel dysfunction participated in this study. They were divided into 2 groups: group 1 (supraconal lesion) and group 2 (conal/caudal lesion). All of them received the FESCE 3 times per week for 12 weeks. The colonic transit time (CTT) assessment and the Neurogenic Bowel Dysfunction Score (NBDS) were used to evaluate patients' bowel condition before and after the treatment. **Results:** The mean colonic transit time (CTT) for all patients shortened from 63.6 to 51.2 hours ( $P < .001$ ). The patients' mean NBDS also decreased from 16.5 to 12.2 points ( $P < .001$ ). Patients who had suffered from constipation had greater improvement than those with fecal incontinence in their bowel function. **Conclusion:** FESCE is likely to provide benefits for patients with SCI to improve their bowel condition. The improvements indicate that FESCE can be an optimal adjuvant treatment for NBD for patients with SCI.

**Support:** This project was funded by National Science Council in Taiwan, NSC 99-2314-B-037-034.

## P-37

### Nocturnal Home Turning Schedule for Pressure Relief Among Persons with SCI

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**Objective:** To determine the nocturnal turning schedule of persons with traumatic spinal cord injury (SCI) at home and its association with level of morning fatigue and history of pressure ulcer development. **Design:** Face-to-face survey and retrospective chart review. **Participants/methods:** A convenience sample of 108 persons with traumatic SCI living in the community. Data analyses included descriptive statistics. Associations between turning schedule, morning fatigue, and history of pressure ulcers were determined by chi-square and ANOVA statistical procedures. **Results:** The sample was 59% male, 57% white, with a mean time since injury of 5.35 years ( $\pm 8.57$ ), mean age of 43.52 ( $\pm 16.67$ ), and mean fatigue level of 7.35 ( $\pm 2.29$ ). 31% turned during the night but did not have a schedule. 25% turned every 2 to 3 hours, 30% turned every 4 hours, while 12% did not turn at all. 33% had a history of a pressure ulcer (PU) during the past year and 43% used a pressure relief mattress. No statistically significant associations were found between turning schedule and fatigue level or history of a PU during the past year. Controlling for age, years since injury, race, gender, or use of a pressure relief mattress did not affect results. **Conclusion:** These SCI consumers did not necessarily conform to the SCI Consortium Turning Guidelines (every 2 to 3 hours). Further study is needed into what the real pattern of turning is for the 31% with no schedule but who turn. A study using diaries may be a better tool for determining actual turning schedules in the community setting.

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## P-38

### Compensation and Restoration in the Rehabilitation of Walking After Spinal Cord Injury: A Review of the Evidence

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**Objective:** Determine the current best evidence regarding the following questions: Is compensation ever appropriate in the rehabilitation of walking after spinal cord injury (SCI) and, if so, when and with which patients? If restoration of walking is the goal, what therapeutic strategies are most effective? **Design:** Literature review. **Participants/methods:** CINAHL, PubMed, and the Cochrane Library were searched using the terms spinal cord injury, paraplegia, tetraplegia, or quadriplegia combined with each of the following: ambulation, walking, locomotion, gait training, orthoses, locomotor training, body weight-supported treadmill training, and electrical stimulation. **Results:** 43 articles were found that report efficacy of restoration-based interventions for the rehabilitation of walking after motor-incomplete (ASIA C & D) SCI. No articles were found that report efficacy of restoration-based interventions for the rehabilitation of walking after motor-complete (ASIA A & B) SCI. 11 articles were found that report efficacy of compensation-based interventions for the rehabilitation of walking after motor-incomplete SCI. 27 articles were found that report efficacy (albeit limited) of compensation-based interventions for the rehabilitation of walking after motor-complete SCI. 12 articles were found that address the relative efficacy of different strategies for the restoration of walking following motor-incomplete SCI. **Conclusions:** For individuals with motor-complete spinal cord injuries, walking can only be achieved using compensatory strategies. For individuals with motor-incomplete injuries, walking can be achieved using compensation, restoration, or a combination of the 2. When restoration of walking using normal movement patterns is the goal, current best evidence indicates that a variety of strategies are equally effective.

## P-39

### The Use of Leisure Time Technology by Patients Hospitalized for Spinal Cord Injuries

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**Objective:** Determine what devices patients used and how; discover impedances to using devices; gauge the personal importance of the devices; gauge interest in arts-related activities. **Design:** In-person oral surveys. **Participants/methods:** Hospitalized patients at the NSIC. Within 1 week, each patient was asked questions from the same survey by the same interviewer. Additional comments were encouraged and often recorded. **Results:** 66 patients were interviewed. Devices asked about were the unitouch (television and radio above the bed), cellular phone, mp3 player, laptop, iPod, iPad, and iPod Touch. Patients spent the most time on the unitouch (9.87 h/day and 56.6% of their free time). While the vast majority of patients considered their devices to be important to them, felt that they provided them with enjoyable activities, and felt that they helped them stay connected to people outside the hospital, there were several discrepancies. Patients in the 11 to 30 age range had more devices than older patients. People who could operate their devices without assistance spent more time on their devices. Also, while 35.48% of patients were interested in arts-related activities, only 4.54% were using devices for such activities. Complaints about Internet quality were common. **Conclusion:** While these devices are clearly having a positive influence in the lives of the patients, more education and access are needed to maximize their usefulness. Suggestions for improvements include improving Internet service, starting a laptop borrowing system, and increasing education about devices, arts-related programs, and tools that can help patients use their devices independently.



## P-40

### The Importance of the Intensity and the Number of Sessions per Week of Functional Electrical Stimulation (FES) in Patients with Post Traumatic Spinal Cord Injury (SCI)

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**Objective:** The number of sessions of stimulation per week and the intensity of stimulation are 2 important parameters that affect the power output. From the literature we know, that high stimulation intensity and 3 stimulation sessions per week are more effective than lower intensity or fewer stimulation sessions. Nevertheless, the combination of both factors is not yet described. **Design:** Case report. **Methods:** 2 patients with complete SCI (AIS A) were treated with FES 6 weeks after injury for 3 months. A robotic device (Motionmaker) was used to perform leg extension and flexion with FES against resistance. Patient A received training twice a week. The intensity of stimulation during the first 3 weeks was 40 mA. Afterwards the intensity was 130 mA. Patient B received training 3 times a week with a stimulation intensity of 130 mA during the whole period. The pulse duration (300  $\mu$ sec) and frequency (35 Hz) were identical in both subjects. Power output was measured with force sensors in the Motionmaker. **Results:** During the first 3 weeks, the power output of patient A was 40 W. The maximal power output during the 3 months with 130 mA was 140 W (extension) and 160 W (flexion). The maximal power output of patient B was 270 W (extension) and 330 W (flexion). **Conclusion:** The maximal power output was nearly 2 times as high as with 3 sessions a week than with 2 sessions. It seems that the number of sessions per week is more important than the intensity of the stimulation.

## P-41

### Multicenter Survey of Rehabilitation Protocols After Tendon Transfer to Restore Pinch in Tetraplegia

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**Objective:** The purpose of this study was to determine if postoperative care is variable across multiple Spinal Cord Injury (SCI) Centers following tendon transfer procedures. **Design:** Prospective evaluation standard postoperative management and rehabilitation protocols were surveyed in 7 SCI centers following tendon transfer procedures as part of an ongoing multicenter trial. **Participants/methods:** 29 individuals (to date), injury level cervical 4-7, underwent transfer of the brachioradialis to flexor pollicis longus. The survey included timing and posture of postoperative cast/splinting, mobilization, strengthening, home exercise, return to functional activities, and use of modalities. The Canadian Occupational Performance Measure (COPM) evaluated changes in patient-identified goals. Pinch force was measured 1 year postoperatively. **Results:** Removal of all splints postoperatively averaged 79 days (range, 48-146). Only 3 of 29 subjects used modalities for muscle re-education. Permitting active pinch postoperatively was variable (range, 1-91 days) and light activities averaged 32 days (range, 4-48). Wheelchair propulsion without splints averaged 76 days (range, 27-116). Average pinch force (to date) was 13.5 nm (range, 3.8-23.5). Clinically significant mean changes in the COPM (to date) for performance was 3.4 (range, .7- 5.8) and satisfaction was 4.3 (range, 1.8- 6.6). **Conclusions:** Postoperative protocols have a large degree of uniformity for initiating light activities and more aggressive functions such as wheelchair propulsion, however, variability exists in the timing, intensity, setting, and focus of rehabilitation. There is minimal use of modalities and notable differences in early mobilization during the rehabilitation process.

**Support:** Rehabilitation R&D Service, Department of Veterans Affairs, grants A3741R

## P-42

### The Benefits of a SCRP Therapeutic Recreation Cottage Program on Psychological Well-Being in Persons with Spinal Cord Injury

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**Objective:** The purpose of this study was to evaluate the effects of a Spinal Cord Rehabilitation Program (SCRP) therapeutic recreation cottage program on well-being in persons with spinal cord injury (SCI). **Design:** Prospective pre-posttest survey design. **Participants/methods:** The sample consisted of patients with SCI who attended the cottage program ( $n = 20$ ) and a comparison group of nonparticipants ( $n = 7$ ). Cottage participants were assessed on their satisfaction with the program and their perceived ability to participate in outdoor leisure activities. Participants and nonparticipants completed the Leisure Motivation Scale, Leisure Attitude Measurement Scale, Rosenberg Self-Esteem Scale, Positive and Negative Affect Scale, and Moorong Self-Efficacy Scale. **Results:** Cottage participants and nonparticipants were equivalent in terms of demographic, impairment, and leisure profiles. Although not significant, perceived barriers to participating in a variety of outdoor activities decreased for cottage participants from pre to post intervention. Repeated measures ANOVA indicated that positive affect increased over time in cottage participants ( $P < .01$ ), while self-esteem increased for both participants and nonparticipants ( $P < .001$ ). The patterns of data, albeit nonsignificant, demonstrated that self-efficacy increased and negative affect decreased in participants while it remained constant in nonparticipants. **Conclusion:** Participating in a SCRP cottage program was a positive experience that yielded a number of benefits on well-being for people with SCI. The findings suggest a need for the development and continued evaluation of outdoor therapeutic recreation interventions that may serve to promote more active and fulfilling lifestyles post SCI.

**Support:** Ministry of Health and Long-Term Care in Ontario

## P-43

### Comparison of Pressure in Commercially Available Seat Cushions in Fulltime Wheelchair Users with Spinal Cord Injury

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**Objective:** The purpose of this study is to utilize interface pressure mapping technology to ascertain pressure changes in people with spinal cord injury (SCI) who are full-time wheelchair users while seated in a motor vehicle. The efficacy of using commercially available seat cushions to decrease sitting pressures on bony prominences was compared to the traditional vehicle seat. **Design:** Prospective study testing multiple cushions in a motor vehicle with full-time wheelchair users. **Participants/methods:** Subjects with a chronic SCI were recruited from an outpatient rehabilitation center. Each subject underwent pressure mapping in his or her own car on the standard vehicle seat, as well as on 3 commercially available seat cushions including a foam, gel, and air cushion for 5 minutes per surface. **Results:** Air and gel cushions consistently demonstrated better peak pressure index (PPI) scores across all anatomical sites, compared to foam or the standard motor vehicle seat. The standard vehicle seat and foam cushion scenarios consistently scored worse on both PPI and dispersion index across all anatomical sites. Pressure on the ischial tuberosities was consistently higher than sacral pressures. Qualitatively, the foam cushion was chosen as least desirable due to increased height and perception of instability. **Conclusion:** The standard motor vehicle seat appears to be the least effective surface for distributing interface pressures when compared to other commercially available seat cushions. Interface pressure mapping should be utilized to assess the efficacy of standard motor vehicle seat surfaces in individuals with SCI. Further research is necessary.

**Support:** This project was funded by Kessler Institute for Rehabilitation.

## P-44

### Improving Quality of Life Through Treatment and Community Reintegration for Individuals with High Tetraplegia; Shepherd Center High Tetra Program

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Patients with spinal cord injuries (SCI) at C1-C4 have unique physical and psychological challenges that patients with lower SCIs may not face. Many individuals require long-term mechanical ventilation (LTMV), continuous supervision, and are dependent or require supervision for all aspects of care. Current research states that there is no known difference in overall quality of life (QOL) between tetraplegics who require mechanical ventilation and tetraplegics who do not. However, studies have found the most common factors affecting overall QOL include family support/relationships, work/productivity, valued hobbies, and community re-integration/socialization. Shepherd Center began ventilator-weaning not long after its inception in 1975; at any given time, we are working with 10 to 12 patients on ventilators. Shepherd focuses on educating the patients and families on how to live an active lifestyle. It is our belief that being ventilator-dependent does not mean you have to stop enjoying life. An interdisciplinary team developed and implemented a program to provide more opportunities for community reintegration, peer interaction, and performing daily tasks and provides resources needed for a smooth transition home. The program consists of weekly outings with up to 6 patients to provide more opportunities to transition skills learned during therapy and gain confidence in the community environment. Patients also learn to utilize assistive devices for daily tasks and mobility such as mouthstick, sip 'n puff controllers, and Dragon Naturally Speaking for computer access. Educational sessions are conducted with patients and families that focus on topics specific to their needs and may include airway management, hiring a caregiver, augmentative communication, emotional adjustment, etc.

## P-45

### Contractile Response to Acetylcholine of Colonic Muscle is Related to the Change of Muscarinic Receptor in Spinal Cord Injured Rat

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**Objective:** The aims of this study are to investigate (1) whether the colonic response to Ach is changed after spinal cord injury (SCI), (2) which muscarinic (M) receptor in colon is changed after SCI, and (3) the changes of the colonic contraction related proteins. **Participants/method:** 16 Sprague-Dawley rats were divided into a control and SCI group. A spinal cord transection was performed surgically at the T10 level. After 1 week of operation, the whole colon was divided into 2 segments: proximal and distal colon. Each segment was mounted with longitudinal and circular direction in a 10 mL organ bath. The percent changes of contractility from the baseline value after Ach alone, Ach with M2 receptor blocker (AQ-RA741) pretreatment, and Ach with M3 receptor blocker (4-DAMP) pretreatment were compared between the SCI and the control groups. Western blot assays were performed to determine the quantity of M2, M3 receptors, RhoA, and HSP27. **Results:** SCI rats showed increased response to Ach in both directions of proximal colon compared to the control ( $P < .05$ ). In the SCI group, the Ach response was significantly different in the proximal segment under AQ-RA741 pretreatment ( $P < .05$ ) and in the distal segment under 4-DAMP pretreatment ( $P < .05$ ) compared to the control. In Western blot study, there was significant difference in the density of proximal and distal colon in PGP 9.5 and proximal colon in RhoA and HSP27. **Conclusion:** These results suggest that the colonic contractility after SCI is at least partly caused by the changes of muscarinic receptor subtypes.

## P-46

### An Aspirin Pro-Drug Rapidly Improves Fasting and Postprandial Glycemia and Lipemia in Persons with Chronic Tetraplegia: Preliminary Findings

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**Objective:** To examine whether a non-acetylated pro-drug of aspirin lowers fasting and postprandial glycemia and lipemia in persons with chronic tetraplegia. **Design:** Randomized, double-blinded, placebo-controlled crossover with interceding washout. **Participants/methods:** Participants were 3 healthy males aged 18-56 years with chronic tetraplegia (AIS A/B) at C5-C7. Exclusions were diabetes, impaired fasting glucose, dyslipidemia, or their treatment with drugs, exercise, or special diet. Participants were randomized to receive either 1 month of Salsalate (*Disalcid* 2g orally twice a day) or placebo, and then the alternative treatment following a 1month nontreatment washout. Glucose, insulin, triglycerides, and free fatty acids (FFA) were assessed while fasting, and then during a standard 8-hour mixed-composition prandial challenge (fast-food breakfast plus *Trutol* [75mg] and fast-food refeeding at procedure hour 4). Areas under the curve (AUC) were computed for the same variables and adjusted for baseline differences. **Results:** All subjects evidenced fasting euglycemia and normolipidemia. No adverse responses to salsalate (ie, tinnitus, bleeding, dyspepsia) were reported. No fasting or postprandial changes were noted for the placebo condition. Fasting glucose and insulin were unchanged by salsalate, although mean fasting triglycerides and FFA were lowered by 22.5% and 29.3%, respectively. Salsalate also lowered AUCs for postprandial glucose, triglycerides, and FFA by 15.5%, 17%, and 59.5%, respectively. **Conclusions:** Early data reflect safety and effectiveness for salsalate monotherapy in rapidly improving fasting lipemia and postprandial homeostasis of both glycemia and lipemia in persons with chronic tetraplegia. Responses resemble reports in nondisabled persons with cardiometabolic disease.

**Support:** This project was funded by the Craig H. Nielsen Foundation.

## P-47

### Efficacy of Multicontact Spiral Nerve Cuff Electrodes for Standing with an Implanted Neuroprosthesis

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**Objective:** To determine the relative performance of multicontact spiral nerve cuff and musclebased stimulating electrodes for activating the quadriceps in an implanted neuroprosthesis for standing after spinal cord injury (SCI). **Design:** Single-subject case study with concurrent and longitudinal controls. **Participants/methods:** One individual with long-term motor complete SCI (C7, ASIA B) received an implanted standing neuroprosthesis consisting of epimysial and intramuscular electrodes to activate vastus lateralis, gluteus maximus, semimembranosus, and erector spinae. After approximately 10 years of regular use, the subject received a second implanted stimulator connected to 4-contact spiral nerve cuff electrodes bilaterally on distal femoral nerve branches to augment knee extension. Strength, endurance, and selectivity of each contact in the cuffs were measured for comparison to contractions elicited by the original epimysial electrodes on bilateral vastus lateralis. Standing duration and bodyweight distribution were assessed for both the original epimysial and cuff electrodes while keeping activation to other muscles unchanged. **Results:** Contractions from individual contacts were strong (grade 4 to 5) and selective for isolated heads of the quadriceps. Standing duration with the multicontact femoral cuff electrodes (>24 min) was more than 10 times longer than the same system utilizing epimysial electrodes (<2 min). Body weight supported by the legs equaled or exceeded the original system (>90%). **Conclusion:** Multicontact nerve cuff electrodes on the femoral nerve can elicit strong and selective contractions of individual quadriceps, extend standing times, and improve standing performance compared to systems utilizing only muscle-based electrodes.

**Support:** Supported by the NIH R01-EB001889 and UL1-RR024989

## P-48

### Rehabilitation Outcomes in Traumatic Cervical Spinal Cord Injury in Elderly People

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**Objective:** To evaluate rehabilitation outcomes in patients with cervical spinal cord injuries (CSCI). **Design:** Retrospective descriptive analysis of rehabilitation outcomes at Indian Spinal Injuries Centre. **Participants/method:** Data from 55 patients, between 2003 and 2010, more than 65 years of age were identified and reviewed. Patients were divided into 2 age groups: 65 to 74 years (Group A-Young Elderly) and 75 years and above (Group B-Old Elderly). Rehabilitation outcomes were assessed on 8 daily activities on Spinal Cord Independence Measure (SCIM) at the time of admission, discharge post rehabilitation, and present follow-up. **Results:** Groups A and B had 40 and 15 patients, respectively. There were 52 males and 3 females with mean age of 70.5 years. 77.5% of Group A elderly had high velocity injuries whereas 73.3% of Group B elderly had low velocity injury. 25 patients had complete and 24 had incomplete deficit, whereas 6 patients had normal neurology at last follow-up. The most common level of injury was C6-7 in Group A and C5 in Group B. The mean SCIM scores at admission and at last follow-up for Group A were 10.7 and 55.9, respectively, whereas for group B they were 17.2 and 83.1, respectively. **Conclusions:** Injuries in young elderly were mainly high velocity injury whereas those in old elderly were low velocity injury. Contrary to expectations, rehabilitation outcomes were better in the old elderly as compared to the young elderly group.

## P-49

### Group Physical Therapy Utilization in Inpatient Rehabilitation for Acute Spinal Cord Injury

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**Objective:** To describe the nature and extent of group physical therapy (PT) utilization in inpatient rehabilitation for spinal cord injury (SCI). **Design:** Prospective, observational, multicenter study. **Participants/methods:** 600 patients with acute traumatic SCI, enrolled in the first year of the SCIREhab project. Data on patient characteristics and treatments provided were collected through chart review and customized research documentation completed by clinicians at the point of care. Intergroup comparisons of patient characteristics and treatment minutes per week were made using chi-square tests and ANOVA. **Results:** The majority of patients (92%) participated in group PT, with 23% of all documented therapy time spent in group PT. The most common group PT activities among all patients were strengthening, manual wheelchair mobility, gait training, endurance activities, and range of motion/stretching. Within all level/AIS subgroups, strengthening was the most common group PT activity (range, 38%-50% of mean min/wk). Power wheelchair mobility, manual wheelchair mobility, and gait were featured prominently among group PT activities for patients with tetraplegia, paraplegia, and AIS D injuries, respectively. **Conclusions:** The majority of PT is provided in individual sessions, but group PT contributes significantly to total PT time. Group PT time and activities differ among injury groups in a pattern consistent with clinical goals.

**Support:** National Institute on Disability and Rehabilitation Research, Office of Special Education and Rehabilitation Services, US Department of Education, grant H133A060103



## P-50

### Impact of Secondary Health Conditions on Functional Abilities in Persons with Spinal Cord Injury

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**Objective:** To document the prevalence and impact of secondary health conditions (SHCs) and their relationship with functional abilities after SCI. **Design:** Cross-sectional telephone survey. **Participants/methods:** Adults with traumatic SCI (AIS A-D; n = 263; 77.9% male) completed the Secondary Condition Scale – Modified (SCS-M), and Spinal Cord Independence Measure (SCIM). SCS-M severity score was used to create low impact (LI) = absent/mild (n = 135) and high impact (HI) = moderate/severe (n = 128) groups. **Results:** Mean SCS-M severity score was 11.67 (SD = 7.6; range, 0 to 43). SHCs with the highest impact ratings were chronic pain (21.7%), and sexual dysfunction (17.9%). ANOVA revealed a main effect for impairment group ( $P < .001$ ), with persons with incomplete paraplegia scoring higher on the SCIM than all other impairment groups ( $P < .000$ ), and a main effect for SHC impact, with the LI group scoring higher ( $P < .05$ ) on SCIM than the HI group. Although there was no significant interaction, the following patterns of mean SCIM scores (SD) for the LI versus HI groups were observed: complete paraplegia = 64.1 (3.6) vs 60.0 (3.4); incomplete paraplegia = 80.1 (3.3) vs 70.0 (5.0); complete tetraplegia = 41.3 (4.3) vs 37.1 (4.0); incomplete tetraplegia = 71.7 (2.8) vs 58.2 (2.7). **Conclusion:** Providers should ensure adequate resources to retain functional abilities for people with HI SHC and incomplete injuries.

**Support:** Physician Services Incorporated Foundation

## P-51

### Unfractionated Heparin vs Low Molecular Weight Heparin as Prophylaxis Against Venous Thromboembolism Post SCI: A Systematic Review and Meta-Analysis

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**Objective:** To examine the effectiveness of unfractionated heparin (UFH) compared to low-molecular-weight heparin (LMWH) in preventing venous thromboembolism (VTE) after spinal cord injury (SCI). **Technology/methods:** MEDLINE, CINAHL, and EMBASE databases were searched for relevant articles published from 1980 to November 2010. All trials examining use of UFH compared to LMWH in improving prophylaxis of VTE post SCI were included if  $\geq 50\%$  of the study sample comprised of SCI subjects and if the SCI sample size was  $\geq 3$ . Pooled analysis was performed to establish the odds ratio (OR) and 95% confidence interval (CI) for presence of deep venous thromboembolism (DVT), pulmonary embolism (PE) and adverse events. **Results:** The systematic review found 4 articles that met inclusion criteria. PE was higher in participants receiving UFH compared to LMWH (OR 3.703; 95% CI, 1.217-11.268;  $P = 0.021$ ). However, analysis of other outcomes indicated that there were no significant differences between participants receiving UFH and LMWH: DVT (OR 0.982; 95% CI, 0.520-1.854;  $P = 0.956$ ); VTE (OR 1.518; 95% CI, 0.809-2.850;  $P = 0.194$ ); death (OR 1.551; 95% CI, 0.456-5.284;  $P = 0.482$ ); minor bleeding (OR 1.273; 95% CI, 0.791-2.050;  $P = 0.320$ ); and major bleeding (OR 2.224; 95% CI, 0.900-5.494;  $P = 0.083$ ). **Conclusion:** Results of the meta-analysis indicate that LMWH is more effective in preventing PE, but show no significant benefit over UFH in the prevention of VTE, DVT, and other adverse events (death and major/minor bleeding).

**Support:** This project was supported by the Rick Hansen Institute and Ontario Neurotrauma Foundation.

## P-52

### Robotic Training of Forearm and Wrist Movements After Spinal Cord Injury

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**Objective:** The objective of this study was to demonstrate the feasibility and effectiveness of robotic training of forearm and wrist movement in persons with incomplete tetraplegia. **Design:** Single case study. **Participants/methods:** This case study reports a 24-year-old male with history of C4 ASIA Impairment Scale D spinal injury and evaluates the effectiveness of rehabilitation using a robotic training device. Robotic training was provided with the Rice Wrist for 3 hours per day on 10 consecutive weekdays for both upper extremities. The training involved wrist flexion/extension, radial/ulnar deviation, and forearm supination/pronation. Therapy sessions were tailored based on the patient's movement capabilities for the wrist and forearm. The treatment was progressed by increasing number of repetitions and resistance applied. The Rice Wrist is an electrically actuated forearm and wrist haptic exoskeleton device. **Results:** The outcome measures included the ASIA upper-extremity motor score, grip and pinch strength, and the Jebsen-Taylor Hand Function test. After training, improvements were observed in range of motion, pinch strength, and performing functional tasks. Pinch strength improvements in the right upper extremity improved from an initial strength of 0 pounds per square inch (psi) to 2 psi and on the left from 6.5 psi to 10 psi. **Conclusion:** The data from one subject demonstrate that intensive training with Rice Wrist is feasible and effective in treatment of forearm and wrist movements after spinal cord injury.

**Support:** This study was supported in part by a grant from Mission Connect/ TIRR Foundation.

## P-53

### Neural and Functional Outcomes After Lower Extremity and Walking Activity-Based Interventions for Persons with Spinal Cord Injury: A Research Synthesis

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**Objective:** To synthesize the literature between 1998 and 2009 related to neural and functional outcomes due to activity-based interventions (ABint) in persons with spinal cord injury (SCI). **Design:** Systematic review. **Participants/methods:** All articles reporting on the use of at least one ABint performed by a person(s) with SCI and that included at least one neural or functional outcome measure, or both, were reviewed for rigor and meaningfulness, then synthesized into a summary with recommendations for consumers of SCI. **Results:** 21 studies met the criteria for both rigor and meaning. 16 used a descriptive, 3 an experimental, and 2 a quasi-experimental design. While there is a significant lack of evidence from randomized controlled studies supporting ABint to improve neural or functional outcomes in individuals with SCI, there is some evidence using other methods that has meaning to consumers related to SCI research. **Conclusion:** SCI consumers should continue to monitor the evidence regarding the efficacy of ABint for SCI to which is the right one for any given person with SCI. This will lead to more realistic expectations on the part of the patient with SCI, more creativity on the part of clinicians to incorporate ABint appropriately to any given individual with SCI, and perhaps more agreement and reimbursement of such programs by the payers.

**Support:** This project was funded by the Innovative Knowledge Dissemination & Utilization Project for Disability & Professional Stakeholder Organizations/ NIDRR grant H133A050006 at Boston University Center for Psychiatric Rehabilitation.

## P-54

### Health-Related Outcomes After Lower Extremity and Walking Activity-Based Interventions for Persons with Spinal Cord Injury: A Research Synthesis

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*Shepherd Center, Atlanta, Georgia, USA*

**Objective:** To synthesize the literature between 1998 and 2009 related to health-related outcomes due to activity-based interventions (ABint) in persons with spinal cord injury (SCI). **Design:** Systematic review. **Participants/methods:** All articles reporting on the use of at least one ABint performed by a person(s) with SCI and that included at least one health-related outcome measure were reviewed for rigor and meaningfulness, then synthesized into a summary with recommendations for consumers of SCI. **Results:** 18 studies met criteria for both rigor and meaning: 10 were related to functional electrical stimulation (FES) cycling, and 8 to locomotor training (LT) approaches. Adults and children with complete or incomplete, acute or chronic, or tetraplegia or paraplegia demonstrate cardiorespiratory or vascular improvement after FES cycling or LT, which may lead to a decrease in risk factors associated with cardiovascular disease. Some precaution is warranted as persons with different levels of SCI respond differently to various forms of exercise. ABint should be compared for relative contributions to exercise and health-related benefits in SCI. **Conclusion:** Persons with SCI who desire pursuing FES cycling or body weight-supported treadmill training (BWSTT) for improving health should discuss with their health care provider the intensity and duration of the program required to effect a change in cardiorespiratory, muscle, vascular, or metabolic variables based on the level, extent, and chronicity of their SCI.

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## P-55

### Spasticity Management in Persons with Spinal Cord Injury: A Research Synthesis

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**Objective:** To synthesize the literature between 2000 and 2010 related to management of spasticity in persons with spinal cord injury (SCI). **Design:** Systematic review. **Participants/methods:** All articles reporting on the management of spasticity in a person(s) with SCI were reviewed for rigor and meaningfulness, then synthesized into a summary with recommendations for consumers of SCI. **Results:** 7 studies met criteria for both rigor and meaning: 2 used a randomized controlled study design, 4 a descriptive, longitudinal or pre-post design, and 1 a case study. Interventions included various forms of electrical stimulation at various points along the neural axis, whole body vibration (WBV), and pharmacologic management. All forms of electrical stimulation were successful in decreasing at least one aspect of spasticity; there were varying responses to WBV; the person who received baclofen showed a dose-related and differential response to oral and intrathecal baclofen. **Conclusion:** Electrical stimulation interventions applied either to the muscles in the legs, the spinal cord, or the brain may lead to a reduction in certain aspects of spasticity in persons with either acute or chronic, complete or incomplete, tetraplegia or paraplegia. In addition, WBV may reduce spasticity in the quadriceps. Finally, baclofen may decrease spasticity but not decrease muscle strength. Persons with SCI who want to treat spasticity should consult with their physician and therapists to diagnose which type of spasticity they have in order to determine the most effective treatment for their needs.

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## P-56

### Series of Case Studies in a Locomotor Training Program: Function, Quality of Life, and Participation Outcomes in Individuals with Spinal Cord Dysfunction

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**Objectives:** To measure the function of walking (speed, endurance), the quality of life, and participation in life activities in individuals with incomplete spinal cord dysfunction upon enrollment and dismissal from a multidisciplinary outpatient locomotor training program. To demonstrate the use of a novel algorithm, clinical decision making tool, and the multidisciplinary team approach in locomotor training at Mayo. **Design:** IRB- approved prospective cohort study. **Participants/methods:** Currently 3 individuals with ASIA-B, C, D spinal cord dysfunction, enrolling up to 20 participants, >18 years of age, physician referred for locomotor training. Progression of training for ≥10 sessions: robotic, body weight-supported manual treadmill training, overground training. Measurements pre/post: Spinal Cord Independence Measure (SCIM-III), Canadian Occupational Performance Measure (COPM), 10-meter walk test, 6-minute walk test, Berg Balance Score, Satisfaction with Life Scale (SWLS), Participation Objective, Participation Subjective (POPS). **Results:** Preliminary mean COPM, Berg Balance, SWLS, and POPS scores increased from initial enrollment to dismissal from program. Mean 6-minute walk test increased 138 feet. Mean 10-meter walk test improved with decrease of 2.5 seconds. **Conclusion:** A multidisciplinary approach and use of a clinical decision-making algorithm in the outpatient setting demonstrates improvement in locomotor speed, endurance, quality of life, and participation reported for individuals with ASIA-B, C, and D spinal cord injury.

## P-57

### How Do VA Clinicians Prescribe and Perceive Power-Assist Wheelchairs?

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**Objective:** To understand the current prescription practices and perceptions of Power-Assist Wheelchairs (PAW) technology among Veterans Affairs (VA) clinicians for patients with spinal cord injuries (SCI). **Design:** Online survey. **Participants/methods:** 576 clinicians (MD/DO, NP, PT, OT, PA) throughout the VA Health Care System who specialize in SCI care including wheelchair prescription were invited via email to participate in an anonymous online survey. **Results:** 159 clinicians participated with 74% having more than 5 years of SCI clinical experience. 73.5% reported that they had prescribed PAWs to their patients, whereas 22.2% were unfamiliar with PAWs. 45.4% thought PAW technology was underprescribed predominantly due to lack of clinicians' knowledge. Top-rated factors considered when prescribing a PAW included ease of use, existing shoulder pain, preservation of shoulder health, and ability to transport PAW. The 3 top-rated potential benefits were prevention of shoulder pathology, aiding in longer distance community mobility, and improved quality of life. Top-rated concerns included reduced cardiovascular health, inability to adjust forearm wheel position, and the batteries/lights making the patients look more disabled compared to manual wheelchair users. 79.8% observed their patients increase community participation after transitioning to a PAW; 89.3% were interested in learning more about the latest PAW technology. **Conclusion:** This study highlights that PAW technology is not well understood by clinicians and thus may be underprescribed. There is a strong need to update prescription guidelines to include prophylactic use and develop informative education sessions for clinicians as PAWs could help patients participate in community activities and improve quality of life.

**Support:** This project was funded by a RR&D Career Development Award (B6597M).

## P-58

### Effects of Neuromuscular Electrical Stimulation Resistance Training on Ectopic Adipose Tissue and Insulin Growth Factors-1 Profile in Men with SCI

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**Objectives:** (1) To determine the effects of 12 weeks, twice weekly, of evoked progressive resistance training (RT) using neuromuscular electrical stimulation (NMES) and ankle weights on trunk visceral adipose tissue (VAT) and thigh intramuscular fat (IMF); (2) To determine the effects of RT on insulin growth-factors-1 (IGF-1) and the relationship between IGF-1 and both VAT or IMF. **Design:** Interventional-longitudinal study. **Participants/methods:** 9 individuals with motor complete SCI (C5-T11, 35 ± 9 years, BMI 22 ± 4 kg/m<sup>2</sup>) were randomly assigned into 1 of 2 groups; RT + diet (n= 5) or diet control (n=4). After an overnight fast, plasma IGF-1 was measured before and after interventions. Multiaxial magnetic resonance images of both thighs and trunk VAT were acquired prior to and after 12 weeks. Analysis of covariance was used for statistical difference. **Results:** Following 12 weeks, VAT CSA (-25%) decreased ( $P < .05$ ) at the region of L5-S1 to S2-S3 as well as %IMF (-3%) in the RT+ diet group but not in the diet group. Plasma IGF-1 increased by 25% ( $P < .05$ ) in the RT+ diet group only. Negative relationships were identified between IGF-1 and VAT CSA ( $r = -0.56$ ,  $P = .023$ ) and IGF-1 and %IMF ( $r = -0.44$ ,  $P = .08$ ). **Conclusion:** Twice weekly evoked RT to the paralyzed lower extremities resulted in significant mobilization of VAT as well as reduction in %IMF. The training protocol improved plasma IGF-1 which is associated with a decrease in VAT and IMF.

## P-59

### Increasing Incidence of Ventilator-Dependent Patients Require Reorganisation of SCI Care

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**Objective:** Evaluate the organisation of SCI care according to the need of an increasing population surviving with partial or total ventilator dependency (VD). **Design:** Questionnaire was sent to SCI units worldwide. Retrospective review of records of patients injured 2008-2009 treated at the SCI Unit in Göteborg, Sweden. **Participants/methods:** More patients survive a high cervical lesion and become VD. Health resources are limited and VD treatment requires specialised competence. A questionnaire regarding treatment of VD patients was answered by 23 SCI units worldwide. To Göteborg, VD patients are referred from other parts of Sweden. Patients living in the Göteborg area were discharged at home, whereas the others were referred to local rehabilitation units for completion of the rehabilitation. Data were analysed regarding injury characteristics and length of stay (LOS). Comparison was made between patients discharged directly at home (n=31) and those referred to local units (n=21). **Results:** 13/23 units treated VD patients. 6 units treated VD patients in need of adjustments of ventilator parameters, whereas 5 units treated VD patients when no further adjustments were necessary. 3 units referred VD patients to other units. Age at injury and level and degree of injury showed no difference in the Göteborg cohort. Total LOS was the same (86.6/88.5 days) in the group discharged at home compared to those referred to local units. **Conclusion:** The international survey showed that only one-quarter of SCI units treated VD patients early after injury. SCI care may be given at different sites without any extension of LOS. An increased centralisation of the care for the VD patients may better serve the needs of VD patients with SCI.

**Support:** NA



## P-60

### Significant Fracture-Dislocation of the Thoracic or Lumbar Spine Without Neurologic Deficit: A Report of Two Cases

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**Objective:** Fracture-dislocation of thoracic or lumbar spine, especially those resulting from high-energy trauma, often result in severe neurological deficit if dislocation is significant. Here, we report 2 cases who presented with significant fracture-dislocation of thoracic or lumbar spine without neurologic deficit.

**Design:** Case report. **Participants/methods:** 2 female patients, aged 27 and 47, were injured in road traffic accidents. Both patients did not have neurological deficits except for mild numbness in the back or thigh at the presentation. Radiologic examinations showed nearly complete fracture-dislocations at Th7-8 and L1-2. The former also had fracture at the pedicles. The latter showed rotational dislocation and did not have fracture of the lamina or pedicle. **Results:** Closed reduction was not attempted. At surgery, subtotal corpectomy and anterior reconstruction using Kaneda device were performed after laminectomy at the lateral decubitus position. No neurological deterioration was observed after surgery. At follow-up, the patients did not have back pain or paralysis, mild local kyphosis remained though. **Conclusion:** Fracture of the pedicles in the first case and rotational dislocation in the second case can be the factors for the escape from neurological deficits. Anterior subtotal corpectomy and reconstruction combined with posterior decompression is a good option for the treatment in the fracture-dislocation of thoracic or lumbar spine without neurologic deficit to restore the alignment and the stability of spine.

## P-61

### Anterior Cervical Discectomy and Fusion with Titanium Cage for Cervical Spinal Disease

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**Object:** Anterior cervical discectomy and fusion (ACDF) is widely used for the treatment of cervical spinal degenerative disease. Threaded titanium cages have recently been introduced to cope with the various disadvantages, but there is little evidence of long-term results. We present our long-term radiographic and neurological results in the patients in whom ACDF was performed with titanium cage. **Design:** Retrospective surveys. **Participants/methods:** Between April 2003 and January 2008, 151 patients suffering with symptomatic cervical spondylosis underwent ACDF with titanium cage. All patients underwent 1, 2, or 3 level ACDF using titanium cage. Surgical outcome were evaluated according to NCSS, Odom's criteria, and the Japanese Orthopaedic Association (JOA) scale. 60 patients had records of radiographs at adequate time points with a minimum 3-year follow-up period (3-8 years). **Results:** In the present study, ACDF with titanium cage had good clinical long-term results (excellent and good) in 88% judging from Odom's criteria. Bony fusion rate was high (100%) in this study at 36 months after ACDF. There were no significant differences in pre- and post operative cervical alignment. Asymptomatic adjacent disc degeneration was detected in 15%-16.7% of the patients by our measurement methods and 2 patients required additional surgery. Cage subsidence was detected in 6 patients by our radiographic measurements especially as using large size single cage. However, nobody with cage subsidence required additional surgery. **Conclusion:** ACDF with titanium is safety procedure with satisfactory clinical long-term results. A significant progression of degenerative changes can be observed on radiographs without clinical consequences for the patients.

## P-62

### Reliability of Daily Step Activity Monitoring in Adults with Incomplete Spinal Cord Injury

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**Objective:** To determine the number of days of step activity monitoring required to establish stable measures of walking activity in adults with incomplete spinal cord injury (iSCI). **Design:** Cross-sectional, reliability study. **Participants/methods:** 11 individuals with iSCI (mean age = 49 years; range, 23 to 65 years; 8 males, 3 females; ASIA Classes C and D) wore an ankle-mounted accelerometer (Step Activity Monitor) during waking hours for 7 consecutive days. Generalizability theory was used to identify sources of variance in daily step counts and to determine the fewest number of days necessary to obtain a reliability (G) coefficient of  $\geq .80$  (D-study). **Results:** The average daily step activity (DSA) of our participants was  $1281 \pm 1594$  steps. Participant (P) and day (D) terms accounted for 70.9% and 1.3% of total variance in DSA, respectively, while unidentifiable error accounted for 27.8% of overall variation in DSA. A minimum of 2 days was required to achieve a G-coefficient  $\geq .80$ . **Conclusion:** An acceptably stable measure of walking activity in adults with iSCI can be obtained by averaging step count values collected over any 2-day period in a week. Results from this investigation should prove helpful in assessing the effectiveness of activity-based programs to improve locomotor function in persons with iSCI.

## P-63

### Use of High Voltage Electrical Stimulation for Healing of Recalcitrant Pressure Ulcer on Patient with Spinal Cord Injury

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**Objective:** To demonstrate the efficacy of high voltage electrical stimulation (HVES) in the treatment of a recalcitrant pressure ulcer. **Design:** We report a

systematic retrospective case review describing the care of a patient with SCI and pressure ulcer. **Participants/Methods:** Patient is a 51-year-old male with C7 ASIA Impairment Scale A SCI following biking accident. Patient developed stage III pressure ulcer over (R) ischial tuberosity during his acute rehabilitation. The pressure ulcer got progressively worse over 11 months. Patient received standard wound care management without significant improvement. HVES was then applied directly into the wound bed using the following protocol: 60 minutes per session, 2 times a week. Parameters used were as follows: pulse duration, 10  $\mu$ s; pulse rate, 100 Hz; and intensity, 124 mA. Polarity was negative initially and switched every session. The same intensity, amplitude, and waveform were maintained throughout. **Results:** The 11-month old pressure ulcer was fully healed in 7 weeks with standard wound care and addition of HVES. PUSH scale classified wound as 0, healed and wound no longer appropriate for HVES. Patient able to increase intensity of outpatient physical therapy for continued functional recovery. **Conclusion:** This case demonstrates the efficacy of HVES for enhancement of stage III wound healing otherwise not responding to standard wound care. Further study is needed to identify the most effective protocol for electrical stimulation therapy in the treatment of recalcitrant pressure ulcers based on presentation, chronicity, and location.

## P-64

### Panspinal Epidural Abscess Without Fever: An Unusual Case due to *Streptococcus intermedius*

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**Objective:** To illustrate an atypical presentation of a panspinal epidural abscess without fever. To discuss microbiology of *Streptococcus intermedius* in this clinical presentation. To increase awareness of *S. intermedius* as a causative pathogen in the development of spinal epidural abscess in healthy individuals. **Design:** Case report. **Participants/methods:** A 34-year-old previously healthy male presented with 8 days of progressive low back, neck, and interscapular pain, associated with right arm and leg weakness, constipation, and urinary retention. He was afebrile. Physical exam was significant for absent rectal tone, uniform right lower extremity weakness, and distal more than proximal right upper

extremity weakness. Hoffman's sign, Babinski's reflex, and ankle clonus were absent bilaterally. **Results:** MRI revealed an extensive posterior spinal epidural abscess (SEA), extending from the posterior arch of C1 down to the L4-L5 level, with cord compression and no cord edema. He underwent surgical decompression. Surgical cultures demonstrated *S. intermedius*. Treatment consisted of Penicillin G and gentamycin for 6 weeks. He made functional gains in rehabilitation, progressing from maximal assistance to minimal assistance with bed mobility, transfers, and ADLs. **Conclusion:** Patients diagnosed with SEA usually have the following risk factors: diabetes, immunocompromised condition, surgical/procedural intervention, intravenous drug abuse, and/or systemic/local infections. He had no identifiable risk factors nor source of infection after comprehensive workup. To our knowledge, this is the first case of a SEA from *S. intermedius* involving the entire spine in a healthy person. *S. intermedius* is an underrecognized, abscess-forming pathogen that may cause spinal infection in healthy individuals without risk factors.

## P-65

### Distal Embolic Brain Infarction due to Recanalization of Asymptomatic Vertebral Artery Occlusion Resulting from Cervical Spine Injury: Case Report

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**Objective:** Spinal injuries are frequently associated with vertebral artery occlusion (VAO). Many aspects of the management of VAO remain controversial, including the screening criteria, the diagnostic modality, and the optimal treatment for various lesions. We present a case of brain infarction due to recanalization of the occluded VA following open reduction of cervical spinal dislocation and discuss the management of VAO. **Design:** A case report. **Participants/methods:** A 41-year-old man presented with C4-5 distractive-flexion injury manifesting with quadriplegia and anesthesia below the C3 cord level (including phrenic nerve paralysis) and bowel-bladder dysfunction. MR angiography and CT angiography showed left extracranial VA (V2) occlusion and patent contralateral VA. He was observed without antiplatelet and/or anticoagulation therapy and underwent surgery (open reduction and internal

fusion of C4/5, and tracheostomy) 8 hours after the injury. **Results:** After surgery, supraspinal symptoms such as left horizontal nystagmus and left homonymous hemianopsia led to cranial CT and MRI, which showed left-side cerebellar infarction in the posterior inferior cerebellar artery (PICA) territory and right-side posterior cerebral artery (PCA) infarction. MR angiography and CT angiography demonstrated patent bilateral VA (but hypoplastic right VA) and occluded right PCA (P2). He was treated with observation alone without any other ischemic complications. **Conclusion:** In this case, VA occlusion on the dominant side caused by cervical spinal dislocation led to cerebellar infarction in the PICA territory due to hemodynamic compromise or arterial dissection. Contralateral PCA infarction was caused by artery-to-artery embolization originated from recanalized VA. The management of asymptomatic VAO is controversial with several treatment options available, including observation alone, antiplatelet therapy, anticoagulation therapy, or invasive intervention. Although there are some reports described that management with observation alone seems safe, we should pay serious attention to the VA injury caused by cervical spine trauma.

**Support:** None

## P-66

### The Incidence and Prevalence of Traumatic Spinal Cord Injury in the World

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**Objective:** The knowledge of the incidence and prevalence of any disease is of importance for research, public health policy, and planning in the health care system. Given this, we performed this systematic review of all studies that are focused on the incidence and prevalence of traumatic spinal cord injury (SCI). **Design:** Systematic review. **Patients/methods:** The primary search included MEDLINE, EMBASE, CINAHL, PSYCHInfo, and Cochrane databases. A secondary search included the references from the articles captured in the primary search. **Results:** Our primary search captured 1,538 article titles of which 69 were selected. The secondary search captured 10

additional articles. Of those, 53 articles fulfilled the inclusion and exclusion criteria for incidence studies and 9 articles on prevalence were selected. The incidence of SCI varied from 6.2 to 174 per million inhabitants yearly. The incidence varied considerably among the continents as follows: (a) North America, 25 to 83 per million inhabitants yearly; (b) Europe, 6.2 to 130.6 per million inhabitants yearly; (c) Asia, 14.6 to 174 per million yearly; and (d) Oceania, 10 to 77 per million inhabitants yearly. There was no publication on the incidence or prevalence of SCI in Africa. The global prevalence varied from 50 to 906 per million inhabitants. **Conclusions:** Our results indicate that there are significant differences among geopolitical regions regarding the incidence and prevalence rates of traumatic SCI. An increase in the incidence and prevalence rates of traumatic SCI has been reported in several countries. However, further studies on incidence and prevalence of traumatic SCI are required.

## P-67

### Demographic Changes and Trends in the Spinal Cord Injury Centre in Ulm, Germany

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**Objective:** Summarizing the development of the patients' structure in a German spinal cord injury (SCI) centre with 26 beds within a decade regarding sex, age, ASIA Impairment Scale (AIS), differentiating between acute SCI and spinal cord disease (SCD). **Design:** Retrospective data analysis. **Participants/methods:** The data of patients with acute SCI and SCD admitted in the SCI centre of the Orthopaedic Department of the University of Ulm from 2001 to 2010 are analysed. **Results:** The average age developed from 42.6 to 54.7 years within a decade. Acute patients older than 80 years steadily increased from 3.2% to 8.4%, and the number of female patients increased from 28.8% to 32.3%. SCD became the main reason for acute admission from 42.9% to 61.3%. The number of tetraplegic patients stayed less than the number of paraplegic patients, but increased from 35.3% to 39.1%. Motoric complete patients (AIS A and B) decreased from 48.2% to 42.7%. **Conclusion:** The general demographic changes in the Western world found reflection in a German SCI centre. SCD steadily increased, and SCI decreased. The admitted patients became older and more incomplete (AIS C and D). More tetraplegic and female patients

were treated. Because of an increasing demand, the SCI centre in Ulm will be enlarged from 26 to 35 beds.

## P-68

### A Comparative Study Assessing the Impact of Social Counselling on Quality of Life Among Males and Females with Spinal Cord Injuries

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**Introduction:** Social rehabilitation is of utmost importance in achieving the quality of life after a spinal cord injury. **Aims:** To study and compare the impact of social counseling on quality of life between the 2 samples. To study the barriers and suggest ways of community re-integration. **Research methodology:** After obtaining consent from the patients, social counseling was done in 5 sessions. Each session addressed specific problems. After that, patients were reassessed. Data were collected at 2 different levels, once at the onset of rehabilitation or when the patient is medically stabilized and the second time after conducting the social counseling session and before the discharge. A semi-structured Performa was used to obtain the sociodemographic data and details regarding the quality of life. Study was conducted on a sample of 50 patients (25 male and 25 female) in the age group of 15 to 50 years. **Instruments:** Semi-structured Performa, WHOQOL-BREF. **Results:** Out of a total sample size of 50, mean age was 34 years, and 25 were females and 25 males. 65% were married, and 37 % were employed at the time of injury. The WHO-QOL measured changes in physical health, psychological health, social relationships, and environment reflected a favorable outcome. **Conclusion:** (1) It was found that males who received social counseling portrayed a more confident and sense of awareness of symptoms, progression, and functional coping after the injury than the females. (2) Counseled female cases presented better integration into the family life than males.



## P-69

### Incidence of Acute Hepatitis B in Patients with Spinal Cord Injury

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**Objective:** To examine the incidence, clinical characteristics, and cost burden of hepatitis B infection in individuals with spinal cord injury (SCI). **Design:** Retrospective case survey. **Participants/methods:** This study includes 161 patients with SCI within the first year. Patients' records were investigated and status of HBsAg, Anti-HCV, Anti-HBs positivity, alanin aminotransferase (ALT) levels, duration of hospitalization, and cost were recorded. **Results:** 6 patients was diagnosed acute hepatitis B on the first hospitalization for rehabilitation. 11 (4.2%) patients were HBsAg positive with previously established diagnosis of HBV infection, 1 (0.4%) patient was anti-HCV positive. After a follow-up of 6 months, 3 of the acute hepatitis B patients progressed into chronic hepatitis B stage. In acute hepatitis B patients, initiation of the rehabilitation was delayed and duration of hospitalization was increased, which in turn increased health care costs. **Conclusions:** After SCI, patients are at high risk for acute hepatitis B infection. High rate of chronicity may be associated with impaired immune response secondary to neurologic deficit. Screening and vaccination protocols may prevent spread of hepatitis B infection and limit health care and financial loss.

## P-70

### Application of the Andersen's Health Care Utilization Framework to Secondary Complications of SCI: A Scoping Review

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**Objective:** To identify research priority areas related to secondary complications and associated health care use for individuals with spinal cord injury (SCI). **Design:** Scoping review. **Participants/methods:** *Data sources:* Peer-reviewed journals were identified using CINAHL, MEDLINE, PubMed, EMBASE, Social Sciences Abstracts, Social Works Abstract, and PsycInfo search engines. Key references were hand searched. *Study selection:* A total of 289 abstracts were identified from the initial search strategy. We removed studies that did not measure health care and those that did not involve analytical investigation. *Data extraction:* The selected 31 studies were reviewed in detail using a coding template based on the domains and subcomponents of the Andersen model (ie, environmental, population characteristics, health behavior, and outcome). **Results:** Most studies measured predisposing characteristics (eg, age, gender) and need characteristics (eg, level of injury). There was a notable absence of environmental characteristics (eg, health system, neighbourhood variables), enabling characteristics, and health behaviours (beyond diet and nutrition). **Conclusions:** We identified a gap in the SCI literature. Future research should focus on longitudinal study designs with more representation of nontraumatic spinal cord injury as well as utilizing more advanced statistical analyses (ie, multivariate level) to adjust for confounding variables.

**Support:** Ms. Guilcher's doctoral training has been supported by the Canadian Institute for Health Research, Women's College Research Institute, Ontario Neurotrauma Foundation, Toronto Rehabilitation



Institute TRI, Community University Research Alliance, and Ontario Training Collaborative Program in Health Services and Policy Research.

## P-71

### Operant Up-conditioning of the Tibialis Anterior Motor Evoked Potential in People with Incomplete Spinal Cord Injury

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**Objective:** Test the hypothesis that operant up-conditioning of the ankle dorsiflexor motor evoked potential (MEP) can strengthen corticospinal tract (CST) connectivity and alleviate footdrop in people after incomplete spinal cord injury (SCI). CST plasticity is necessary for motor recovery. A method that strengthens remaining CST function might enhance movement recovery. **Design:** Exposure to 24 up-conditioning sessions over 8 weeks and gait evaluation before/after completion of conditioning. **Participants/methods:** Individuals with footdrop due to chronic (>1.5 years post injury) incomplete SCI. The protocol comprises 6 baseline and 24 conditioning sessions. In all sessions, tibialis anterior (TA) MEPs at 10% above threshold are measured while the sitting subject provides a preset level of TA background EMG with ankle, knee, and hip joint angles fixed. In all baseline trials, the subject receives no feedback as to MEP size. In conditioning trials, the subject is encouraged to increase the TA MEP and is given immediate feedback as to whether MEP size was above a criterion (ie, whether the trial was a success). **Results:** 4 of 6 subjects significantly increased the TA MEP size (final size, 132% to 157% of the baseline value). These subjects reported better control of the ankle during walking. 10-m walking time was also shortened by 0% to 33%. **Conclusion:** TA MEP up-conditioning is possible in people with footdrop due to incomplete SCI and may improve locomotion.

**Support:** This work was funded by Helen Hayes Hospital Foundation (AKT), New York State Spinal Cord Injury Research Trust Fund C023685 (AKT), and NIH NS69551 (AKT).

## P-72

### Operant Down-conditioning of the Soleus H-reflex in People with Incomplete Spinal Cord Injury

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**Objective:** To evaluate the therapeutic effects of soleus H-reflex down-conditioning in people with spastic gait and footdrop due to chronic incomplete spinal cord injury (SCI). We hypothesize that operant conditioning of the H-reflex can reduce spasticity and enhance functional recovery by inducing and guiding central nervous system (CNS) plasticity. **Design:** Exposure to 30 operant down-conditioning sessions over 10 weeks, and gait evaluation before and after these 10 weeks. **Participants/methods:** Ambulatory individuals with chronic (>8 months) incomplete SCI who have ankle extensor spasticity and footdrop. The protocol comprises 6 baseline and 30 conditioning sessions. In all sessions, H-reflexes are measured at just above motor threshold while the standing subject provides a specific soleus background EMG level. During conditioning trials, the subject is encouraged to decrease the H-reflex and receives immediate feedback as to whether H-reflex size was below criterion (ie, whether the trial is a success). **Results:** 6 of 9 subjects significantly decreased H-reflex size. In these 6, the final 32% ( $\pm 11\%$ ) H-reflex decrease (from its initial baseline value) was similar to previous results in normal subjects, and 10-m walking time decreased to 45%-85% of baseline value (which may reflect better locomotor EMG activity and reflex modulation). **Conclusion:** Soleus H-reflex operant conditioning is possible in people with incomplete SCI and is associated with improved locomotion.

**Support:** Helen Hayes Hospital Foundation (AKT), New York State Spinal Cord Injury Research Trust Fund C023685 (AKT), NIH NS69551 (AKT), and NS22189 (JRW).

## P-73

### A Novel Ultrasound Protocol for Measuring Soft Tissues and Detecting Deep Tissue Injury in the Buttocks

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**Objective:** To translate an MRI protocol into a reliable ultrasound protocol that measures skin/fat and gluteus muscle overlying the ischial tuberosities and detects abnormal tissue. Ultrasound is less costly and more accessible than MRI. There is growing evidence that decreases in gluteus muscle thickness after a spinal cord injury (SCI) may be a risk factor for developing a deep tissue injury. **Design:** Cross sectional. **Participants/methods:** 14 able-bodied (AB) and 14 subjects with SCI participated. 2 senior musculoskeletal sonographers (SONO) measured the skin/fat and muscle layers in unloaded sitting and in loaded sitting on a water cushion. Measurements were taken 10 times and averaged for each SONO. **Results:** Able-bodied: mean age,  $36.7 \pm 12.1$  years; weight,  $73.29 \pm 14.6$  kg; height,  $1.75 \pm 0.1$  m. For both SONO, the mean of the gluteus muscle thickness was  $3.654 \pm 0.63$  cm. Muscle thickness was not significantly affected by the measuring SONO using repeated measures ANOVA ( $F_{1,13} = 0.159$ ,  $P = .697$ ). Muscle thickness measurements between 2 SONOs were reliable with the intraclass correlation ICC (A,k) = 0.947 with  $P < .001$  (CI = 0.835-0.983) using 2-way random effects model with type absolute agreement. Results for the group with SCI will be presented. **Conclusion:** Soft tissue thickness over the ischium can be reliably measured with ultrasound for AB subjects by different sonographers. This protocol has been adapted for simulated sitting (supine) and used in a multisite, international study.

**Support:** Funding for this project was provided by the Fremantle Hospital Medical Research Foundation and the Australian Wound Management Research Foundation.

## P-74

### The Spinal Cord Injury Participation and Quality of Life (Par-QoL) Web-Based Tool-Kit

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**Objective:** To describe a Web-based participation and quality of life (Par-QoL) tool-kit designed to support the spinal cord injury (SCI) clinical and research community with the outcome tool selection process for assessing the impact of secondary health conditions (SHCs). **Methods:** In order to address issues related to lack of clarity on the measurement of quality of life (QoL) and participation (*involvement in life situations*) after SCI, multiple databases were searched for articles addressing SHCs and QoL/participation. The evidence was summarized into a set of guidelines for 10 SHCs, which categorized identified measures according to a QoL theoretical model (Dijkers, 2003) and provided details regarding their psychometric properties and sensitivity to SHC impact. The guidelines have been summarized into an on-line clinical tool-kit. **Results:** The Par-QoL tool-kit ([www.parqol.com](http://www.parqol.com)) provides information on QoL/participation measures for pressure sores, spasticity, bladder and bowel dysfunction, sexual dysfunction, SCI-related pain (neuropathic, musculoskeletal, visceral), autonomic dysreflexia, respiratory complications, bone complications (fractures, heterotopic ossification), and comorbidities (fatigue, obesity and cardiovascular). Features of the site also provide opportunities for knowledge exchange among users. **Conclusion:** The Par-QoL tool-kit provides a comprehensive overview on which outcome measures have been used to assess the impact of QoL and participation on SCI-related SHCs. Given the increased recognition of including QoL measures in clinical trials, the information provided by the Website serves as an evidence-based platform to support the SCI clinical community with their research and program evaluation activities.

**Support:** Ontario Neurotrauma Foundation (ONF) and Réseau provincial de recherche en adaptation-réadaptation (REPAR)

## P-75

### Modeling the Provision of Care for Patients with Traumatic SCI in British Columbia

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**Objective:** Develop a model of the provision of prehospital, acute, and rehabilitation services in British Columbia (BC) for patients with traumatic spinal cord injury (SCI), in order to assist in evaluation of both administrative (resource) and clinical interventions and how these impact both short-term and long-term outcomes. **Design:** Computer simulation of patient flow for traumatic SCI using operations research. **Participants/methods:** A discrete event simulation (DES) model was developed of patient flow through the traumatic SCI continuum of care (prehospital, acute, and rehabilitation) using data from the Rick Hansen Spinal Cord Injury Registry (RHSCIR) (n=534), from literature reviews, and expert opinion. Extensive statistical analyses (primarily RHSCIR) support this DES modelling. The model was validated by comparing patient, injury, and treatment attributes of simulated and real RHSCIR patients. **Results:** This resulting DES model can materially assist with policy analysis for the care of patients with traumatic SCI in BC. Such policy analyses include evaluating the impact of changes to the system (eg, time to surgery, increased unit capacity, reduction in complications) and also improving clinicians' quantification of how decisions affect patient outcomes (eg, change in neurological impairment) and system outcomes (eg, length of stay). Several policies have been analyzed using the DES model. **Conclusions:** The main added value of a tool such as the DES model is in the ability to track how the impact of new policy initiatives propagate both upstream and downstream through the traumatic SCI continuum of care.

**Support:** Funded by RHI, Health Canada, and the provinces of British Columbia and Ontario

## P-76

### Classifying Neurological Impairment and Spinal Column Injuries: Does Administrative Coding Accurately Represent Clinical Diagnoses?

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**Objective:** To examine the sensitivity, specificity, and positive predictive value (PPV) of *International Classification of Diseases (ICD)-10* codes compared to the clinical diagnoses for neurological impairment and spinal column injuries recorded in the Rick Hansen Spinal Cord Injury Registry (RHSCIR). **Design:** Retrospective review of clinical diagnoses and administrative codes. **Participants/methods:** 555 patient records from the Vancouver RHSCIR were included. *ICD-10* codes used to diagnose traumatic spinal cord injury (tSCI) and spinal column injuries in Canada were mapped to the International Standards for Neurological Classification of Spinal Cord Injury and the most specific RHSCIR spinal column injury diagnostic codes, respectively. 25 *ICD-10* neurological impairment codes and 28 *ICD-10* spinal column injury codes were evaluated for their sensitivity (true positives), specificity (true negatives), and PPV (proportion of *ICD-10* codes correctly assigned). **Results:** 506 patients in RHSCIR were used to assess the *ICD-10* codes pertaining to neurological impairment, and 278 patients were included in the analysis of the *ICD-10* codes for spinal column injuries. 40 patients (7.9%) diagnosed in RHSCIR as having a tSCI were missed using the *ICD-10* codes. Overall, specificity was fair for both the neurological impairment codes and spinal column codes (range, 0.52 -1) while sensitivity was highly variable. The PPVs for the *ICD-10* codes pertaining to ASIA Impairment Scale A injuries ranged from 0.47 to 0.77. **Conclusions:** *ICD-10* codes cannot be reliably used to classify types of tSCI or spinal column injuries. Prospective clinical registries, such as RHSCIR, should be used if detailed diagnostic data is required.

**Support:** Funded by RHI and Health Canada

## P-77

### Improving Spinal Cord Injury Services in Canada Through Accreditation

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**Objective:** Develop Accreditation Canada standards for spinal cord injury (SCI) services across the continuum of care, including prehospital and acute care management, rehabilitation, and community reintegration. This accountability framework may accelerate the implementation of best practices and improve the quality of care. **Design:** Standards are developed through a systematic review of literature and best available evidence, input from an advisory committee composed of Canadian experts, and feedback obtained through a Web-based national consultation. The standards are then piloted in Canadian health care organizations. The Rick Hansen Institute (RHI) is funding this project and providing results from its research findings to improve the knowledgebase on evidence-based care. **Participants/methods:** Accreditation Canada provides national and international health care organizations with a rigorous and comprehensive accreditation process and fosters quality improvement based on evidence-informed standards and external peer review. More than 30 acute care and rehabilitation centres deliver SCI services in Canada that may benefit from these standards. **Results:** Implementing standards of excellence helps improve the quality and safety of care and could impact the uptake of best practices by SCI care providers. The adoption of SCI standards through accreditation may also help reduce the economic burden associated with prolonged hospitalization and preventable complications. **Conclusion:** By providing a framework to evaluate quality and safety, Accreditation Canada and RHI have an opportunity to improve the dissemination and implementation of best practices in SCI care.

**Support:** Funded by RHI with the support of Health Canada and additional government partners, and in collaboration with Accreditation Canada, the standards will allow clinicians to use best practices across the continuum of care for SCI.

## P-78

### Providing Incentives to Primary Care Physicians for Increasing Their Knowledge in SCI

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**Objective:** Equip generalist physicians – about 50,000 of all physicians in Canada – with the information they need to offer evidence-based best practices in spinal cord injury (SCI) care.

**Design:** Best practices in SCI primary care has been encapsulated in an innovative knowledge translation product called “Actionable Nuggets.” Actionable Nuggets are a series of 20 postcards summarizing common health problems in SCI, latest clinical evidence, and best practices. Field testing shows that they are highly rated by family physicians in Canada and Australia. The next step is to use the Canadian Medical Association (CMA) “micro credit” system to deliver educational material to its members. Through successful completion of this training, it is anticipated that physicians will be able to receive Continuing Medical Education (CME) credits through the Collage of Family Physicians and the Royal College of Physicians and Surgeons of Canada. **Participants/methods:** CMA Members, Collage of Family Physicians (CFPC), and Royal College of Physicians and Surgeons. **Results:** This approach to knowledge dissemination can have a material impact on the uptake of best practices in primary care for people in SCI. Providing incentives, such as CME credits, is a viable model to disseminate best practices and support knowledge translation activities in SCI. **Conclusions:** Improving the access to knowledge is a key component to knowledge translation activities. Providing incentives to support the uptake of knowledge can positively influence care.

**Support:** Funding provided by the Rick Hansen Institute in collaboration with the Canadian Medical Association and Queens University



## P-79

### Barriers for Newly Injured Individuals with SCI Returning to the Community

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**Objective:** Individuals with newly acquired spinal cord injury (SCI) face numerous barriers during reintegration into the community. The purpose of this study is to identify and develop a preliminary classification of barriers to community reintegration that persons with SCI experience during the postacute period. **Design:** Randomized-controlled repeated measures pilot study. **Participants/methods:** 26 individuals with newly acquired SCI admitted to National Rehabilitation Hospital participated (mean age, 40.6 years; 81% male; 54% tetraplegia). Self-report data were collected during the first year post discharge from inpatient rehabilitation. **Results:** The 3 most common categories of self-reported barriers were physical problems (23%), lack of community participation (20%), and insurance issues (18%). The 2 most common specific barriers were lack of insurance coverage (6.5% of all reported barriers) and residing in a nursing home (5.4%). Pain as a barrier steadily increased with time as did the weakness/tightness/spasticity barrier. **Conclusion:** Our findings provide a preliminary classification of the barriers and problems that newly injured persons with SCI encounter during the postacute period. Data indicate the importance of health system barriers in the first year post injury. Surveillance for and timely identification of these barriers is imperative for designing interventions to assist newly injured people to reintegrate back into the community.

**Support:** This project is funded by NIDRR grant H133N060028, The National Capital Spinal Cord Injury Model System.

## P-80

### Rehabilitation Outcomes in People with Spinal Cord Disease

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**Objective:** Compare demographic characteristics, rehabilitation processes, and inpatient rehabilitation outcomes between spinal cord disease (SCD) and spinal cord injury (SCI). **Design:** Prospective observational cohort study. **Participants/methods:** Patients who had a diagnosis of SCI or SCD and were  $\geq 16$  years were eligible for the study. Study obtained data from medical records on patient demographics, injury and impairment levels (ASIA Impairment Scale), functional status (Functional Independence Measure), and rehabilitation outcomes. Physical and occupational therapy (PT/OT) data were collected by therapists at each patient encounter. **Results:** 58 SCD and 54 SCI patients were enrolled in the study. Patients with SCD were more likely to be older, female, and have a higher level of education. There were more Medicare beneficiaries in the SCD group and more Medicaid beneficiaries in the SCI group. The top 3 etiologies for SCD were spondylosis, cancer, and inflammation (98.3%). The top 3 etiologies for SCI were vehicular collisions, falls, and gunshot wounds (91.1%). At admission, SCD group had a higher percentage ( $>90\%$ ) of incomplete injuries and higher motor FIM scores. The SCD group had shorter rehabilitation stays and received less therapy per week. The SCD patients spent a higher proportion of PT on gait training, whereas SCI patients spent more on stretching regimens and transfers. The SCD group spent more OT on education, whereas the SCI group spent more on therapeutic activities. At discharge, the SCD group had higher motor FIM scores and FIM efficiency. The majority of both groups were discharged to community. **Conclusion:** This study characterizes the differing demographic and impairment profiles and functional outcomes of those with SCI versus SCD. These characterizations help define and refine inpatient rehabilitation regimens to optimize outcomes and efficiency.

**Support:** This project was funded by NIDRR grant H133B060028, the National Capitol Spinal Cord Injury Model System.



## P-81

### Estimating the Incidence and Prevalence of Spinal Cord Injury in Canada

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**Objective:** To estimate the incidence and prevalence of traumatic SCI (tSCI) and nontraumatic SCI (ntSCI) in Canada. **Design:** A statistical model using published literature. **Participants/methods:** The incidence and prevalence of tSCI and ntSCI in Canada were estimated using published tSCI rates from one Canadian province and ntSCI rates from Australia. The initial incidence (ie, number of tSCIs at the scene per year) and the discharge incidence (ie, number discharged into the community from hospital per year) were calculated. Prevalence was estimated by applying the discharge incidence rate for tSCI and ntSCI to Canadian statistics for mortality and birth rates by single years of age and gender for each year between 1921 and 2010. To accurately reflect prevalence, age-specific mortality rates for tetraplegia and paraplegia were used. **Results:** The estimated initial incidence of tSCI is 1,785 cases per year and the discharge incidence is 1,389. Using a ratio of 1.6 ntSCI occurrences for each tSCI based on Canadian and Australian studies, the estimated discharge incidence for ntSCI is 2,286 cases per year. In 2010, the prevalence of SCI in Canada is approximated to be 85,556 (51% tSCI and 49% ntSCI); by 2030, it is expected to be 121,000 (41% increase). **Conclusions:** This study provides an estimate of the incidence and prevalence of SCI in Canada using the best available data. Previously, these values were not known. More population-based studies are needed, particularly for ntSCI, as a growing number of Canadians are expected to be affected by SCI.

**Support:** Funded by RHI and Health Canada

## P-82

### Fragments 1.0: Initiating Changes in Sublesional Osteoporosis Management through a Case Based Tool Developed from "Best Evidence" and Practice

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**Objective:** To provide a reference tool and action guide for clinicians treating sublesional osteoporosis (SLOP) in persons with spinal cord injury (SCI) through case-based scenarios developed from practice and incorporating "best evidence." **Design:** Systematic review and proposed practice paradigm. **Participants/methods:** *Fragments 1.0* contains 10 fictional cases of commonly encountered clinical scenarios among persons with SCI and low bone mass that are not addressed in the current literature/systematic reviews. *Fragments* also include an action guide, management decision tree, and key references. Cases are intentionally brief for quick reference with main concepts emphasized. **Results:** *Fragments 1.0* provides clinicians with examples of how to detect SLOP and manage commonly encountered clinical situations when treating those with SCI (ie, medication use in women of childbearing age, common drug-drug interactions, relative versus absolute contraindications to therapy, and fiscal constraints). Key features of the patients' presentation including their medical history, medications, lifestyle factors, nutrition status, fracture risk factor profile, and bone density test results should be reviewed prior to determining fracture risk and recommending intervention(s). **Conclusions:** *Fragments 1.0* bridges the gap between "best evidence" and common practice conundrums encountered when treating SLOP, by providing tools for facilitating changes in clinical practice. There is a need to evaluate the utility of this tool among clinicians, with a goal of including additional cases in the future.

**Support:** Ontario Neurotrauma Foundation 2007-SCISO-584; Ontario Ministry of Health

## P-83

### Best Practice Implementation: Physical Therapy Outcome Measures in SCI

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**Objective:** To establish valid, quantifiable, relevant outcome measurement practices to enable physical therapists (PTs) to guide and evaluate the rehabilitation of individuals with spinal cord injury (SCI). **Design:** Best practice implementation and evaluation. **Participants/methods:** An implementation science specialist and a local champion (ie, physical therapist with interest in facilitating change) led the PTs in the SCI rehabilitation program of Parkwood, SJHC, through the following steps:

1. Review evidence base for outcome measurement tools used in SCI. Most notably, SCIRE (<http://www.scireproject.com/outcome-measures>) was used as a resource.
2. Gap analysis.
3. Stakeholder analysis and engagement.
4. Risk and benefit determination of potential practice changes.
5. Selection of specific tools.
4. Training to selected tools.
5. Initial implementation.
6. Audit and feedback (3 months post implementation).
7. Final audit and evaluation (6 months post implementation).

Implementation success was determined by pre-post assessments of the following:

- Practice change / utilization patterns
- Stages of concern
- Self-efficacy of administration

**Results:** Tools selected for systematic assessment included the SCI Functional Ambulation Inventory, 6-minute walk test, 10-meter walk test, SCIM III Mobility subscale, Timed Up and Go, Community Balance and Mobility Scale, Berg Balance Scale, and BESTest. There was negligible systematic utilization of these tools prior to this project and consistent, although not universal, utilization afterward. There was significant variation among the therapists with respect

to prior knowledge, and this was also the case for self-efficacy and stages of concern. **Conclusions:** A best practice implementation process involving an evidence-informed implementation science approach resulted in successful practice change. It is hoped that the result (ie, more systematic assessment) will create improved patient outcomes.

## P-84

### Coping Strategies Used by People with Spinal Cord Injury: A Qualitative Study

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**Objectives:** It is an accepted fact that using coping strategies play an important role in the adaptation process following spinal cord injury and is effective on the well-being of the people with spinal cord injury, but there is no sufficient and deep information on the coping strategies used by patients with spinal cord injury in the world and, especially, in Iran. The purpose of this study was to explore coping strategies used by Iranian patients with spinal cord injuries. **Study design:** Qualitative. **Setting:** The Brain and Spinal Injury Repair Research Center of Tehran University of Medical Sciences and the Protection Center of Spinal Cord Disabilities, Iran. **Method:** The study sample comprised 18 patients with spinal cord injury, were indepth interviewed and data were concurrently analyzed, using the constant comparison method. **Results:** During the data analysis, 3 coping strategies, including seeking help from religious beliefs (understanding the disease as a divine fate and as a spiritual combat), hope, and making efforts towards independence/ self-care appeared. **Conclusion:** It was concluded that understanding strategies that influence on the patients' coping with the spinal cord injury and its challenges from the patients' viewpoint will contribute to the body of knowledge and understanding of nurses and other health care professionals as well as the families towards the reinforcement of effective strategies and promoting the quality of care.

## P-85

### Suicide Bombing as an Unusual Cause of Spinal Cord Injury: A Descriptive Case Series from Pakistan

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**Objectives:** To describe the unusual etiology and pattern of spinal cord injury after terrorist suicide blasts in Pakistan. **Design:** Descriptive case series. **Participants/methods:** 6 victims of terrorist suicide blast were admitted during the last 4 years, at the Spinal Rehabilitation Unit, Armed Forces Institute of Rehabilitation Medicine, Rawalpindi, Pakistan, with a spinal cord injury (SCI). Demographic data were recorded, history was taken to ascertain mode of injury, and detailed examination was performed to determine the level and completeness of SCI and associated injuries. Relevant investigations and medical case sheets were also reviewed. **Results:** All patients were males. The mean age was 30 ± 11 years. Most (5) were injured directly due to splinters from the blast. All had thoracic complete paraplegia (ASIA-A) with stable spines and were managed conservatively for their spinal injuries. Associated injuries included intestinal perforations, fractured metatarsals and humerus, and brachial plexus injury. Pressure ulcer was the most common complication in 3 patients. Comprehensive SCI rehabilitation was offered to all, but neurological improvement was observed in only 2. **Conclusions:** This is the first report in biomedical literature describing pattern of SCI in terrorist suicidal blasts. Suicide bombing is an effective weapon of terrorists in the modern world of today. The resulting injuries can be diverse and devastating. SCI is unusual sequel of suicide bombing, which should be kept in mind while dealing with victims of suicide bombing

## P-86

### Reasons for Job Loss Following Return to Work Post Traumatic Spinal Cord Injury

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**Objective:** To ascertain the reasons for job loss reported by a sample of Australians who gained a position of employment post spinal cord injury but then lost that job. **Design:** Retrospective survey. **Participants/methods:** 30 participants were interviewed about the situation obtained at the time of their job loss or withdrawal from the paid workforce. A semi-structured interview schedule was used to seek information from study participants about 4 main groups of factors possibly implicated in decisions about job continuity: characteristics of the individual, of the job, of the work environment, of the nonwork environment. **Results:** The ratios of male to female participants (75%: 25%) and of those with tetraplegia as opposed to paraplegia (47%:53%) were similar to those within the Australian traumatic spinal cord injury population (Cripps, 2006). The majority of participants (>70%) had been injured more than 10 years previous. The single most reported reason for job withdrawal was some aspect of health and/or limitations imposed by the injury which conflicted with job demands (approximately 30%). The 2 next reported reasons were (a) work-family life issues (approximately 15%) and (b) being offered a better job (approximately 15%). **Conclusions:** While health issues and matters to do with person-job mismatch are commonly reported barriers to return to work (see, for example, Krause, 2001), both of these types of job-loss situations require more precise assessment, particularly with respect to differentiation between those health issues that were largely preventable and those that were inevitable. The same caveat applies when person-job mismatches are reported as leading to the loss of a job gained post spinal cord injury.

**Support:** Financial support was provided by a collaborative grant from the Victorian Neurotrauma Initiative and the Ontario Neurotrauma Foundation (DCP19).

## P-87

### Physical Capacity After Spinal Cord Injury in a Follow-Up Cohort Study 5 Years After Discharge and the Effects of Loss to Follow-Up

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**Objective:** To determine (1) the course of physical capacity of persons with spinal cord injury (SCI) and its determinants from start of active rehabilitation up to 5 years after discharge of inpatient rehabilitation, with focus on 1 to 5 years after discharge; and (2) the effects of loss to follow-up. **Design:** Prospective cohort study. Measurements of peak aerobic power output (PO<sub>peak</sub>) and peak oxygen uptake (VO<sub>2peak</sub>) at the start of active rehabilitation, at discharge of rehabilitation, 1 year (1Y) and 5 years after discharge (5Y). Setting: 8 rehabilitation centres in The Netherlands. Participants: 225 persons with SCI, aged 18-65, and wheelchair-dependent at least for long distances. Main outcome measures: Wheelchair exercise capacity (VO<sub>2peak</sub>, PO<sub>peak</sub>). **Results:** Random coefficient analysis revealed no significant change of PO<sub>peak</sub>, from 50.8 Watt at 1Y to 53.8 Watt 5Y. VO<sub>2peak</sub> also showed no significant change: 1.3 L/min at 1Y to 1.4 L/min at 5Y. Gender and level of lesion were significant determinants for the level of physical capacity, not for the course between 1Y and 5Y. The loss to follow-up group was older, included more persons with tetraplegia, and scored lower physical capacity levels at start and discharge of inpatient rehabilitation. **Conclusion:** Persons with SCI are able to stabilize their physical capacity 1 year after discharge up to 5 years after discharge. However, the participating group appears to be a positive selection of the total study group.

## P-88

### The ADAPSS a New Measure of Cognitive Appraisals Following Acquired Spinal Cord Injury

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UK, and University of Oxford

**Objective:** This study aimed to develop a reliable and valid appraisal scale (Appraisals of Disability: Primary and Secondary Scale [ADAPPS]) for an adult spinal cord injury (SCI) population. **Design:** Cross-sectional population survey. **Participants:** 237 community-based people with SCI. **Methods:** Items for the scale were derived from the themes of a qualitative study exploring appraisals after an SCI. The ADAPPS was administered with 2 existing appraisal measures: a measure of anxiety and depression and a measure of social desirability and demographics. **Results:** Factor analysis revealed the ADAPPS to have a 6-factor structure named as follows; (a) Fearful Despondency, (b) Overwhelming Disbelief, (c) Determined Resolve, (d) Growth and Resilience, (e) Negative Perceptions of Disability, (f) Personal Agency. **Conclusion:** Analyses indicate that the ADAPPS has reasonable reliability and validity and has been useful in predicting those who have and have not significant adjustment problems. Further research can explore its predictive utility within the clinical setting.

## P-89

### A Three-Stage Evaluation of the Spinal Nutrition Screening Tool (SNST) in Patients with Spinal Cord Injuries (SCI): Result From a UK Multi Centre Study

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**Objective:** A disease-specific nutrition screening tool (NST), the Spinal Nutrition Screening Tool (SNST), is based on 8 parameters screening (body mass index [BMI], age, level of spinal cord injury [SCI], presence of comorbidities, skin conditions, diet, appetite, and ability to eat) has been developed<sup>1</sup> for use in SCI, but its reliability and agreement with other published tools require investigation. The aims of the study were to assess the prevalence of malnutrition risk and diagnostic accuracy of the SNST. **Design:** Prospective, cross-sectional, multicentre, validation study. **Methods:** On admission, baseline clinical data, anthropometric measurements, NST score, and blood biochemistry were assessed. The validity of SNST was assessed by (i) comparison with full dietetic assessment (criterion valid-



ity); (ii) comparison with a generic NST, Malnutrition Universal Screening Tool<sup>2</sup> (MUST) (concurrent validity); and (iii) completion of an additional SNST form by the researcher to assess inter- and intrarater reliability. The agreement was assessed using Cohen's  $\kappa$ -statistics.<sup>3</sup> **Results:** Using SNST, the prevalence of malnutrition risk ranged from 22% to 64% on admission to the different SCI centres. SNST had "substantial agreement" with MUST ( $\kappa = 0.723$ ; 95% CI, 0.607-0.839) and dietitian assessment ( $\kappa = 0.567$ ; 95% CI, 0.434-0.699). The SNST had a moderate to substantial reliability (inter-rater reliability,  $\kappa = 0.5$ ; 95% CI, 0.2-0.8; intrarater reliability,  $\kappa = 0.64$ , 95% CI, 0.486-0.802). When compared with dietetic assessment, SNST had a lower specificity (76.1% vs 80.4%) and similar agreement to MUST ( $\kappa = 0.57$  vs 0.58) but SNST showed a higher sensitivity (85.7% vs 80.4%) and a higher negative predictive value (92% vs 89.2%) than MUST. Patients who were at risk of undernutrition were found to have significantly reduced total protein, albumin, magnesium, creatinine, haemoglobin, BMI, and appetite and significantly higher C-reactive protein and received more prescribed medications. **Conclusions:** Malnutrition is common in patients with SCI. SNST is an acceptable (valid and reliable) and may be a better tool in identifying SCI patients at risk of malnutrition. Further investigation is warranted to test its predictive validity.

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## P-90

### Prevalence of Dyslipidemia After Spinal Cord Injury

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**Objective:** To compare the prevalence of dyslipidemia (DL) in veterans with spinal cord injury (SCI) with the prevalence in the general population of men in the US. **Design:** Retrospective analysis of medical records. **Participants/methods:** Research involved data of 96 male patients (62 tetraplegics and 32 paraplegics) with SCI derived from the computerized record base of VA Medical Center, Miami, Florida. Mean age of the patients was  $58.6 \pm 15.1$  (SD) years; the length of injury  $22.3 \pm 14$  (SD) years. We analyzed 2 groups of patients; older ( $n = 73$ ) and younger ( $n = 23$ ) than 50 years. The prevalence of DL in SCI patients was compared with the results obtained from National Health and Nutrition Examination Survey 2003-2004. The prevalence of DL was also evaluated using the body mass index (BMI) scale where BMI of 20-25 was normal, 26-30 overweight, and  $>30$  obese. **Results:** The prevalence of DL in all SCI patients was 35.1% as compared to 45% in the general population of men in the US. The table illustrates the prevalence of DL adjusted by age. In both groups of patients, the prevalence was lower in SCI patients than in the general population. When the groups were analyzed by BMI, there were 2.4 times higher risk of DL in the overweight group and 3.3 times higher risk in the obese group than in the patients with normal level of BMI.

Age, years	<50	>50
SCI	13%	43.3%
General population	45%	65.3%

**Conclusion:** Our data indicate that patients with SCI tend to have a lower prevalence of DL than men in the general population in the US, but the risk of DL increases with the level of BMI score.

**Support:** This project was not funded.



## P-91

### Prevalence of Hypertension After Spinal Cord Injury

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**Objective:** Comparison of prevalence of hypertension (HTN) in veterans with spinal cord injury (SCI) with the general population. **Design:** Retrospective analysis of medical records. **Participants/methods:** Research involved data of 96 male patients (62 tetraplegics and 32 paraplegics) with SCI derived from the computerized record base of VA Medical Center, Miami, Florida. The mean age of the patients was  $58.6 \pm 15.1$  (SD) years; the length of injury  $22.3 \pm 14$  (SD) years. We analyzed 2 groups of patients; older (n = 56) and younger (n = 40) than 55 years. The prevalence of HTN in SCI patients was compared with the results obtained from National Estimates of HTN reported for 2008 by Centers for Disease Control and Prevention (CDC). **Results:** Prevalence of HTN in SCI patients was 44.7% as compared to 31.8% in the general population of men in the US. The table illustrates the prevalence of HTN adjusted by age. SCI patients <55 years of age had lower prevalence of HTN than men in general population. SCI patients in group > 55 years of age with tetraplegia had 2 times lower prevalence of HTN, while those with paraplegia had similar prevalence as men in general population (68% vs 60%). **Conclusion:** Our data indicate that patients with SCI tend to have lower prevalence of HTN except for paraplegics age >55 years with the prevalence similar to men population in the US.

Age, years	<55	>55
Tetraplegia	7%	24%
Paraplegia	3%	68%
General population	22%	60%

**Support:** This project was not funded.

## P-92

### Is Diabetes Mellitus More Common After Spinal Cord Injury?

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**Objective:** Evaluate if prevalence of diabetes mellitus (DM) in veterans with spinal cord injury (SCI) is higher than in the general population as previously reported. **Design:** Retrospective analysis of medical records. **Participants/methods:** Research involved data of 96 patients (62 tetraplegics and 32 paraplegics) with SCI derived from the computerized record base of VA Medical Center, Miami, Florida. The mean age of SCI patients was  $58.6 \pm 15.1$  (SD) years; the length of injury was  $22.3 \pm 14$  (SD) years. We analyzed 2 groups of patients; older (n = 73) and younger (n = 23) than 60 years. After adjustment for age, the prevalence of DM was compared with more recent results obtained from National Estimates of DM reported for 2007 by Centers for Disease Control and Prevention (CDC). **Results:** Prevalence of DM in the age group >60 years was 28% that was similar to 23% in the same age group of general population reported by the CDC. Prevalence of DM in the group <60 years was 18% compared to 11.2% reported by the CDC. **Conclusion:** Our analysis, after adjustment for age of patients, does not support the previously published 3 times higher prevalence of DM after SCI. These preliminary findings indicate that further studies are needed to determine an accurate prevalence of DM after SCI.

## P-93

### Development of Exercise Performance After First Rehabilitation in Subjects with Spinal Cord Injury

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**Objective:** To determine changes in maximal and submaximal physical exercise performance of patients with spinal cord injury (SCI) after completion of the first rehabilitation process. **Design:** Prospective study design. **Participants/methods:** 15 male subjects

with SCI (age,  $38 \pm 10$  years; height,  $178 \pm 10$  cm; weight,  $77 \pm 8$  kg; lesion level range, C6-L1/AIS A-C) performed the same standardized ramp test to exhaustion on an arm-cranking ergometer at the end of their first rehabilitation process as well as 3 months after discharge from the clinic. Peak data for oxygen uptake, heart rate, power output, rating of perceived exertion, and blood lactate concentration were measured. Anaerobic threshold was determined based on the respiratory equivalent for oxygen uptake to represent subjects' aerobic endurance performance. To compare data between tests, a Wilcoxon signed rank test was used for analysis. Significance level was set at  $P < .05$ . **Results:** There were no significant differences between the 2 tests concerning all mentioned peak data (oxygen uptake,  $19.3 \pm 6.2$  vs  $20.9 \pm 6.5$  mL/min/kg; heart rate,  $152 \pm 32$  vs  $157 \pm 30$  bpm; power output,  $75 \pm 23$  vs  $74 \pm 21$  W; rating of perceived exertion,  $16.3 \pm 1.7$  vs  $16.5 \pm 1.8$ ; blood lactate concentration,  $5.5 \pm 2.4$  vs  $5.7 \pm 2.4$  mmol/L). However, a significant increase of relative oxygen uptake from  $13.8 \pm 4.4$  mL/min/kg to  $15.8 \pm 4.4$  mL/min/kg at the anaerobic threshold was found, which points toward an increased aerobic endurance performance. **Conclusion:** Data revealed an increased aerobic endurance performance in subjects with SCI 3 months after completion of the first rehabilitation process, whereas peak performance did not change. These findings might result from still ongoing adaptation processes concerning muscle fiber composition in the upper extremities based on the regular daily use of the wheelchair at home. Further longitudinal measurements over a longer time period (eg, up to 1 year after leaving the clinic) will show the future development of physical exercise performance after the first rehabilitation process in subjects with SCI.

## P-94

### Ampyra in Acute AIS B SCI Without Preservation of Pinprick

Marca Alexander, MD, and Andy Wright, MBA  
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**Objective:** To evaluate the use of *Ampyra* in acute AIS B SCI without pinprick preservation. **Design:** Proof-of-principle pilot study. **Participants/methods:** Case A: A 28-year-old male with C6 AIS B SCI secondary to C5 burst fracture and traumatic C6 herniated disc who underwent anterior cervical decompression and fusion the same day. Examination was consistent from day of injury to 18 days post with preserved

light touch but without pinprick or voluntary motor or rectal contraction below the level of injury. Case B: A 47-year-old female with C6 AIS B SCI secondary to C5 burst fracture who underwent anterior cervical decompression and fusion the same day. Examination was consistent from day of injury to 20 days post with less than normal preservation of light touch sensation but without pinprick or voluntary motor or rectal contraction below the level of injury. Both patients were started on *Ampyra* 10 mg daily with the dose increased to 10 mg PO twice a day for 8 days post injury. **Results:** Patients began *Ampyra* 18 to 20 days post injury. At 21 to 33 days later, grade 1 toe flexion returned bilaterally in both subjects. At 15 to 21 days later, grade 4 quadriceps were present bilaterally. Case A performed sit to stand independently at 6 months post injury. Case B required assist of 2 to go sit to stand at 3.5 months post injury. **Conclusion:** Patients without pinprick preservation below the level of SCI rarely regain motor function. Results suggest individuals in this subgroup of AIS B patients may be ideal to study new treatments for SCI in addition to a potential benefit of *Ampyra* to promote recovery of motor function in this subset of SCI.

## P-95

### Neoplastic Myelopathies and Traumatic Spinal Cord Lesions: Comparison of Functional and Neurologic Outcome

Giorgio Scivoletto, MD,<sup>1,3</sup> Luisa Maria Lapenna, MD,<sup>2</sup> Silvia Sterzi, MD,<sup>2</sup> Calogero Foti, MD,<sup>3</sup> and M. Molinari, MD, PhD<sup>1</sup>

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**Objective:** To evaluate the neurological and functional outcomes of patients with nontraumatic spinal cord injury (NSCI) in comparison to those with traumatic spinal cord injury (TSCI). Study design: Retrospective analysis. Patients and methods: 208 patients with TSCI and 63 with NSCI were evaluated with a matching cohorts procedure; 43 comparable couples were selected from each group according to several prognostic factors: age, lesion severity, lesion level, and distance from the lesion. Measures: American Spinal Injury Association standards, Barthel Index, Rivermead Mobility Index, and Walking Index for Spinal Cord Injury. Results: In the general population, NSCI patients were older, with a longer lesion to admission time and more incomplete lesions than TSCI patients.

Therefore, functional status at admission and outcomes were different. In the matching cohorts, at admission, TSCI patients showed lower Barthel Index scores than NSCI patients. At discharge, the 2 groups showed comparable functional outcomes. Neurological status was comparable both at admission and discharge. **Conclusions:** Although starting from slight different functional levels at admission, both NSCI and TSCI patients present the same outcomes at discharge. Present data suggest that in a selected cohort of NSCI patients, rehabilitation could be as successful as in TSCI and would allow most patients to be discharged home.

## P-96

### Recovery Following Ischemic Myelopathies and Traumatic Spinal Cord Lesions

*Giorgio Scivoletto, MD,<sup>1,2</sup> Letizia Laurenza, MD,<sup>1</sup> Alessia Mammone, PhD,<sup>3</sup> Calogero Foti, MD,<sup>2</sup> and Marco Molinari, MD, PhD<sup>1</sup>*

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**Objective:** To compare the neurological and functional outcomes of patients with ischemic spinal cord injury (ISCI) and traumatic spinal cord injury (TSCI). Study design: Retrospective study. Patients and methods: 181 patients with TSCI and 71 with ISCI were examined. At admission and discharge, patients were examined by means of American Spinal Injury Association (ASIA) standards, Barthel Index, Rivermead Mobility Index, and Walking Index for Spinal Cord Injury. Bowel and bladder management and discharge destination were recorded at discharge. Analysis of covariance (ANCOVA) models and logistic regression models were used to analyze the effects of lesion etiology, AIS level at admission, site of lesion, and presence of complications on measured outcomes. **Results:** In the entire group of 252 subjects, patients with ISCI were older and had a lower frequency of cervical lesions and of complications at admission. ANCOVA and logistic regression showed that age, AIS level, and lesion level were the major predictors for neurological and functional outcome, while etiology had no effect on outcome measures. **Conclusions:** The diagnosis ischemia and trauma was not a determinant for neurological and functional recovery of SCI patients. The outcome of these patients was rather determined by age, lesion level, and AIS level.

## P-97

### A Subspecialty Nursing Certification in Spinal Cord Injury: Has the Time Come and Gone?

*Catharine Farnan-Kennedy, RN, MS, CRRN, CBIS Clinical Specialist, and Mary Patrick, RN, MSN, Delaware Valley Regional SCI Project Coordinator*

*Thomas Jefferson University Hospital, Philadelphia, Pennsylvania, USA*

**Objective:** The objective of this poster is to determine factors for and against a subspecialty nursing certification in spinal cord injury. Certification validates knowledge and promotes excellence in nursing care but also translates into proven better patient outcomes in regard to patient safety and cost containment. Currently, nationally or globally, there is no subspecialty certification in spinal cord injury nursing. This poster will examine the pros and cons of putting forth the idea of a subspecialty nursing certification for spinal cord injury at the national and international level. **Design:** An extensive review of the literature from the history of certification and growth throughout the nursing profession with patient outcomes. **Methods:** Analysis of patient outcomes. **Results:** To be determined. **Conclusion:** Time and money to obtain and then maintain subspecialty certification can be costly. The literature does indicate that nursing certification improves patient outcomes.

## P-98

### Prospective Analysis of Lipid Profiles in People with Spinal Cord Injury from 1 Year to 5 Years After Discharge of Inpatient Rehabilitation

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Rehabilitation Centre, Enschede, The Netherlands

**Objective:** To investigate the course of lipid profiles from 1 year (T1) up to 5 years (T2) after discharge of inpatient spinal cord injury (SCI) rehabilitation, and to determine which personal, lesion, and lifestyle

characteristics influence lipid profiles. **Design:** Prospective cohort study. **Participants/methods:** People with a SCI (n = 48). Total cholesterol (TC), high-density lipoprotein (HDL), low-density lipoprotein (LDL), and triglycerides (TG) were measured at T1 and T2. Using multi-level regression models, the effects of personal (age, gender, body mass index [BMI]), lesion (level, motor completeness), and lifestyle (glasses of alcohol per day, number of cigarettes per day, active lifestyle, low-fat diet) factors on the lipid profile and its course were determined. **Results:** No changes in lipid profiles between T1 and T2 were seen. Persons with a low-fat diet had lower TC and LDL levels. People with a lower BMI showed a lower TG level. A higher HDL was found in women, older people, those with a motor incomplete lesion, a low BMI, and in those who consume some alcohol or have an active lifestyle. **Conclusion:** Lipid profiles seem to stabilize 1 year after discharge of inpatient SCI rehabilitation. Lifestyle factors associated with a favorable lipid profile could be identified.

**Support:** Zon-Mw Rehabilitation program, grant 1435.0003 and 1435.0025

## P-99

### Comparison of Saggital Alignment, Balance of Spine and Pelvis Between Indian and European population: A Pioneer Study

*Dr. Gururaj, and Dr. H. S. Chhabra (ISCoS Member)  
Indian Spinal Injuries Centre, New Delhi, India*

**Objectives:** A cross-sectional study of several radiographic parameters of the sagittal profile of the spine and pelvis was conducted to determine the physiological values of these parameters, to calculate the variations of these parameters according to epidemiological and morphological data, and to study the relationships among all of these parameters. We compared these values with the European population. **Methods:** Sagittal lateral radiographs of 100 asymptomatic volunteers were evaluated. **Results:** The mean values of various parameters measured were thoracic kyphosis (T4-T12),  $35.04 \pm 8.74$ ; thoracic kyphosis (T1-T12),  $44.41 \pm 10.46$ ; lumbar lordosis,  $43.61 \pm 12.04$ ; L1-S1,  $56.39 \pm 9.95$ ; L2-S1,  $54.03 \pm 7.4$ ; L3-S1,  $48.41 \pm 6.67$ ; L4-S1,  $39.04 \pm 6.17$ ; L5-S1,  $23.19 \pm 7.20$ ; -sacral slope,  $39.62 \pm 7.98$ ; pelvic incidence,  $51.28 \pm 11.63$ ; C7 sagittal offset,  $4.29 \pm 3.04$ ; T9 sagittal offset,  $10.79 \pm 3.31$ ; pelvic tilt,  $12.46 \pm 7.75$ ;

and sacral translation,  $15.34 \pm 6.49$ . Maximum lumbar lordosis (L1-S1), sacral translation, and pelvic tilt were significantly higher in females than in male. Thoracic kyphosis (T4-T12) and maximum thoracic kyphosis (T1-T12), lumbar lordosis, sacral slope, and pelvic incidence showed significant correlation with body mass index (BMI). A strong correlation was found between the lumbar lordosis and sacral slope, lumbar lordosis and pelvic incidence, sacral slope and pelvic incidence, pelvic incidence and sacral translation, pelvic incidence and pelvic tilt, C7 sagittal offset and T9 sagittal offset, and sacral translation and pelvic tilt. Compared with European population, thoracic kyphosis (T4-T12), thoracic kyphosis (T1-T12), lumbar lordosis, pelvic incidence, and sacral translation of Indian population were found to be significantly higher. **Conclusions:** This physiological spinal sagittal balance will serve as a baseline in the evaluation of pathological conditions. The significant difference found between 2 populations shows there is a racial difference in the sagittal parameters of spine and pelvis. This study is the first study of Indian population and the first study that compares the sagittal profile of 2 racially different populations.

## P-100

### Efficacy of Peer Counselling in Facilitating Life Long Adjustment of People with SCI in South-East Asian Countries

*S. S. Raghaw  
Indian Spinal Injuries Center, New Delhi, India*

**Objective:** Explore and identify the role of peer counseling in the rehabilitation, so as to facilitate lifelong adjustment of people with SCI resulting in better quality of life. **Design:** Data were collected at 3 different times, once right in the beginning of rehabilitation, at the time of discharge, and third time through email and telephone after 1 year from discharge. During rehabilitation after obtaining consent from the patients, peer counseling was done in 10 sessions. Each session addressed specific problems. **Participants/methods:** Study was conducted on a sample of 60 patients admitted at ISIC with an experimental group of 30, who received counseling and a control group of 30, who did not. (1) A semi-structure Performa was used to obtain the socioeconomic details and also the status specifically in relation to areas like pressure sores and recurrence of urinary infections. (2) WHOQOL-BREF. **Results:** Out of the total of 30 sample size in each group, mean



age was 32 years, 6 were females, and 24 were males; each group had representation of married/unmarried, employed/unemployed, different level of education and socioeconomic background. The WHO-QOL measured changes in physical health, psychological health, social relationships, and environment reflected a favorable outcome. **Conclusion:** Peer counseling results in better rehabilitation outcomes, fewer secondary complications, improved adjustment to injury, less psychological distress, improved independence, reduced substance abuse, and increased motivation for vocational or educational opportunities. Also improved marital relationships, sexual functioning, and interpersonal relationships.

## P-101

### A Case Report on the Application of the ICF (International Classification of Functioning, Disability and Health) in Rehabilitation Management in Spinal Cord Injury

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**Objective:** To illustrate a concrete application of the ICF within the combined use of the ICF Core Set for spinal cord injury and ICF-based documentation tools in rehabilitation management. **Design:** Case report. **Participants/methods:** ICF-based documentation tools (ICF Categorical Profile, ICF Assessment Sheet, ICF Intervention Table, ICF Evaluation Display) were applied in the different steps of the rehabilitation management of a 22-year old male patient with incomplete tetraplegia (AIS C, C2). The ICF Core Set for spinal cord injury in the early postacute context served as the basis for the assessment and documentation of functioning during the management. **Results:** The ICF Categorical Profile allowed the comprehensive depiction of the patient's limitations in all areas of functioning, in particular in movement-related functions. The ICF Assessment Sheet highlighted the patient's experience in relation to these limitations. Based on the ICF-based assessment, mobility was identified as the most impor-

tant treatment goal. A goal-oriented plan of care was after that implemented. The ICF Intervention Table provided an overview of the comprehensive and multidisciplinary rehabilitation management. Over the course of treatment, the patient achieved significant improvements in functioning which became evident in the ICF Evaluation Display. **Conclusion:** The use of ICF tools contributes to comprehensive rehabilitation management by facilitating multidisciplinary teams to develop and work on common and patient-oriented rehabilitation plans.

## P-102

### Development of Arm Hand Skilled Performance Up to 5 Years After Inpatient Rehabilitation in Persons with a Cervical Spinal Cord Injury

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<sup>1</sup>Rehabilitation Centre Het Roessingh, Enschede; <sup>2</sup>Reade Centre for Rehabilitation and Rheumatology, Amsterdam;

<sup>3</sup>Center for Human Movement Sciences, UMCG, University of Groningen; <sup>4</sup>Adelante, Centre of Expertise in Rehabilitation, Hoensbroek; <sup>5</sup>Rehabilitation Centre De Hoogstraat, Utrecht, The Netherlands

**Objective:** To assess arm hand skilled performance (AHSP) up to 5 years after inpatient rehabilitation in persons with cervical spinal cord injury (CSCI) and determine significant variables contributing to outcome. **Design:** Prospective cohort study. **Setting:** 8 rehabilitation centres with specialised SCI department in The Netherlands. **Participants/methods:** AHSP was assessed with the Van Lieshout Test (VLT) in persons admitted with recent CSCI; at the beginning (T1), after 3 months (T2) and at discharge (T3) of inpatient rehabilitation, and 1 and 5 years thereafter (T4, T6). Multilevel regression analysis was done, T3 as reference, to determine development of AHSP and associations between AHSP and age, gender, motor completeness, lesion level (high or low CSCI), motor scores of upper extremities (MSUE), and pain in the tested arm. **Results:** 55 participants included: mean age 38 years, 73% male, 80% high CSCI (C3-C6), and 69% motor complete lesion. Scores of VLT improved significantly during inpatient rehabilitation (mean: T1 = 25; T3 = 33) ( $P = .005$ ), no improvement or decline at 1 year (VLT = 32) and 5 years (VLT = 32) ( $P = .903$ ) after rehabilitation. Motor completeness ( $P < .001$ ), MSUE ( $P < .001$ ), and pain ( $P = .015$ ) were associated significantly to the VLT score; age, gender, and lesion level



had no significant relationship. **Conclusion:** AHSP improved during inpatient rehabilitation and was then stable during 5 years after discharge. In general, a person with an incomplete lesion, high MSUE, and no pain in the tested arm performs best on the VLT.

## P-103

### Admission Delays for Patients Referred to a Spinal Rehabilitation Unit

Peter New,<sup>1,2,3</sup> John Olver,<sup>2</sup> Peter Cameron,<sup>3</sup> and Just Stoelwinder<sup>3</sup>

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**Objective:** To describe key time intervals in the triage and admission of spinal cord injury (SCI) patients referred to a spinal rehabilitation unit to identify opportunities for improvement. **Design:** Prospective, observational study. **Methods:** All SCI patients referred to the Spinal Rehabilitation Unit, Caulfield Hospital, Melbourne, Australia, between September 1, 2006, and December 31, 2010, had a range of variables recorded, including dates of key processes. **Results:** 207 patients were referred over the study period. Median age was 65 years (interquartile range [IQR] 50.5-76); 55.6% were males. Most (81.2%) patients had nontraumatic SCI and most (89.4%) had an acute SCI. 87.9% were admitted to the unit, 7.3% went to a non-SCI specialist rehabilitation unit due to a lengthy wait for a bed, 1.5% were transferred to palliative care, 1.5% went to a nursing home, and 1.9% died. The median time for key steps in the triage and admission process were acute hospital admission until referral 12 days (IQR 7-19.5), referral until assessment 1 day (IQR 0-2), assessment until ready 0 days (IQR 0-4), and ready until admission or off the waiting list 9 days (IQR 4-22). **Conclusions:** SCI patients typically spent a substantial proportion of their acute hospital admission waiting for a specialist SCI rehabilitation bed. It is believed that this time patients spend waiting for a bed is excessive. Steps to address this problem and achieve earlier referral of SCI patients for rehabilitation would improve the patient journey, potentially reducing preventable complications and disability.

**Support:** None

## P-104

### International Comparison of Non-traumatic SCI Rehabilitation: Survey of Services and Organisation of Care

Peter New,<sup>1</sup> Rob Campbell,<sup>2</sup> Inge Eriks-Hoogland,<sup>3</sup> Anupam Gupta,<sup>4</sup> Marcel W.M. Post,<sup>5</sup> Giorgio Scivoletto,<sup>6</sup> Éimear Smith,<sup>7</sup> Andrea Townson,<sup>8</sup> and Ronald Reeves<sup>9</sup>

<sup>1</sup>Caulfield Hospital, Melbourne, Australia; <sup>2</sup>Life Aurora Hospital, Port Elizabeth, South Africa; <sup>3</sup>Swiss Paraplegic Centre/Research, Nottwil, Switzerland; <sup>4</sup>National Institute of Mental Health & Neurological Sciences, Bangalore, India; <sup>5</sup>Rehabilitation Center De Hoogstraat, Utrecht, The Netherlands; <sup>6</sup>IRCCS Fondazione S. Lucia, Rome, Italy; <sup>7</sup>National Rehabilitation & Mater Misericordiae University Hospitals, Dublin, Ireland; <sup>8</sup>GF Strong Rehabilitation Centre, Vancouver, Canada; <sup>9</sup>Mayo Clinic College of Medicine, Rochester, Minnesota, USA

**Objective:** The objective of this project was to conduct an international study comparing the organisation, setting, service delivery, and selection of patients for inpatient rehabilitation following non-traumatic spinal cord injury. **Design:** Survey. **Methods:** Survey development based on clinical experience and literature review, with input from an international expert. 12 SCI rehabilitation centres in different countries representing a broad range of health systems were invited to participate. **Results:** 9 centres completed survey. In most (8/9) centres, the rehabilitation team determines patient readiness for discharge (South Africa reported some third party involvement). Funding sources varied: all report public/government involvement. Others sources included compensation schemes (n = 6; Australia, Canada, India, South Africa, Switzerland, USA), private insurance (n = 5; India, The Netherlands, South Africa, Switzerland, USA), and self-funding (n = 1; USA). Only 5 units had formal attachment to an acute SCI unit (Canada, Ireland, The Netherlands, Switzerland, USA). Italy, Ireland, India, and Switzerland provided a service to their whole country. The Netherlands and USA provided services to a regional area, while Australia, Canada, and South Africa provided services to their State. All units reported patients were typically admitted from acute hospitals. The estimated median number of SCI rehabilitation beds was 23 (interquartile range [IRQ], 15-30). The estimated aetiology of SCI was traumatic median 55% (IQR, 30%-58%) and non-traumatic 40% (IQR, 30%-42%). All units reported that patients had equal access irrespective of aetiology. There was great variability between units in the availability of

SCI speciality services, staff/patient ratios, and access or discharge problems. **Conclusions:** There is a wide range of systems and services available. The results of this survey will be helpful for interpreting future phases of this project.

## P-105

### Getting on with Life Following a Spinal Cord Injury: Regaining Meaning Through Six Phases

Sanne Angel, RN, PhD,<sup>1</sup> Marit Kirkevold, RN, EdD,<sup>2</sup> and Birthe D. Pedersen, RN, PhD<sup>3</sup>

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**Objective:** To investigate the process of regaining meaning after spinal cord injury. **Background:** Getting on with life following a spinal cord injury is a tremendous challenge. Little is known about how patients experience this process over time. **Design:** A longitudinal design with a phenomenological-hermeneutic approach. **Participants/methods:** 12 newly spinal cord injured patients' process was followed by field observation and narrative interviews. The data analysed built on the 3 stepped interpretation theory of Ricoeur. **Results:** The main finding was that the process of regaining meaning after a spinal cord injury proceeded through 6 phases: surviving physically and regaining vitality, moving back to life where possibilities present themselves, working with progress to pursue possibilities, fading progress narrow possibilities down, exploiting limited possibilities, and living a life with qualities despite limitations. The core was the patient's imagination of a future worth going for, and whether the present situation made this future seem possible. The balance between present and future concerns was very vulnerable to influence from the environment. **Conclusion:** Getting on with life after a spinal cord injury is a difficult process. The delicacy of the situation is such that even minor incidents may disturb the balance and upset the situation.

**Support:** This project was funded by Novo Nordic, Danish Council of Nursing, and Danish Nursing Research Society.

## P-106

### Explaining the Dynamics of Pain Interference in Spinal Cord Injury

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**Objective:** To explain the dynamics of pain interference following inpatient rehabilitation. **Design:** Analysis of data from the Spinal Cord Injury Models Systems (SCIMS) database. **Participants/methods:** Participants in the SCIMS who did not have minimal neurological deficits at discharge from inpatient rehabilitation and had completed at least 2 follow-up interviews including the assessed variables. Analysis was conducted using multinomial logistic regression. A model was developed using data from the first pertinent follow-up. An analogous model was specified for their second follow-up and then an extended version of this, adding lagged pain severity and pain interference. The independent variables in these models included: time since injury (TSI), gender, race/ethnicity, and education; neurological status at discharge (Neuro); perceived health; and scores on various measures collected by the SCIMS. **Results:** Data from 2,245 subjects were used. Their mean age at injury was 31.3, and there was an average of 4.5 years between assessments. On a 0 to 5 scale, with lower ratings reflecting less interference, median interference was 1 both times. Significant predictors of interference at the first assessment were: TSI, race/ethnicity, education, Neuro, perceived health, Patient Health Questionnaire (PHQ-9) and Satisfaction with Life Scale (SWLS) scores, and pain severity. Nagelkerke's  $R^2=.57$ . At the second assessment, Nagelkerke's  $R^2$  for this model was .59, which increased to .62 when lagged pain severity and interference were included. In this final model, the significant predictors were: TSI, Neuro, perceived health, scores on the Functional Independence Measure, Craig Handicap Assessment and Reporting Technique Physical Independence scale, PHQ-9, SWLS, and all pain proxies. **Conclusion:** Various factors jointly explain pain interference following SCI.

**Support:** This project was conducted with support from NIDRR grant H133N06003.

## P-107

### A Validation Study of the National Trauma Registry as a Canadian Spine Trauma Database

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**Objective:** Miscoding is a common source of error in population-based registries. Given this, we carried out this validation study comparing the National Trauma Registry (NTR) data based on the 10th Revision of the *International Classification of Diseases (ICD-10)* coding with clinical data from an institutional database. **Design:** Validation study. **Patients/methods:** All patients with acute spine trauma who were admitted to Toronto Western Hospital in Canada from May 2003 to April 2007 were included. Accuracy, sensitivity, and specificity were estimated having chart data abstraction as the gold standard. **Results:** There were 92 patients with spine trauma (50 males and 42 females; ages from 16 to 102 years, mean age of 51.4 years). The use of the NTR as a spine trauma database has an accuracy of 87%, sensitivity of 89.8%, and specificity of 25%. If the same database is considered as a spinal cord injury database, there will be a decrease in the precision with an accuracy of 32.6%, sensitivity of 81.3%, and specificity of only 6.7%. **Conclusions:** Our results indicate that the NTR may be relatively more precise when used as a database of spine trauma in comparison with its use as a spinal cord injury database. However, the low specificity suggests that the NTR should be comprehensively validated using data from the other institutions that contribute with data collection for the NTR. The results of this study reinforce the need for validation of the registries and large databases in addition to having a comprehensive data quality control.

## P-108

### The Role of the Spinal Cord Neurologist in the Reconstructive Hand Surgery Team

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**Objective:** To evaluate the role of the spinal cord injury (SCI) neurologist in reconstructive hand surgery.

**Design:** Retrospective chart review. **Participants/method:** Chronic SCI patients are referred from all parts of Sweden and Iceland for reconstructive hand surgery. The patient is evaluated prior to surgery by hand surgeon, neurologist, and physical and occupational therapist. In addition to the preoperative assessment of muscle strength, joint range of motion, and sensibility, the evaluation also includes bladder and bowel function, pain assessment, spasticity, ongoing infections, and autonomic dysreflexia. The wish and need to become independent in bladder and bowel care are incorporated. Preoperative treatment of spasticity might include botulinum toxin injections or oral medication. The risk of reactivation of psychological crisis reaction is evaluated. Special attention is given to detect and deal with factors that may directly affect outcome of surgery: general physical status, wheelchair manoeuvring technique, cauterisation strategies, and pressure sores. **Results:** In the year of 2010, 36 patients underwent reconstructive hand surgery in our unit. All had extensive preoperative evaluation including the factors listed above. All patients were operated according to schedule, and they were also able to fully comply with the early active training protocol after surgery. Short-term evaluation of patient satisfaction of outcome was high or very high. **Conclusion:** Modern tetraplegia hand surgery and ensuing rehabilitation is quite demanding for the patient and requires active involvement in the training. Physical and psychological preparations are necessary for optimal outcome. Involvement of the SCI neurologist in the hand surgery team plays a key role in reducing adverse treatment effects and improving functional results after surgery.

**Support:** Not applicable

## P-109

### Intestinal Transit Study Is an Essential Supplement for Defining Severity of Bowel Dysfunction in Patients with SCI: Correlation with Clinical Score

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**Objective:** Neurogenic Bowel Dysfunction (NBD) score is a specific symptom-based score which was developed and validated for assessment of constipation and fecal incontinence severity and their impact on quality of

life (QOL). Our aim was to investigate relationship between NBD score and Intestinal Transit Time (ITT), particularly if low NBD scores are compatible with slow IT and incomplete evacuation. **Design:** In consecutive SCI inpatients reporting difficulties of defecation, a single abdominal x-ray was taken and the 10-item NBD questionnaire was completed, after daily ingestion of 10 radioopaque markers for 6 days during which evacuation diary was kept. **Participants/methods:** NBD score (range, 0-47) and ITT in hours were calculated in 87 patients: 18 females; 25 tetraplegic; mean age  $41 \pm 14$  years; range, 16-72 years. Evacuation frequency and stool consistency were also evaluated. **Results:** ITT was  $81 \pm 39$  hours. In 24 patients (27.5%), it was normal ( $< 60$  hours): their NBD score was  $14.8 \pm 6$  versus  $17.4 \pm 6$  in the 63 patients with slow transit. Severe bowel dysfunction (NBD score  $\geq 14$ ) resulted in the 75% of patients with slow ITT and in the 58% with normal ITT, while very minor dysfunction (score  $\leq 6$ ) was in 3% and 8%, respectively. Differences are never statistically significant. **Conclusion:** No correlation was found between NBD score and ITT: maximum severity in NBD score may be associated to normal or very slow colorectal transit. Evidence that a delayed transport is not determining greater severity of a symptom-based score makes us conclude not that ITT study is of limited value, but that both are necessary for a complete clinical assessment of constipation in SCI patients.

## P-110

### Neurological Level of Injury as a Factor in Depression and the Use of Antidepressants Among SCI-D Inpatients

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**Objective:** To determine associations between neurological level of spinal cord injury/disease (SCI-D), depression, and antidepressant medications among traumatic and nontraumatic inpatients, and to predict factors related to antidepressant prescription at discharge. **Design:** Analysis of data from the University of Michigan Spinal Cord Injury Inpatient Rehabilitation Unit. **Participants/methods:** 100 participants with new onset of injury or disease admitted to the rehabilitation unit. Analysis used inpatients medical records and Model System data. The Patient Health Questionnaire 9 (PHQ-9) was used to assess depression. ASIA examination determined neurological groups: 35%

ASIA D; 31% paraplegia ABC; and 34% tetraplegia ABC. Bivariate statistics and logistic regression were used for analysis. **Results:** The mean age of the sample was 49.5 years old. Mean length of hospital stay was of 38.9 days. Nontraumatic cases made up 31% of the sample. PHQ scores varied with 39% having no to minimal symptoms, 33% having mild symptoms, and 28% moderate to severe symptoms. 24% of the sample was prescribed antidepressants upon entering rehabilitation. This increased to 40% at discharge. 83% of those prescribed at admission were selective serotonin reuptake inhibitors (SSRIs). At discharge, 55% received SSRIs and 40% serotonin norepinephrine reuptake inhibitors (SNRIs). PHQ scores did not differ significantly as a function of neurological status. Prescriptions for antidepressant medication at admission similarly were not associated with extent of impairment though their use at discharge was ( $P = .002$ ). The logistic regression had a Nagelkerke's  $R^2$  of 0.69. Significant predictors were antidepressants use at admission ( $P < .001$ ), discharge neurological status ( $P < .01$ ), and occupation ( $P < .05$ ). **Conclusion:** PHQ scores did not differ significantly as a function of neurological status. Antidepressant use upon admission was the best predictor of its use at discharge followed by neurological classification.

**Support:** This project was conducted with support from NIDRR grant H133N060032.

## P-111

### International Perspectives on Spinal Cord Injury (IPSCI)

*Jerome Edmond Bickenbach, PhD, and Per Maximilian von Groote, MA*

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The World Health Organization (WHO) and the International Spinal Cord Society (ISCoS) have joined forces to provide a global overview and assessment of interventions, services, health systems, and policies for people with a spinal cord injury (SCI). Coordinated by Swiss Paraplegic Research in Nottwil, Switzerland, the *International Perspectives on Spinal Cord Injury (IPSCI)* aims to inform policy, service developers and providers and people with SCI on key issues, highlighting best practices and gaps in system coverage, care, and ultimately research agendas. The talk will



both introduce the rationale behind the project, the scope and content of the report, as well as survey insights into its dissemination and implementation. The scope of *IPSCI* is the entire lived experience of SCI, from the onset of the lesion and acute care through rehabilitation towards full participation in family and community life, education, and employment. Chapters on causes and prevention of SCI, assistive technology, and the enabling environment complete the worldwide picture of life with SCI. The report is being developed in partnership with professional organizations and organizations of persons living with SCI from around the world. To ensure the dissemination and most importantly making use of the report in a detailed, multifaceted dissemination and implementation plan is being devised in close cooperation with WHO regional offices, ISCoS, and their partners. *IPSCI* will be invaluable to health professionals and policy makers but, most importantly, also to people living with SCI around the globe.

## P-112

### Measuring Body Structures and Body Functions from the ICF Perspective: Considerations for Biomedical Parameters in Spinal Cord Injury (SCI) Research

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*Swiss Paraplegic Research, Nottwil, Switzerland*

**Objective:** To provide a selection of biomedical parameters based on the ICF Core Sets for SCI and to present an overview of their corresponding measurement instruments that can be used in SCI research. **Design:** Conceptual framework. **Participants/methods:** The following sources of information were used: (1) systematic literature search; (2) evaluation of ongoing studies in SCI; (3) ISCoS International SCI Data Sets; (4) SCIRE Database. Furthermore, expert opinion was used to determine the priority selection of biomedical parameters for use in SCI research from the candidate set. For this selection, we extracted the used measurement instruments. These measurement tools were evaluated according to the defined guiding principles: (1) redundancy, (2) efficiency, (3) reasonable detail of information, (4) comparability, (5) feasibility, and (6) validity and reliability. **Results:** Literature searches were performed for 70 ICF *Body functions* categories of the comprehensive ICF Core Sets for SCI and for 4 ICF *Body structures* categories of the brief

ICF Core Sets for SCI. Using expert opinion, most relevant parameters for SCI research were defined and the corresponding measurement instruments indicated in the literature were listed. For some parameters, no measurement instruments were found (eg, function of sweating), while for other parameters several different measurement instruments were available (eg, pain and mood). Using pain as an example, we showed how the “guiding principles” can be applied in selecting appropriate measurement instruments for given parameters in SCI research. **Conclusion:** The ICF Core Sets for SCI and the guiding principles proved to be a useful framework for the selection of relevant biomedical parameters and its corresponding measures.

**Support:** Swiss Paraplegic Foundation

## P-113

### Late Complications of Intrathecal Baclofen Pump Management

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**Objectives:** To explore late complications of intrathecal baclofen (ITB) pump usage, leading to ultimate explantation of the pump; and to explore reasons for elective discontinuation of the pump in subjects with long term ITB use. **Design:** Retrospective chart review. **Participants/methods:** 205 charts were screened to identify 67 eligible subjects with ITB pump >8 years and diagnoses of spinal cord injury, anoxic or traumatic brain injury, stroke, multiple sclerosis, or hereditary forms of spastic paraplegia. Independent variables included diagnosis causing spasticity, eventual daily ITB rate, age, years with pump, and living situation. The above factors were examined as a function of complication type and incidence and of rate of voluntary pump. Tests of significance ( $P < .05$ ) were performed on each of the variables. **Results:** Complications leading to pump explantation were not associated with daily rates ITB (in mcg), years with pump independent of subject's overall health status, or subject's age. There was a significantly higher number of infections leading to pump removal in persons with SCI relative to other diagnostic groups, especially in SCI subjects with tracheostomy, pressure ulcers, or recurrent urinary tract infections. Independent of diagnostic group, those living in chronic long-term care centers (nursing or group homes) were at significantly higher rates of pump

explantation for medical, financial, and social reasons. **Conclusion:** Complications with ITB such as infections and pump dislodgement/spontaneous explantation were observed more often in persons with urinary tract infections, osteomyelitis and pressure ulcers, and chronic tracheostomy and in those residing in chronic care facilities. In addition to high infection risk, those living in a nursing home face financial and logistical challenges in maintaining the pump, sometimes leading to voluntary discontinuation.

## P-114

### Physical Activity in Persons With Spinal Cord Injury: What Makes the Difference?

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**Objective:** To describe the level of physical activity (PA) in persons with spinal cord injury (SCI) in Switzerland and to identify potential determinants for PA. **Design:** Secondary data analysis of questionnaire-based survey. **Participants/methods:** Data were obtained from a survey for vocational integration among the SCI population in Switzerland (2008). Frequency of PA was assessed retrospectively for the time before onset of SCI and for the time of the survey. Items likely to be related to PA were selected from the complete questionnaire (86 items) based on expert opinion. Descriptive statistics, correlation, and regression analyses were performed. **Results:** Data from 510 subjects were analysed (male, 73.5%; mean age, 49.4 years; paraplegic, 70.8%; complete lesion, 48.4%). Subjects participated less frequently in regular PA after onset of SCI than before (60.0% vs 71.2%;  $P = .000$ ). After onset of SCI, women participated less frequently in regular PA than men (47.3% vs 64.3%;  $P = .001$ ). Items referring to disease/disability specific (11) and sociodemographic (8) aspects, behaviours (3), and attitudes (2) were selected for correlation and regression analyses. From these, 11 items correlated with PA ("Gender," "Percentage employment," "Lesion level," "Length of first rehabilitation," "Manual/electric wheelchair," "Required time for ADLs," "Subjective health," "Importance of sport before onset of SCI," "Importance of sport today," "Frequency of sport before onset of SCI," "Being an active club member"). After regression analysis, only "Gender," "Importance of sport before onset of SCI," "Importance of sport today," "Frequency of sport before onset of SCI," and "Being an active club member" correlated with PA. **Conclusion:**

Gender and attitudes seem to play an important role in the level of PA in persons with SCI. Future research is necessary to better understand their relationships to PA.

## P-115

### SwiSCI: Design of an ICF-Based Spinal Cord Injury Research Program in Switzerland

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**Objective:** The Swiss Spinal Cord Injury cohort study (SwiSCI) aims at advancing optimal functioning and quality of life of persons with SCI along the continuum of care and over the life span through comprehensive functioning and rehabilitation research. **Design:** SwiSCI comprises 3 pathways, including (1) a retrospective study of medical records in 4 Swiss SCI centers; (2) a cross-sectional population-based study of persons with chronic SCI; and (3) a prospective cohort study. SwiSCI is a cooperation between the Spinal Cord Injury Center, University Hospital Balgrist, Zürich; REHAB center for Spinal Cord and Brain Injuries, Basel; Romande Clinic for Physical Rehabilitation, Sion; and Swiss Paraplegic Center, Nottwil, Switzerland. **Participants/methods:** Swiss residents with traumatic or nontraumatic SCI who are aged 16 or older, excluding SCI linked to progressive neurological disorders or end-of-life care. Pathway 1 captures people who were diagnosed with SCI between 2005 and 2009. Data include demographic characteristics, associated injuries and co-morbidity, and neurological and functional status at admission and discharge from initial rehabilitation. Pathway 2 is a cross-sectional community survey, which is projected for 2011 and focused on all Swiss living with SCI. Main topics include functioning, current morbidity and health behavior, work integration, and environmental and personal factors related to functioning. Pathway 3 is a prospective inception cohort study involving all Swiss persons with a newly diagnosed SCI admitted to one of the SwiSCI study centers. **Results:** The data collection in Pathway 1 is in progress and first results are submitted for presentation at ISCOS 2011. **Conclusion:** SwiSCI might provide an epidemiological database for SCI and platform for nested and joint research projects.

**Support:** Swiss Paraplegic Foundation

## P-116

### SCI Characteristics and Outcomes of First Rehabilitation: First Evidence from the Swiss Spinal Cord Injury Cohort Study (SwiSCI)

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**Objective:** To determine demographic and SCI characteristics of patients receiving first rehabilitation after SCI in the Swiss Paraplegic Center (SPZ), Nottwil. **Design:** Retrospective file study, as part of ongoing nationwide data collection for the multicenter SwiSCI cohort study. **Participants/methods:** From medical records, we identified patients with SCI who started first rehabilitation at SPZ between 2005 and 2010 and were 16 years or older at SCI. SCI linked to progressive disorders and end-of-life care was excluded. Sociodemographic, clinical, and first rehabilitation data were extracted. **Results:** 319 patients were included; 74% were male and median age was 47 years. SCI was traumatic in 79% of cases. Spinal surgery was performed in 87% and 52% of cases, respectively. Injury-related morbidity in traumatic SCI involved nonvertebral fractures (39%), major damage to chest (33%) or internal organs (23%), and traumatic brain injury (20%). SCI diagnosis at admission was paraplegia in 56%, and tetraplegia in 39% (5% unspecified). At discharge, 38% of patients were classified as AIS A, 11% as AIS B, 17% as AIS C, 30% as AIS D, 0.3% as AIS E, and 4% was undetermined. The median duration from SCI to start of rehabilitation was 10 days; first rehabilitation period was 5.9 and 8.2 months for paraplegic and tetraplegic patients, respectively. Overall 76% of patients were discharged to their private residence. **Conclusion:** Traumatic SCI is frequent and to a larger extent due to sports and leisure activities than reported in other studies. Duration of first rehabilitation is relatively long and a high proportion of patients are discharged to their private residence.

**Support:** Swiss Paraplegic Foundation

## P-117

### Epidemiology of Traumatic Spinal Cord Injury in Haapsalu Neurological Rehabilitation Centre from 2008-2010

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**Objective:** To analyze the causes, demographics, and medical data of traumatic spinal cord injury (SCI) in Haapsalu Neurological Rehabilitation Centre (HNRC), Estonia, from 2008 to 2010. **Design:** Retrospective study. **Participants/methods:** HNRC is one of the major providers of neurological rehabilitation in Estonia covering approximately 25% of the inpatient physical and rehabilitation medicine services in Estonia. The current study included patients who acquired spinal cord injury between 2008 and 2010 and were treated in HNRC during a respective year. Case histories and clinical database was used for patients' data collection. For statistical analysis, standard statistical methods were used. **Results:** 56 new traumatic SCI cases were treated in HNRC from 2008 to 2010: 82% of them were male (n = 46) and 18% female (n = 10). Average age (mean  $\pm$  SD) was 38.04  $\pm$  18.32. The main age group at the moment of trauma was 15-24 years (36%), followed by 35-44 years (16%), 45-54 years (16%), 25-34 years (12%), 55-64 years (11%), and older than 64 (9%). The most common causes of injury were falls (46%) followed by motor vehicle accidents (20%), diving (17%), accidents (11%), and violence (2%). Cause was unknown for 4% of cases. 27 patients (48%) suffered from SCI at cervical level. The average length of stay per year (mean  $\pm$  SE) was 40.45  $\pm$  3.63 days. **Conclusion:** Falls and motor vehicle accidents were found to be the leading causes of traumatic SCI. The number of ATV-associated accidents has increased remarkably during the recent years. It was concluded that the prevention of falls and well-organized notification campaigns about motor vehicle driving safety would be beneficial in order to reduce the frequency of traumatic SCI in Estonia.

## P-118

### Structural Relationships Between Personal Factors, Functioning, and Subjective Quality of Life

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**Objective:** To clarify relationships between activities, participation, and subjective quality of life in persons with spinal cord injury (SCI), and to specify how psychological factors and appraisals interact with these components. **Design:** Cross-sectional study. **Participants/methods:** 143 persons with SCI 5 years after discharge from inpatient rehabilitation. Standardised measures: Functional Independence Measure (FIM), social dimension of the SIP68, Mental Health subscale of the SF-36, total score of “current life satisfaction” and “current life satisfaction compared with life satisfaction before SCI.” Structural equation modelling was used for the analyses. **Results:** Functional status and neuroticism were related to participation and explained 49% of the variance in participation. 2 psychological variables and 2 appraisals were related to mental health and explained 35% of the variance in mental health. Participation, 3 appraisals, and mental health were related to life satisfaction and together explained 50% of the variance in life satisfaction. **Conclusions:** Mental health and life satisfaction can be seen as 2 separate but interrelated outcome variables. Neuroticism and self-efficacy were directly related to mental health and indirectly related to life satisfaction via appraisals.

**Support:** This study was supported by the Dutch Health Research and Development Council, ZON-MW Rehabilitation program, grant 1435.0003 and 1435.0025.

## P-119

### Arm Cycling Combined with Lower Extremity Vascular Occlusion Enhance VO<sub>2</sub>peak in Persons with High Level SCI

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**Objective:** To determine if lower extremity vascular occlusion (LEVO) during arm cycling (ACE) augment peak oxygen uptake (VO<sub>2</sub>peak) and therefore offer a more effective training modality, VO<sub>2</sub>peak is compared between (1) ACE combined with LEVO, (2) ACE alone, and (3) ACE combined with functional electrical stimulation cycling (FES hybrid). **Design:** Cross-sectional. **Participants/methods:** 15 persons with SCI, AIS A were recruited in 2 groups according to level of injury: above (SCI-high, n = 8) or below (SCI-low, n = 7) the 6th thoracic vertebra. VO<sub>2</sub>peak tests during ACE, ACE combined with LEVO, and FES hybrid was performed on separate days. VO<sub>2</sub>peak served as the main outcome. **Results:** In the SCI-high group, VO<sub>2</sub>peak during ACE combined with LEVO was 13% higher compared to ACE alone: 20.0 (±5.0) vs 17.6 (±5.0) mL·kg<sup>-1</sup>·min<sup>-1</sup> (*P* = .015). In the SCI-low group, for the same variables no significant differences were found. FES hybrid elicited higher VO<sub>2</sub>peak compared to ACE with LEVO for both groups: SCI-high, 24.4 (±4.1) vs 20.0 (±5.0) mL·kg<sup>-1</sup>·min<sup>-1</sup> (*P* = .000); and SCI-low, 25.6 (±4.1) vs 24.4 (±3.7) mL·kg<sup>-1</sup>·min<sup>-1</sup> (*P* = .046), respectively. **Conclusions:** LEVO during ACE for the SCI-high group augmented VO<sub>2</sub>peak, but not to the level of the FES hybrid mode. No effect of occlusion was observed for the SCI-low group. LEVO during ACE for SCI-high may facilitate training at a higher VO<sub>2</sub>.

**Support:** St Olav's University Hospital and Norwegian University of Science and Technology



## P-120

### Ultrasonographic Evaluation of Elbow Joint and Triceps Tendon Among Paraplegic Patients: A Preliminary Controlled Study

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**Objective:** The elbow joint and the triceps muscle play important roles in the activities of daily living in paraplegic patients. Accordingly, the joint and the force transmitting unit of the muscle – the triceps tendon – undergo a significant amount of stress. To our best knowledge, evaluation of these structures has not been done in the previous literature. Therefore, we reasoned that both the elbow joint and the triceps tendon could be evaluated by musculoskeletal ultrasound. **Design:** Cross-sectional, controlled study. **Methods:** 60 elbows of 30 patients with paraplegia (with a disease duration >3 months) and 40 elbows of 20 healthy controls were enrolled. Demographic and clinical data including duration of injury, transfer and push up activities, and pain in the humeroulnar and humeroradial joints and in the olecranon fossa elbow joint were recorded. Thickness of triceps tendon and the presence of fluid in elbow joint were recorded. **Results:** The patient and control groups were similar with respect to age, gender, and body mass index. Triceps tendons (right and left) of the patients were thicker than those of the controls ( $P:0.03$ ,  $P:0.05$ , respectively). The presence of fluid in right humeroradial joint was more common in the patient group ( $P:0.049$ ). **Conclusion:** According to our preliminary results, the triceps tendons of paraplegic patients were found to be thicker than the controls. Cumulative stress on the triceps tendon during ambulation and transfers could be the reason of this thickening.

## P-121

### Arm Cycling Combined with Passive Leg Cycling Enhance $VO_2$ peak in Persons with Spinal Cord Injury Above the 6<sup>th</sup> Thoracic Vertebra

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**Objective:** To determine if passive leg cycling (PLC) during arm cycling (ACE) augment peak oxygen uptake ( $VO_2$  peak) in subjects with spinal cord injury (SCI), by comparing  $VO_2$  peak between (1) ACE combined with PLC, (2) ACE-only, and (3) ACE combined with functional electrical stimulation cycling (FES hybrid). **Design:** Cross-sectional. **Participants/methods:** 15 subjects with SCI, AIS A were recruited. They were divided into 2 groups according to level of injury: above (SCI-high,  $n = 8$ ) or below (SCI-low,  $n = 7$ ) the 6th thoracic vertebra.  $VO_2$  peak tests with ACE, ACE combined with PLC, and FES hybrid exercise were performed.  $VO_2$  peak served as the main outcome. **Results:** In the SCI-high group,  $VO_2$  peak during ACE combined with PLC was 14% higher compared to ACE-only:  $20.8$  ( $3.7$ ) vs  $17.6$  ( $5.0$ )  $mL \cdot kg^{-1} \cdot min^{-1}$  ( $P = .002$ ). In the SCI-low group, no significant differences were found. FES Hybrid cycling elicited higher values for  $VO_2$  peak compared to ACE with PLC for both groups: SCI-high,  $24.4$  ( $4.1$ ) vs  $20.9$  ( $3.8$ )  $mL \cdot kg^{-1} \cdot min^{-1}$  ( $P = .001$ ); and SCI-low:  $25.6$  ( $4.1$ ) vs  $23.6$  ( $2.7$ )  $mL \cdot kg^{-1} \cdot min^{-1}$  ( $P = .01$ ). **Conclusions:**  $VO_2$  peak was significantly augmented in ACE in combination with PLC for the SCI-high group, but not to the level of the more resource demanding FES hybrid modality. In the SCI-low group, no difference was found. Therefore, passive leg cycling during ACE for SCI-high may facilitate exercise at a higher  $VO_2$ .

**Support:** St Olav's University Hospital and Norwegian University of Science and Technology, Trondheim, Norway

## P-122

### Rehabilitation Needs in Persons with Spinal Cord Injury in Post-Earthquake Haiti

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**Objective:** To explore the feasibility of rehabilitation needs assessment using the *International Classification of Functioning, Disability and Health* (ICF) in persons with spinal cord injury (SCI) following the earthquake in Haiti and to discuss the need for such assessments following humanitarian emergencies in general. **Design:** Feasibility study. **Participants/methods:** Rehabilitation needs were assessed during a relief action of Swiss Paraplegic Foundation at Haiti Hospital Appeal (HHA) centre, 5 months following the earthquake. The assessment included (1) the rating of the extent of problems in each of 41 ICF categories selected from the ICF Core Sets for SCI, (2) the identification of related rehabilitation needs, and (3) the allocation to specific intervention types. **Results:** 18 persons with SCI were assessed. 7 (39%) were male, 17 (95%) paraplegic, and 13 (72%) with complete lesions; mean age was 36.7 years (26 to 55). For at least 1 participant, some or complete problems were identified in all 11 categories of the ICF component "Body functions," in 2 of 4 categories in "Body structures," in all 17 categories in "Activities and Participation," and in 5 of 9 "Environmental factors." Rehabilitation needs (including preventive approaches) were identified in 39 of 41 ICF categories. Technical investigations, medication, counselling, nursing care, physical therapy, and psychological and social worker's support would be required to address these needs. Most of these are presently unavailable in Haiti. **Conclusion:** ICF-based needs assessments could provide standardized information to plan and provide rehabilitation services in the aftermath of humanitarian emergencies. However, the assessment has to be adapted to the particular setting and is only useful if the evidence will effectively inform health care providers and policy makers.

## P-123

### Indications and Trends in Use of CT of the Renal Tract in Spinal Cord Injured Patients

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**Objective:** To review trends and indications for CT of the renal tract in spinal cord injured patients. **Design:** Retrospective case review study. **Participants:** Adult patients with spinal cord injury being investigated with CT attending the National Spinal Injuries centre. **Methods:** Retrospective review of radiology management system and PACs system between 2008 and 2010. Only those scanned with an indication related to the renal tract were included. Patients with known malignancy were excluded. **Results:** 70 patients having CT of the renal tract were reviewed to evaluate indications and appropriateness of examination between 2008 and 2010. 21 patients had CT for equivocal ultrasound (US) or plain abdominal radiographs, 21 had CT for known calculi for planning percutaneous nephrolithotomy or monitoring stone progression. 13 patients had CT looking for causes of outflow obstruction from US or isotope renography. 4 patients had CT related to infection and 11 had other indications including evaluation of equivocal masses and haematuria. 9 patients had multiple exams. There was an increase in use of CT from 16 in 2008 to 29 in 2010. A number of studies were unenhanced when CT urography was indicated. **Conclusion:** Evaluation of equivocal renal calculi or for stones for treatment planning is the most common indication. CT is increasingly used to clarify the cause of outflow obstruction and indeterminate findings from other modalities and in high risk patients.

**Support:** Thames Valley CLRN

## P-124

### Long-Term Effect of MRI on Sacral Anterior Root Stimulators: The Stoke Mandeville Experience

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National Spinal Injuries Centre, Stoke Mandeville, UK

**Objective:** To review and identify complications in implanted sacral anterior root stimulators (SARS) up to 6 months following MRI examination. **Design:** Retrospective review study. **Participants:** Adult patients with spinal cord injury and implanted SARS, investigated with MRI attending the National Spinal Injuries Centre. **Methods:** Retrospective review between 1989 and 2010. The function of the implanted sacral nerve stimulator (Finetech-Brindley, UK) was assessed up to 6 months following MRI at 0.2 and 1.5 Tesla. **Results:** MRI scans were conducted in 19 patients, mainly in the cervical and thoracic spine but also in the head, shoulder, lumbar spine, and pelvis. 2 MRI examinations were stopped in 1 patient due to radiofrequency interference. 1 patient had problems with the SARS' hardware 5 months following MRI; both of these patients showing complications had their MRI examinations at 0.2 Tesla. There were no adverse effects at 1.5 Tesla. In 1 patient, the SARS was removed within 6 months after MRI due to an unrelated medical condition. 18 patients showed no symptoms that required terminating the examination and in 16 patients the SARS was functioning appropriately, and no change in bladder function was reported up to 6 months following MRI. **Conclusion:** Long-term follow-up showed no adverse effects attributed to more recent MRI examinations at 1.5 Tesla in patients with SARS.

**Support:** Thames Valley CLRN

## P-125

### Neuropathic Pain in Patients with Spinal Cord Injury

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**Objective:** Neuropathic pain (NP) is frequently seen in spinal cord injured patients (SCI) and is an important factor effecting quality of life. The aim of our study was to determine the prevalence and characteristics of neuropathic pain in SCI patients and evaluate the relationship between clinical and demographic factors.

**Design:** Cross-sectional study. **Participants/methods:** 220 SCI patients have been enrolled. Demographic characteristics, injury duration, and etiology were recorded. The patients were examined and classified according to American Spinal Injury Association Standards, NP was evaluated with Leeds Assessment of Neuropathic Symptoms and Signs (LANSS), and pain intensity with Visual Analog Scale (VAS). The region (at the level of the lesion, above or below the lesion level), location (lower extremity, upper extremity, and trunk) and the characteristics, frequency, and duration of pain were recorded. Descriptive statistics, *t* test, and chi-square tests were used as statistical methods.

**Results:** NP was present in 46.3% (n = 102). There was no statistically significant difference between NP and pain-free group in respect of age, gender, marital status, injury level, and etiological factors. The most common region of pain (88.2%) was below the neurological level and pain was described as burning (50%). A positive significant correlation was found only between age and VAS ( $r = 0.214, P = .038$ ). **Conclusion:** According to the results of this study, NP after SCI is common and pain severity is higher in patients at older ages. This indicates the importance of pain management in particular for older SCI patients.

## P-126

### Health-Related Quality of Life Among Patients with Traumatic Spinal Cord Injuries

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**Objective:** To investigate the health-related quality of life (HRQL) in patients with traumatic spinal cord injuries (TSCI) in a Norwegian cohort and compare with normative data from the general population, and to investigate relationships between HRQL and

demographic and clinical variables. **Design:** Data were obtained through telephone interviews using the Norwegian Medical Outcomes Study 36-item Short-Form Health Survey (SF-36) from a Norwegian cohort injured in the period 1982-2001. Age- and sex-specific expected scores representative for the population were obtained using prediction equations from normative data from the general Norwegian population published in 1998 by Loge and Kassa. **Participants/methods:** 115 patients, 23 women and 92 men, were included in the study. Mean age was 49.6 years at time of interview, and mean time since injury was 12.4 years. Multiple linear regression analysis was applied to determine the variables affecting deviance from expected physical and mental health-related quality of life among the patients, while controlling for age, gender, level and completeness of injury, marital status, education, employment, work place, living condition, and economy. **Results:** All SF-36 subscores were significantly reduced in patients with TSCI compared with Norwegian norms except for the domain general health. Compared to the other patients, reduced scores were seen for patients with cervical complete injuries for physical function and emotional role, while incomplete thoracolumbosacral injuries scored significantly lower on social function and general health. The regression analysis results indicated that level and completeness of injury was significantly related to lower physical function, social function, and vitality. Economy was significantly associated with physical role, bodily pain, social function, mental health, and vitality. **Conclusion:** HRQL was reduced in this study sample of TSCI patients. TSCI is associated with a reduction in most SF-36 subscales and most pronounced among patients with cervical complete injuries and incomplete thoracolumbosacral injuries.

## P-127

WITHDRAWN

## P-128

### Physical Therapy Workforce in the United States: Forecasting Nationwide Shortages

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**Objective:** To examine current and future physical therapy (PT) job surplus/shortage trends across the United States. **Design:** Forecast models and grading methodology previously published for nursing were used to evaluate individual state PT job shortages from 2008 to 2030. **Participants/methods:** The forecast model used to project PT job supply and demand accounted for changes in age and population size on the basis of estimates from the US Census Bureau for each of the 50 states. PT shortages were assigned letter grades on the basis of shortage ratios to evaluate PT shortages and describe the changing PT workforce in each state. **Results:** On the basis of current trends, demand for PT services will outpace the supply of PTs within the United States. Shortages are expected to increase for all 50 states through 2030. By 2030, the number of states receiving below-average grades for their PT shortages will increase from 12 to 48. States in the Northeast are projected to have the smallest shortages, whereas states in the South and West are projected to have the largest shortages. **Conclusion:** These data serve to provide health professionals, policy makers, and stakeholders with a means of assessing current and future PT needs. Discussion of the issues surrounding PT shortages and ongoing assessment of supply and demand must ensue to mitigate projected shortages.

## P-129

### Occupational Therapy Workforce in the United States: Forecasting Nationwide Shortages

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**Objective:** To examine current and future occupational therapy (OT) job surplus/shortage trends across the United States. **Participants/methods:** Forecast models and grading methodology previously published for nursing were utilized to evaluate individual state OT shortage ratios from 2008 to 2030. The metric used for grading was the OT shortage ratio defined as the



difference between OT demand and OT supply per 10,000 population. 50 states were aggregated into 4 geographic regions as defined by the Bureau of Labor and Statistics (BLS). **Results:** Based on current trends, demand for OT services will outpace the supply of OTs within the US. The number of states receiving below average grades for their OT shortage ratios will increase from 10 to 41 with a total national deficit of 55,997 (52,209 to 60,370) OT jobs. In 2030, states with the highest shortage ratios include Florida, Arizona, and New Mexico. States with the lowest shortage ratios are Massachusetts, Connecticut, and Pennsylvania. Using the BLS geographic regions, the Northeastern region is projected to have the smallest shortages while the Southern and Western regions are projected to have the largest shortages. **Conclusion:** This study forecasts significant OT workforce shortages throughout the country in 2030. In order to prevent an OT workforce crisis, increased efforts to understand shortage dynamics and decisive action to train additional nurses is warranted.

## P-130

### Analysis of New Spinal Cord Injury Admissions Over a 10 Year Period in a UK Centre

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**Objective:** To assess the change in demography of spinal cord injury (SCI) patients over a 10-year period admitted to a spinal injury centre in UK **Design:** Systematic retrospective review of case records. **Methods:** Case records of new SCI patients admitted to our centre over a 10-year period (January 1999 to December 2008) were reviewed. Data were subdivided into 2 periods of 5 year duration (January 1999 to December 2003 and January 2004 to December 2008). Demography with clinical details were retrieved and analysed. **Results:** Total of 590 case records were reviewed. Data were analysed based on parameters including age, gender, level of SCI, aetiology, and detailed subclassification of SCI. Aetiology of SCI was compared with published data from other countries. This study showed fall as the leading cause of SCI (48%) followed by motor vehicle accident (MVA) (35%). Subgroup analysis on all aspects of SCI demography did not show any significant change in two 5-year segments. **Conclusion:** North West spinal injury unit caters to

approximately 6 million populations. Our regional data reasonably reflect similar demographic details of SCI in the UK. Analysis of these data indicates 10 SCI per million populations per annum in UK (average 60 new admissions per annum). Fall was the leading cause of SCI followed by MVA. This finding is at variance with the other published literature.<sup>1,2</sup>

### REFERENCES

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## P-131

### Ultrasonic Detection of Suspected Deep Tissue Injury: The Jury is Still Out About Its Clinical Relevance

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**Objective:** (1) Develop a standardized protocol to detect abnormalities in the soft tissues overlying the ischial tuberosities (ITs). (2) Develop a standardized reporting protocol of the abnormal tissue overlying the ITs. (3) Follow the natural history of these cases to determine outcomes. **Design:** Cross-sectional. **Participants/methods:** 14 participants with spinal cord injuries (SCI) were assessed using a standardized ultrasound protocol to measure the thickness of the soft tissues overlying the ITs. These layers include skin/fat and gluteus muscle. This was done by a senior musculoskeletal sonographer with the participant in a simulated sitting position (supine). **Results:** 3 participants had abnormal soft tissues overlying the ischium. Case 1 was a 38-year-old male, T12 complete SCI, with swelling in the soft tissues overlying his left IT. Ultrasound revealed an area measuring 45mm x 33mm x 18 mm with a thick hypochoic pseudo capsule with possible calcification in the fat layer. Peak interface pressures were in excess of 200 mmHg. His wheelchair cushion was replaced, and he has not developed an open pressure ulcer. Case 2 was a 52-year-old female, T12 incomplete who was treated for cellulitis and swelling on the left buttock and inguinal area. Ultrasound revealed a complex cystic collection measuring 37mm x 43mm x 44mm which extended from the IT to the dermis (no gluteus

muscle detected). The skin was intact. **Conclusion:** The ultrasound detection and natural history of abnormal tissue overlying the IT is being determined in a multisite, international prospective study.

**Support:** Funded by the Fremantle Hospital Medical Research Foundation and the Australian Wound Management Research Foundation

## P-132

### Complications Following SCI During the Acute Phase

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**Aim of study:** To explore the incidence of complications following spinal cord injury, explore the possible relation of complication development and the time lapse from injury to admission to a spinal unit, and compare results in both centres and those in literature. **Research study:** Retrospective study. **Material and methods:** Retrospective study has been taken to determine complications following SCI during the acute phase. Random samples were collected from Stoke Mandeville (50 patients). Data collected are from patients' medical records. Data collection tool designed to explore the following aspects: completeness of the notes, referrals forms/outreach services, aetiology and level of injury, pre- and postadmission management, time between injury and admission to spinal unit, type of complications reviewed include skin, respiratory, urinary, bowels, cardiovascular/ deep vein thrombosis (DVT)/pulmonary embolism (PE), psychological, surgical, gastrointestinal (GI), pre- and postadmission complications. **Results:** Study suggested that early admissions to specialised spinal centres reduce the incidence of complication development. A high incidence of at least one complication on admission was documented; the most common complications detected were skin, urinary, respiratory, and psychological. The study findings highlighted the poor documentation of the multidisciplinary team. Other findings will be outlined within presentation. **Conclusion:** It is evident from the finding of the study that a uniform standard of SCI treatment will soon be provided throughout the country. As a result this will serve to improve the quality of care given to SCI patient groups. This will lead to diversion of resources to improve services of SCI

management further, further recommendations will be outlined within poster presentation

## P-133

### Rehabilitation Outcomes of Robotic-Assisted Locomotor Training in Incomplete Spinal Cord Injured Individuals

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**Objective:** To determine improvement in ambulation and rehabilitation outcome measures in incomplete SCI patients undergoing robotic-assisted locomotor training. **Design:** Retrospective review of the data collected from both inpatients and outpatients with SCI undergoing robotic-assisted locomotor training at the Tan Tock Seng Hospital Rehabilitation Centre in Singapore. **Participants/methods:** All patients undergoing treatment who were more than 21 years old, able to tolerate 20 minutes of standing, and participate in training were included. Patients with pressure sores, orthostatic hypotension, unstable cardiovascular status, severe osteoporosis, lower limb joint fractures, and limb deformities affecting normal kinematics were excluded. **Results:** There were 16 tetraplegics and 11 paraplegics. The mean lower extremity motor score pre training was  $24.5 \pm 8.7$ . With respect to Lokomat training parameters, there was significant reduction in mean body weight support post training (47% to 19%) and the amount of orthosis guidance force used (98% to 55%). There was increase in speed of treadmill (1.6 to 2.3 km/h), distance covered without fatigue (601.4 to 1387.3 m), and duration of ambulation tolerated (21.7 to 40.3 min). Post training, mean FIM transfer subscores improved from  $3.92 \pm 1.87$  to  $4.85 \pm 1.48$  ( $P < .05$ ) and FIM walking scores from  $2.12 \pm 1.64$  to  $2.92 \pm 1.77$  ( $P < .05$ ). In those who were able to ambulate ( $n = 7$ ), the mean distance achieved via 6-minute walk test improved from 48.47 m to 128.4 m. **Conclusion:** Robotic-assisted locomotor training is able to improve locomotion and functional mobility in persons with incomplete SCI.

## P-134

### Extensive Dermatitis Artefacta in a Longstanding T4 Paraplegic Below the Level of Lesion

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**Objective:** Describing a rare condition. **Design:** Case report. **Methods:** We present a T4 paraplegic patient who was admitted to the readmission unit for urological investigations. **Results:** On examining the patient, many strange ulcerated lesions all over his lower limbs and abdomen, mainly on the right side, were noted. On talking to the patient, he was extremely embarrassed but admitted that he had compulsively been picking at his skin for some time. As he lacked sensation below T4, he could not feel how much damage he was doing, leading to very extensive lesions. He admits to “getting a buzz from it” but feels guilty immediately afterwards. He had avoided any medical contact – even with his GP – in case it was noticed. It happens more when he is feeling anxious. The picking coincided with a long inpatient stay and inadvertent alcohol cessation although he smokes cannabis from one-fourth to one-half ounce a week, depending on availability. He self-medicates for spasms in legs and has noted that he is much more relaxed and does less picking when high. He was referred to the psychiatrist for management. **Conclusion:** Dermatitis artefacta also known as compulsive skin picking, acne excoriee, and psychogenic excoriation is a poorly understood and underresearched condition. It results from repetitive and compulsive self-induced trauma to normal skin. The lesions are usually found on face or any area patients can reach but in our paraplegic patient only in anaesthetic part of body with much extensive lesions; consequently there is tissue damage and even permanent disfigurement. Patients often attempt to camouflage the lesions and in extreme cases may avoid social situations

## P-135

### Advanced Opportunities of Computer Implementations of the International Standards For Neurological Classification of Spinal Cord Injury

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**Objective:** The ASIA Impairment Scale (AIS) as an important component of the International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) often serves as in-/exclusion, stratification criterion, and outcome measure in clinical trials. The objective of this study is (1) to investigate in how many datasets with not testable (NT) segments the AIS can be determined with computer-based implementations of the ISNCSCI, and (2) to simulate the consequences of ISNCSCI revisions using the example of omitting the “more than 3 segment” rule for determination of AIS C. **Design:** Retrospective analysis of datasets from the ISO-certified EM-SCI network. **Methods:** A sample of the EM-SCI database (queried in February 2009) containing 5,542 ISNCSCI datasets of 1,594 patients was used. In an iterative process, the implemented algorithms were first tuned to process all datasets without NTs (5,049). **Results:** In 493 datasets, between 1 and 10 NTs occurred (8.90%). The AIS was determinable in 411 datasets (83.4%) with a trend to lower determinability rates in higher numbers of NTs (75% classification rate in 10 NTs). By omitting the “more than 3 segment” rule, the amount of AIS B datasets significantly (10.1%;  $P < .001$ , Wilcoxon matched pair test) increased at the expense of AIS C (387) and AIS D (166). In addition, 38 datasets (AIS B, 6; AIS C, 26; AIS D, 6) not classifiable by the current standard due to NTs would be assigned a valid AIS. **Conclusion:** Computer implementations of the ISNCSCI are a helpful (re-) calculation tool for error-free analysis of large clinical and research databases and allow for simulation of the consequences of future revisions of the standards. Additionally they allow the setup of efficient teaching and training tools (<http://ais.emsci.org>).

**Support:** This project has been partially supported by the EM-SCI network funded by the International Institute for Research in Paraplegia (IFP).

## P-136

### Pressure Ulcers in the Immediate Post Injury Period

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**Objectives:** To determine incidence of pressure ulcers (PU) prior to admission to SCI centre (SCIC), relationship to delay in admission to SCIC, and their impact on rehabilitation outcomes. **Design:** Retrospective review of 50 consecutive admissions to a supra regional SCIC. **Participants/methods:** Medical and nursing records of 50 consecutive acute SCI admissions to a supra regional SCIC between October 2009 and May 2010 were reviewed. Details of the injury, initial treatment, delay in admission to SCIC if any, ASIA grading, size and grading of PU if any, haemoglobin and albumin levels, management of PU, delay in commencing rehabilitation, outcome, length of hospital stay, and discharge destination were determined. **Results:** Of the 50 patients (mean age 48 years, 28 traumatic, 22 nontraumatic SCI), 23 patients (46%) had PU. Mean time to admission from the date of injury was 32 days (range, 0 to 122 days). Most sores were over the sacrum (69%) followed by heel and malleolar sores. Poor nutritional status, low albumin, low haemoglobin, and wet skin were associated with increased incidence of pressure sores. There was a direct relationship between delay in admission to the SCIC and an increased likelihood of PU. In 18 patients, the sores were managed with conservative techniques; in 5, surgical closure was required. Patients with PU had significantly longer hospital stays, delayed attainment of functional goals, and increased likelihood of other complications such as contractures. **Conclusion:** PU continue to be an important problem in the acute period following SCI, with consequent adverse impact on length of hospital stay and rehabilitation outcomes. Delay in admission to SCIC is associated with an increased incidence of PU. Reconfiguration of services which may lead to fragmentation of existing care pathways has the potential to exacerbate delays and worsen the problem.

## P-137

### Causes of Traumatic Spinal Cord Injuries: Evidence from the Past 30 Years in the Area of Florence

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**Design:** Retrospective data analysis. **Introduction:** Traumatic spinal cord injury (TSCI) is a devastating injury giving a lifelong disability. The most common causes of TSCI are road traffic accidents (RTA) and falls. The patients are mostly young males; 60% of the patients have a complete SCI. The aim of this study is to analyze the causes of TSCI, severity of injury, gender, and age at the time of injury in the area of Florence during the period 1981-2009. **Methods:** The medical files from the computerized database of all patients that sustained their TSCI between 1981 and 2009 were studied. The causes of injury were divided into the following categories: falls, RTA, sports and leisure accidents, and gunshots. RTA accidents were divided in car and motorcycle accidents. The patients were divided into 3 groups according to the time of injury: 1981-1990, 1991-2000, 2001-2009. **Results:** 1,559 patients were identified. Falls were the most common accident. The incidence of motorcycle accidents has increased from 11% to 25% over the years. The incidence of falls and sports accidents has been constant, representing 40% and 7%, respectively. The mean age for falls is 50 years, for car accidents, 38; for motorcycle accidents, 28; and for sports, 24. Diving results in the most common sports and leisure accident. 70% of the patients with falls and 84% of the motorcycle accidents are males. **Conclusion:** The incidence of motorcycle accidents has increased over the years while the incidence of falls, sports and leisure accidents, and gunshots has been constant.



## P-138

### Direct Cost of Care in Individuals Sustaining Spinal Cord Injuries from Motor Vehicle Collisions in the Province of Quebec

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**Objective:** To determine the direct costs of care for 2 years following a spinal cord injury. **Design:** Retrospective database analysis. **Participants/methods:** Using data from the Quebec Trauma Registry, RAMQ (Quebec Medical Insurance Board), and the SAAQ (Quebec Automobile Insurance Corporation) between 1997 and 2007, 449 individuals who sustained a spinal cord injury from motor vehicle accidents were identified. Individuals sustaining moderate or severe traumatic brain injuries were excluded. Individuals were classified as complete and incomplete in the following categories: C1-C7, C8-T6, T7-L1, L2-S5 (incomplete only). Calculation was made of acute hospital costs as well as direct costs for the first 2 years post injury. Inclusion of both government health costs and auto insurance costs makes this comprehensive. **Results:** All values are in 2009 Canadian dollars calculated per patient. For C1-C7 complete spinal cord injuries, the first year cost was 157,718. Incomplete lesions at the same level had costs of 56,505. Similar differences between complete and incomplete were seen for the other groups. Furthermore, for complete injuries, costs were higher for higher levels of injury both for the first and second years post injury. For incomplete lesions, costs did not differ significantly between groups for the first or second year. **Conclusion:** Incomplete spinal cord injury results in significantly lower health care costs compared to complete injuries. Monies spent to reduce the severity of spinal cord injury could at least partially be recouped through health care savings.

**Support:** This project was funded by the Quebec Spinal Cord Injury Research Foundation.

## P-139

### Secondary Health Conditions and Health Preference in Spinal Cord Injury

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**Objective:** To describe the relationship between secondary health conditions (SHCs) and health preference (HP) in spinal cord injury (SCI). **Design:** Cross-sectional telephone survey. **Participants/methods:** Adults with traumatic SCI AIS A-D (n = 263; 77.9% male; mean years post-injury [YPI] 20.9) completed the Secondary Condition Scale-Modified (SCS-M) and Health Utilities Index [HUI-3; (0 = death to 1 = perfect health)]. SCS-M responses for different SHCs were used to create low impact (LI) = absent/mild and high impact (HI) = moderate/severe groups. **Results:** The mean SCS-M score was 11.67 (SD = 7.6; range, 0 to 43) and was 0.24 (0.25; range, -0.28 to 0.97) for HUI-3. ANCOVAs (controlling for SCI impairment) revealed that HUI-3 scores were lower ( $P < .001$ ) in HI groups for spasms, bowel dysfunction, autonomic dysreflexia, psychological distress, chronic pain, and joint pain compared to the LI groups. As well, HUI-3 scores were lower ( $P < .01$ ) in HI groups for pressure sores, contractures, unintentional injuries, sexual dysfunction, urinary tract infections, circulatory problems, cardiac problems, respiratory complications, neurological deterioration, and depression than LI groups. HUI-3 and SCS-M severity scores were negatively associated ( $r = -.46, P < .001$ ). **Conclusion:** HI SHCs are negatively associated with HP in persons with SCI. The HUI-3 data provide the basis for calculating quality adjusted life years (QALYs) and can be used to advocate for additional resources where SHCs have substantial adverse impact on health.

**Support:** Physician Services Incorporated Foundation

## P-140

### Ten Things You Might Not Know About SCIs Worldwide (If you don't attend the Prevention Committee Symposium)

ISCoS Prevention Committee; H. Murray, MD, and D. Brown, MD

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**Objective:** To share interesting information from global incidence studies of SCI from the Prevention Committee of ISCoS. **Design:** We have chosen 10 items of interest highlighting variations of SCI injury prevalence, incidence, causes, and mortality rates from available worldwide data. There are photographic illustrations of regional causes. **Participants:** Prevention Committee ISCoS. **Results:** Wide variations exist worldwide in causes, such as primary causes of SCI in Western Europe being four-wheeled motor vehicles, in South Africa it is violence, in Southeast Asia it is two-wheeled and "non standard" vehicles, and in Southern Asia and Oceania falls from trees and rooftops. **Conclusions:** These variations make standardized data collection and mapping techniques essential to directing SCI prevention efforts, both locally and globally. Education and prevention programs in many regions are in urgent need.

## P-141

### Bladder Dysfunction in Patients with Thoraco-lumbar Spinal Cord Injuries: A Long-Term Follow-up Study

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**Objective:** To examine bladder dysfunction in patients with traumatic thoraco-lumbar (T11-L3) spinal cord injuries (T/L-SCI). **Design:** Cross-sectional follow-up study. **Participants/method:** Patients admitted to an acute centre between 1995 and 2005 diagnosed with a T/L-SCI were contacted by mail. MRI was used to classify the injury type (cord, conus or cauda equina injury) and a neurological exam was conducted at follow-up. Bladder dysfunction (eg, incontinence, urinary infections) was measured using the Qualiveen patient-reported measure. A univariate nonparametric

analysis was used to examine the association of personal factors (age, gender, marital status) and injury type (cord, conus, cauda equina) with the Qualiveen Specific Impact of Urinary Problems (QSIUP) index (score range, 0-4; higher score indicates more impact). **Results:** 51 patients completed the follow-up. 82% of patients were male and the median age at injury was 33 years. Injury types at follow-up included cord (37%), conus (39%), and cauda equina (24%); 41% were complete injuries (ASIA Impairment Scale A). The median QSIUP index was 1.2 (range, 0.0-3.8). Injury type, age, and marital status had no effect on the QSIUP index. Women had a significantly higher QSIUP index ( $P < .01$ ) compared to men, indicating greater bladder dysfunction. **Conclusions:** Women with T/L-SCI reported greater bladder dysfunction compared to men, which is consistent with previous studies. The bladder dysfunction present in this population did not appear to differ in severity among the various neuro-anatomic levels of injury. Future studies should continue to define the clinical characteristics of T/L-SCI.

**Support:** Funding was received from the Rick Hansen Foundation.

## P-142

### Cardiometabolic Risk Profiles in Pre- Versus Postmenopausal Women with Spinal Cord Injury

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**Objective:** To compare the cardiometabolic risk profile in a sample of pre- and postmenopausal women with spinal cord injury (SCI). **Design:** Multicenter cross-sectional study. **Participants/methods:** 14 women with C5 to T12 ASIA Impairment Scale (AIS) A or B SCI participated and were divided into 2 groups according to menopause status ( $n = 9$  premenopausal vs  $n = 5$  postmenopausal women). Assessments included demographic, social, and medical history, including information on menopausal status, hormone use, and menstrual history; physical, anthropometric, and blood pressure assessments; fasting serum assays including total cholesterol (TC), high-density

lipoprotein cholesterol (HDL-C), triglycerides, and hemoglobin A1C; calculated low-density lipoprotein (LDL-C); and an oral glucose tolerance test. **Results:** The premenopausal group had a mean age of 29.3 years compared with 56.7 years in the postmenopausal group ( $P = .001$ ). BMI (22.8 vs 22.7;  $P = .798$ ), HDL-C (51.0 vs 67.5;  $P = .546$ ), LDL-C (95.8 vs 115.7;  $P = .072$ ), HbA1c (4.8 vs 5.0;  $P = .141$ ), FBG (80.8 vs 85.0;  $P = .505$ ), SBP (108.0 vs 118.5;  $P = .593$ ) were similar between the 2 groups. Triglyceride and TC were significantly higher in postmenopausal females (57.2 vs 99.7;  $P = .007$ ; and 158.2 vs 203.0;  $P = .013$ , respectively). **Conclusions:** The findings from this study demonstrate that postmenopausal women with SCI have CMR profiles similar to that observed in able-bodied women. Levels of TC and TG were significantly higher in postmenopausal women compared with premenopausal women and differences in LDL-C approached statistical significance and were above the recommended values.

## P-143

### Colonoscopy Is Safe for Veterans with Spinal Cord Injury or Disorder (SCI&D)

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**Objective:** Colonoscopy is the most effective screening test for colorectal cancer (CRC), but up to 1% of patients experience complications. Despite similar CRC incidence rates, persons with SCI&D are less likely to receive colonoscopy due to practical considerations. Sensory deficits and chronic rectal bleeding in persons with SCI&D may mask CRC symptoms, heightening the importance of regular screening. Therefore, the aims of this study of veterans with SCI&D undergoing colonoscopy were to report (1) patient and procedure characteristics and (2) the incidence of complications within 30 days of colonoscopy. **Design:** Retrospective chart review. **Participants/methods:** VA administrative data identified 107 veterans with SCI&D seen at our medical center who underwent 142 diagnostic or screening colonoscopies from 1998 to 2008. We reviewed subjects' electronic medical records for demographics, length of stay, preprocedure symptoms, procedure indication and other details, and for

postprocedure complications. **Results:** Median length of stay was 10 days (range, 1-779). 44% had paraplegia, and 56% had tetraplegia. Median age was 57 (range, 32-88), and 44% were African American. Median duration of colonoscopy was 30 minutes (range, 3-205). 56% of patients were inadequately bowel prepped. 4 patients experienced postprocedure abdominal bloating and 1 experienced rectal bleeding, but none required medical intervention. 2 CRCs and 1 precancerous lesion were found (3% incidence). **Conclusions:** Colonoscopy is more difficult in SCI&D patients: neurogenic bowel increases the rate of poor prep. However, colonoscopy does not pose a higher risk of complications and can be potentially life-saving by detecting CRC. This is especially important as the median life expectancy of veterans with SCI&D approaches that of the general veteran population. These data should encourage SCI&D providers to offer more screening colonoscopies and suggest a need for an extended prep period in these patients.

**Support:** This study was supported by a Center for Management of Complex Chronic Care (CMC3) locally initiated project grant.

## P-144

### Rick Hansen Spinal Cord Injury Registry (RHSCIR): A Canadian Initiative

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**Objective:** Create a national registry of individuals with traumatic spinal cord injury (SCI) to advance clinical practice, facilitate translational research, and enhance quality of life. **Design:** Prospective longitudinal observational data collection. **Participants/methods:** Individuals who sustain a traumatic SCI (AIS A-D) and are admitted to a participating RHSCIR hospital are eligible. Participation has grown to 27 hospitals spanning 7 provinces. Acute and rehabilitation phase data collection includes chart review, structured interview, and linkage to hospital databases. Community integration data, based on patient-reported outcome measures, is collected at 1 and 2 years post injury and at 5-year intervals until death. The dataset includes the International SCI Core Dataset and information on patient factors, prehospital, acute, and rehabilitation, and

community integration. **Results:** 1,469 participants were enrolled from 2005 to 2010. Descriptive results of the national sample include 78% males and a mean age of  $45 \pm 19.5$  years. Types of injuries include 24.9% cervical complete, 16.9% thoracic/lumbar complete, 40.1% cervical incomplete, 13.5% thoracic/lumbar incomplete, and 3.9% cauda equina. On discharge, 33% had no funding. 36% of injuries caused by falls occurred in those 65 years or older. These results appear consistent with other US and single-site Canadian data. **Conclusion:** There were many challenges to launching a national registry, including new privacy legislation and securing long-term funding. The composition of the RHSCIR data is increasingly becoming more representative of traumatic SCI in Canada. Future directions include expanding RHSCIR internationally and using the RHSCIR network to support clinical trials.

**Support:** Funded by the Rick Hansen Institute and Health Canada

## P-145

### A Comprehensive, Multimodal, Integrated Approach to Patient and Family Education Following Spinal Cord Injury (SCI)

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**Objective:** (1) Develop and implement a comprehensive, multimodal program for patient and family education and (2) prepare individuals with SCI for community reintegration. **Design:** Mixed methods. **Participants/methods:** Patient and family education is an essential component of rehabilitation and required to maximize function, health, and quality of life. A framework for patient education was developed for the 60 bed Spinal Cord Rehabilitation Program at Toronto Rehab. Existing literature, best practices, and needs assessments informed planning. Additional input was solicited through focus groups and stakeholder interviews. Specific initiatives include development of a Website (Spinal Cord Connections), a series of interactive e-learning courses (SCI-U), a patient education binder comprised of individualized handouts (Spinal Cord Essentials), a dedicated SCI Resource Center, and a series of

problem-based learning educational sessions. Initiatives were integrated and leveraged to maximize efficiency and effectiveness, and a Patient and Family Educator ensured consistency across initiatives. Awareness campaigns served to promote the new initiatives and the importance of patient and family education during rehabilitation. **Results:** Implementation of the new patient and family education model is ongoing. There has been widespread participation by program staff who provided input and generated content for one or multiple projects. Objective evaluation of efficacy is underway. **Conclusion:** SCI-U e-learning courses and content for the patient education binder are accessible online at [www.spinalcordconnections.ca](http://www.spinalcordconnections.ca).

**Support:** Funded in part by the Ontario Ministry of Health Innovation Fund and Rick Hansen Institute grant 2010-77

## P-146

### Impairment and Rehabilitation Outcomes of Ontarians with Traumatic and Nontraumatic SCI

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**Objective:** Compare sociodemographic, impairment, and rehabilitation outcomes of Ontarians with traumatic (T) and nontraumatic (NT) SCI. **Design:** Prospective observational study. **Participants/methods:** Participants included 117 adults with acute SCI (C1-T12 AIS A-D) admitted for inpatient rehab at 2 SCI rehab centres in Ontario, Canada. Data was obtained via chart abstraction, interview, or direct assessment. Outcomes included rehab onset days, rehab length of stay (LOS), ISCSI total motor scores (TMS), AIS, and SCIM change. Parametric and nonparametric statistics were used to detect between group differences. **Results:** Of the consenting participants, 77% had T SCI (n = 90 T, n = 27 NT): a higher proportion of eligible T vs NT patients consented (83% T, 39% NT). The NT group was predominantly paraplegic, older (42 years T, 58 years NT) and had a greater proportion of women (21%



T, 37% NT). NT also required on average 21 days longer achieving similar motor outcomes. Rehab admission TMS for T was significantly lower than NT but changes at discharge were similar (T admission 53, change 10, NT admission 75, change 10). Similarly, T admission SCIM scores were lower (46 T, 64 NT) with greater SCIM gains observed in the T group (21 T, 11 NT). **Conclusion:** LOS targets for the NT SCI population should be longer to facilitate optimization of motor and functional outcomes.

**Support:** Ontario Neurotrauma Foundation and the Ontario Ministry of Health and Long-term Care

## P-147

### Spinal Cord Injury Knowledge Mobilization Network

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**Objective:** Expedite best practice implementation (BPI) by working with IS experts to develop knowledge/skills/abilities related to scale-worthy, evidence-based practices and evidence informed innovations. **Design:** Descriptive. **Participants/methods:** Utilizing ONF's partnerships with Canadian Stroke Network/Strategy (CSN/CSS) and National Implementation Research Network (NIRN), a knowledge mobilization network (KMN) has embarked on BPI in SCI secondary complications. The concurrent/integrated/synergistic KMN builds BPI capacity through leadership and implementation teams to ensure fidelity/sustainability/scalability. 3 key elements of implementation infrastructure include: Executive Management (EMT), Transformation (TT), and Regional Implementation (RIT) Teams. The EMT, from the programs-services-administration-legislation continuum, initiates the process and manages capacity building and the process of evolving roles/functions/structures at the provincial/regional/organizational levels. The TT members were selected for implementation experience, knowledge of the health systems, and adaptive leadership skills to initiate change. The RIT members (4 Ontario/Quebec centres) were selected for organizational-level knowledge and leadership/implementation skills. These teams collectively build BPI fidelity/sustainability/scalability to ensure health practice responds to current/evolving conditions and contributes to population

health/well-being. Innovations in practice and policy are driven by 4 integrated knowledge domains: community/regional needs and emerging issues; fidelity/sustainability/scalability core indicators for interventions and for implementation processes; and practice/program/system improvement cycles. **Results:** Rick Hansen Institute (RHI) and ONF partnership resourced executive management, transformation, and regional expert teams to initiate SCI secondary complications BPI: pressure ulcers, bladder, and pain. The RIT were trained in IS processes to build fidelity/sustainability/scalability capacities and, beginning with pressure ulcers, identified regional needs/emerging issues. With expert partner (CSN/CSS, NIRN) assistance, pressure ulcer-related BP interventions and intervention implementation core indicators were identified for administration. **Conclusions:** The RHI-ONF KMN is in operation and results of improvement cycles for practice/program/system change will be presented in the future.

**Support:** This initiative is funded by RHI and ONF.

## P-148

### Pressure Ulcer: Current Status and Preventing Health Behaviour Utilised by Community-Residing People with Spinal Cord Lesion (SCL) in Bangladesh

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**Objective:** To explore the current status of "pressure ulcer and preventing behaviour" of people with SCL living in the community and challenges faced practicing these. **Design:** The research was mixed-design consisting of a prospective survey and a qualitative part. **Method:** 81 expatriates in 3 districts were visited following purposive comprehensive sampling. A semi-structured questionnaire and an observation checklist were used as tools of this survey part of the study. In order to explore their challenges, 5 patients living in the community were interviewed conveniently. Quantitative part of the study would be analysed using descriptive statistics whereas content analysis would be used for qualitative part. **Result:** 36% patients died, of whom 70% had severe pressure sore at time of death. Pressure sore prevalence among 51 of the living patients was 39% and almost 70% experienced dealing with pressure sores at home. 80% of patients were practicing

pressure relief techniques at infrequent intervals. 87% were stuck with one method of pressure relief. 57% of patients were turning regularly at night when they were in bed. 78% of patients do not check their skin regularly. 50% of patients were using a cushion that was no longer suitable. The relaxed culture leads to lack of value on the prevention; lack of habituation, lack of emphasis on alternative techniques, and adaptability to the long-term situation were found as major challenges to follow pressure sore preventing behavior. **Conclusion:** The study gives an outline of the current situation and shows several areas for improvement in the prevention of pressure sores in the community.

## P-149

### Muscle Oxygenation Trend During FES-Assisted Cycling in Spinal Cord Injured Individuals

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**Objective:** This study compared acute exercise and muscle oxygenation responses during arm cranking, FES-assisted leg cycling, and combined arm and leg (“hybrid”) exercise modalities in SCI individuals. **Design:** Cross-sectional study. **Participants/methods:** 9 individuals with long-standing neurological lesions from C7-T12 (ASIA A, B and C) were recruited. All subjects performed arm crank ergometry (ACE), FES-leg cycle exercise (FES-LCE), combined ACE+FES-LCE, and hybrid-FES cycling. They were assessed for their peak exercise responses in all 4 modalities. Subsequently, their submaximal HR, cardiac outputs (Q), stroke volumes (SV), and muscle oxygenation were measured at 40%, 60%, and 80% of their mode-specific  $VO_{2peak}$  and work intensities. Muscle oxygenation was measured with near-infrared spectroscopy. **Results:** Mean  $VO_2$  during submaximal FES-leg cycling exercise is significantly lower than the arms and hybrid exercises in all exercise intensities ( $P < .05$ ). FES-leg exercise at submaximal intensities results in significantly lower mean Q, HR, and  $avdO_2$  ( $P < .05$ ). The arms and hybrid exercises elicited between 24% and 33% higher Q, 22% and 33% higher HR, and 34% and 42%  $avdO_2$  than in the FES-leg exercise. In all the exercise modalities, muscle oxygenation showed a decreasing trend with increasing work intensities and a reactive hyperaemia

after exercise cessation. **Conclusion:** Combined arm and leg exercise develop a higher oxygen uptake and greater cardiovascular demand compared to FES cycling alone. Although, FES-leg cycling exercise produces modest acute exercise responses, the muscle oxygenation pattern suggests contribution of aerobic metabolism in FES-assisted muscle contractions to whole body oxygen consumption.

## P-150

### Is The Progressive Necrosis Which Occurs in the Contused Spinal Cord Reversible?

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Over the past 50 years, basic and clinical research by at least 50 centres have identified the fact that, initially, trauma to the spinal cord causes direct as well as indirect damage to the injured neurones. As early as 1964, Hughes (United Kingdom) had identified in human autopsies the frequent presence of central haemorrhage, dilatation of small blood vessels as well as oedema at the level of the spinal cord trauma. Further animal studies since have continued to identify extravasation of red blood cells with migrating neutrophils before the arrival of macrophages indicating the likelihood of progressing ischaemia and hypoxia adding to the initial pathology in spinal cord injury. This review identifies at least 63 reports over these last 50 years confirming vascular changes in the spinal cord after injury. There have been significant advances in surgical repair of the spinal column during this period but, as yet, no convincing proven evidence of a “cure” for the contused spinal cord. The emphasis, generally, remains in the area of studying apoptosis of neurones rather than exploring the complex change of events which causes alteration in the normal haemodynamics of the microvasculature. Neuroprotection for the partly damaged neurones may be, in the future, better achieved by maintaining normal spinal cord blood flow in this early period after injury. Any modification to the likely damage from secondary ischaemia and hypoxia must be encouraging with the anticipation of improving prognosis in spinal cord injury. This paper will summarise accumulating evidence from over the last 40 years, confirming secondary posttraumatic ischaemia and hypoxia in the contused spinal cord are significant contributors to the pathology which results in profound loss of spinal cord function.