11th, 2020. Questions sought to elicit residents' current experiences and gain insight into methods by which to enhance future training. **Results:** 108 residents and 21 program directors, from various surgical specialties across Canada, completed the survey. Operative exposures were reported to be reduced by 25-100% and 39% of residents were redeployed. However, 89% of residents reported accessing academic half days virtually and 57% had additional online modules. Despite lost time, 100% of program directors confirmed that residents did not require training extensions. Concerns regarding training, personal health, employability and fellowships were raised. 55-70% of residents and program directors advocated for alternative educational courses, increasing elective time, utilizing simulation for assessment and flexibility in crediting different training experiences. **Conclusions:** Canadian surgical residents had a significant reduction in operative experiences during the pandemic. Moving forward, it will be important to find alternative educational experiences.

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Neurosurgical Faculty Expectations of Entrustable Professional Activities Evaluations

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Background: Competence by Design (CBD), a new outcomes-based approach to medical education, has been recently introduced into neurosurgical programs across Canada. A cornerstone of this educational paradigm shift requires evaluation of residents' performances of entrustable professional activities (EPAs). This study aimed to define Faculty expectations and markers of competence for resident EPA performances. **Methods:** Canada-wide survey of neurosurgical Faculty (NSF) with a 55-item online questionnaire referencing 15/45 available core neurosurgery EPAs. **Results:** Of the 52 respondents, majority believed that being able to perform safely (98%), effectively (92%) and independently (90%) and being able to adapt to contextual complexities of the case (88%) and unexpected events (88%) represented necessary qualities for demonstrating competence achievement of an EPA. Performing efficiently, without supervision and responding to rare events were all considered less important. On average, NSF believed that at least five separate assessments involving two or more different assessors were necessary for documenting competence achievement of each EPA. Proportion believing EPAs were representative of general neurosurgery competences varied significantly across all EPAs ($p<0.00001$) with >25% believing 5/15 EPAs required fellowship training. **Conclusions:** This study defined expectations and indicators of competent surgical performance and revealed a significant debate regarding perceived appropriateness of current EPAs for general neurosurgical training.

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An International Comparison of Neurosurgical Competence by Design Curriculum

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Background: Prior to its recent introduction into Canadian neurosurgical curriculum, Competence by Design (CBD) principles have been implemented across many international neurosurgical training programs for several years. As such, comparing other international competency-based educational frameworks and curricula can help anticipate, avoid or mitigate potential future challenges for Canadian neurosurgical trainees. **Methods:** A comparative web-based analysis of neurosurgical postgraduate medical education documents and resources provided by medical accreditation and regulatory bodies of Canada, the United States, the United Kingdom and Australasia, was performed. **Results:** All four countries varied considerably across four major curriculum-based themes: 1) general program structure; 2) overarching foundational competency frameworks; 3) types and numbers of performance assessments required and; 4) curricular learning outcomes. In particular, the expected progression and degree of competence required of neurosurgical residents when performing entrustable professional activities (EPAs) or defined tasks of neurosurgical practice, varied across all countries. Differences in types of neurosurgical EPAs and number of required assessments demonstrating a trainee's competence achievement were also appreciated. **Conclusions:** This study revealed variations across competency-based neurosurgical curricula proposed by four international medical training regulatory bodies. Differences in types of EPAs and their required degree of competence achievement suggests potential disconnects between neurosurgical educational outcomes and actual medical practice.

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What do patients expect of a competent neurosurgeon?

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Background: To improve accountability and reflect patient and societal needs, the Royal College of Physicians and Surgeons of Canada proposed Competence by Design (CBD) for all residency programs. This study compares neurosurgical patient values and expectations of their neurosurgeon to resident competences proposed by CBD curriculum. **Methods:** Semi-structured interviews of 30 neurosurgical patients and family members were recorded, transcribed and analyzed for themes. **Results:** Of

the first 13 interviews (8 males, 5 females; median age 54), 10 had English as a first language, all completed post-secondary education, and 8 had a brain tumor. In addition to expecting excellent surgical skills and comprehensive medical knowledge, participants expected "good" neurosurgeons to be human (compassionate, empathetic, no ego), transparent communicators, accountable, passionate, collaborative, emotionally composed and highly intuitive. However, there were marked differences in minimum set of competencies required and the expectations of the thresholds to determine competence for neurosurgeons. **Conclusions:** Patient perspectives show commonalities and marked differences of the expected competencies compared to CBD and significant variability of the thresholds of competence. Further investigations should explore these themes in other specialties. The existing CBD curriculum will need to expand its framework to include humanistic values to improve public perceptions of competence.

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High-Fidelity Simulation-Based Microsurgical Training for Neurosurgical Residents

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Background: Microsurgical techniques remain a cornerstone of neurosurgical training. Despite this, neurosurgical microvascular case volumes are decreasing as endovascular and minimally invasive options expand. As such, educators are looking towards simulation to supplement operative exposure. We review a single institution's experience with a comprehensive, longitudinal microsurgical simulation training program, and evaluate its effectiveness. **Methods:** Consecutive postgraduate year 2 (PGY-2) neurosurgery residents completed a one-year curriculum spanning 17 training sessions divided into 5 modules of increasing fidelity. Both perfused duck wing and live rat femoral vessel training modules were used. Trainee performance was video recorded and blindly graded using the Objective Structured Assessment of Technical Skills Global Rating Scale. **Results:** Eighteen participants completed 107 microvascular anastomoses during the study. There was significant improvement in six measurable skills during the curriculum. Mean overall score was significantly higher on the fifth attempt compared to the first attempt for all 3 live anastomotic modules ($p<0.001$). Each module had a different improvement profile across the skills assessed. The greatest improvement was observed during artery-to-artery anastomosis. **Conclusions:** This high-fidelity microsurgical simulation curriculum demonstrated a significant improvement in the six microneurosurgical skills assessed, supporting its use as an effective teaching model. Transferability to the operative environment is actively being investigated.

Neurotrauma

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Self-Assembling Peptide Biomaterial to Optimize Human Stem Cell-Based Regeneration of the Injured Spinal Cord

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Background: Human induced pluripotent stem cell-derived neural stem cells (hiPS-NSCs) are a promising therapeutic approach to regenerate after spinal cord injury (SCI) as they can differentiate to myelinating oligodendrocytes, synaptically-active neurons, and supportive astrocytes. Unfortunately, most chronically injured patients develop *ex vacuo* microcystic cavitations which prevent regenerative cell migration and neurite outgrowth. QL6 is a novel, pH-neutral, biomaterial which can self-assembles into a supportive extracellular matrix (ECM)-like matrix *in vivo*. This work assesses QL6's ability to support hiPS-NSC-based regeneration. **Methods:** *In Vitro:* hiPS-NSCs were extensively characterized by EDTA assay, qPCR, and immunocytochemistry(ICC), electron microscopy(EM) and neurosphere formation assays. *In Vivo:*Immunodeficient rats received clinically-relevant chronic C6-7 injuries. Animals were randomized: (1)vehicle, (2)hiPS-NSCs, (3)QL6, (4)QL6+hiPS-NSCs. All rats underwent treadmill rehabilitation and behavioural testing. A subset underwent single-cell RNA sequencing(scRNAseq). **Results:** hiPS-NSCs proliferated robustly on QL6($Ki67^+/DAPI^+$; 29%vs6%; $p<0.01$). EDTA assay showed hiPS-NSC binding to QL6 to be driven by calcium-independent mechanisms. Importantly, QL6 enhanced adherent neurosphere formation. EM-imaging provided the first images of the hiPS-NSC/QL6 interaction. Behavioural assessments demonstrate synergistic improvements with combinatorial treatment. High-throughput scRNA-seq differential gene expression analyses suggest QL6 is altering lineage signalling in the human graft post-transplantation. **Conclusions:** This work provides key proof-of-concept data that QL6 can support translationally-relevant human iPS-NSCs in traumatic SCI.

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Accuracy of External Ventricular Drain Freehand Placement in patients with Traumatic Brain injury. A 5-year single-institution experience

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Background: Placement of an external ventricular drain is considered a simple yet fundamental procedure. Despite its wide practice, an inaccuracy rate of around 50% has been reported.