Use of Artificial Intelligence to Improve Surgical Referrals in Degenerative Lumbar Spine Conditions

A presentation at the 2019 American Association of Neurological Surgeons Annual Scientific Meeting

SAN DIEGO (April 15, 2019) — Winner of the Sanford J. Larson, MD, PhD Award, Nathan Xie, presented his research, *Use of Artificial Intelligence to Improve Surgical Referrals in Degenerative Lumbar Spine Conditions*, during the 2019 American Association of Neurological Surgeons (AANS) Annual Scientific Meeting.

Most referrals to spine surgeons for degenerative lumbar spinal conditions, such as low back pain, do not actually result in surgery. This means that the majority of referred patients may not necessarily require a spine surgery consult. Low surgical conversion rates are an issue in various countries around the world and have contributed to long waitlists to see spine surgeons, which are amongst the longest of all specialties. To illustrate this, two centers in Melbourne, Australia, reported wait times of over 1,200 days for the first consultation, with centres in Sydney not far behind. A possible strategy would be to evaluate referrals from primary care sources based on the likeliness that the patient will proceed to surgery and redirect those unlikely to proceed to non-operative treatment, allowing them to pursue alternative management strategies earlier and reducing waitlists as a result.

A novel way of achieving this would be through modeling surgeon decision-making using machine learning models (a branch of Artificial Intelligence). Researchers therefore aimed to identify factors that spine surgeons consider important for surgical decision-making and use these to develop an Artificial Neural Network (a machine-learning model developed that emulates the structure and interaction of biological neurons) able to calculate the probability that a patient would receive surgery at a given center.

Fifty-five factors in the literature associated with surgical progression or outcome were identified. These factors were then collected through reviewing medical records of all patients presenting with an elective lumbar spine complaint between 2013 and 2018 at a single Australian Tertiary Hospital. The outcome variable was whether or not the patient proceeded or had been wait-listed for a surgical procedure. Using these data, an Artificial Neural Network with a back-propagation learning method was constructed, able to predict the likelihood of progression to spinal surgery. To compare it with a more traditional statistical model, a Logistic Regression (LR) model was created from the same data.

Ultimately both the neural network and regression models predicted surgical progression with a high degree of accuracy, although the neural network was superior in this regard. This demonstrates that the operating patterns of single centers can be accurately modeled, potentially allowing for more appropriate and tailored referrals. This in turn can help to reduce wait lists and increase surgical conversion rates. Further research is warranted in order to explore the role of such technology in the current system and its potential impacts.

Author Block: Nathan Xie (Sydney, Australia); Peter Wilson; Rajesh Reddy

Disclosure: The author reported no conflicts of interest.
**Media Representatives:** The 2019 AANS Annual Scientific Meeting website’s press section will include releases on highlighted scientific research, AANS officers and award winners and other relevant information about the 2019 program. Releases will be posted on the 2019 AANS Annual Scientific Meeting website. If you have interest in a topic related to neurosurgery or would like to interview a neurosurgeon — either onsite or via telephone — during or after the event, please contact Alice Kelsey, AANS associate executive director, via email at aik@aans.org.

**About the 2019 AANS Annual Scientific Meeting:** Attended by neurosurgeons, neurosurgical residents, medical students, neuroscience nurses, clinical specialists, physician assistants, allied health professionals and other medical professionals, the AANS Annual Scientific Meeting is the largest gathering of neurosurgeons in the nation, with an emphasis on the field’s latest research and technological advances. The scientific presentations accepted for the 2019 event will represent cutting-edge examples of the incredible developments taking place within the field of neurosurgery. Find additional information about the 2019 AANS Annual Scientific Meeting and the meeting program here.

Founded in 1931 as the Harvey Cushing Society, the American Association of Neurological Surgeons (AANS) is a scientific and educational association with more than 11,500 members worldwide. The AANS promotes the highest quality of patient care and advances the specialty of neurological surgery. Fellows of the AANS are board-certified by the American Board of Neurological Surgery, the Royal College of Physicians and Surgeons of Canada or the Mexican Council of Neurological Surgery, A.C. Neurosurgery is the medical specialty concerned with the prevention, diagnosis, treatment and rehabilitation of disorders that affect the spinal column, spinal cord, brain, nervous system and peripheral nerves.

For more information, visit [www.AANS.org](http://www.AANS.org).