In its 100th year, Canada’s National Research Council (NRC) is continuing to push the boundaries of technology to deliver new solutions to old problems. Its aims of realism, convenience and affordability are at the centre of the NRC’s drive to advance virtual simulation technology, which has the potential to vastly improve health outcomes for patients. In keeping with this, Dr Robert DiRaddo’s Simulation and Digital Health team has been developing interactive simulators to aid training and improve patient care.

Virtual reality (VR) simulators are key to this for several reasons: they can enable long-distance skill sharing and treatment; create an immersive experience to help patients combat conditions such as anxiety, phobia and ADHD; and set benchmarks to monitor progress, allowing users to improve their skills and develop new ones.

RISK-FREE SURGERY TRAINING
The NRC’s headline product, developed with simulation technology giant CAE Healthcare, is called NeuroVRTM (previously NeuroTouch). The innovative system provides interactive simulation of neurosurgery procedures. Teaching modules include instrument handling, fundamental skills, endoscopic surgery and microsurgery. The technology allows training neurosurgeons to practice techniques before operating on real patients, and helps experts demonstrate or brush up on their skills. Around 11% of diseases can be treated with surgery, so this technology will clearly play a vital role in healthcare.

Dr Robert DiRaddo is the Section Head of Simulation and Digital Health at the National Research Council of Canada. Based in Ottawa, the NRC celebrates its centennial this year. Dr DiRaddo’s team develops mathematically-based and interactive virtual reality technology for a wide range of uses, such as training neurosurgeons, training pilots to fly drones and helping passengers control anxiety.

Virtual reality (VR) simulation can be a key part of training and provide critical practice time.
VR is a versatile tool that can be applied to many fields and areas.

What was the drive behind developing Virtual Reality (VR) technology to improve patient outcomes? VR, or what we refer to as Interactive Simulation, allows users interaction with a mimicked real-life scene, at controlled risk and relatively low cost. It provides a mechanism for objectively quantifying performance measures of skills, for users/patients. If one is able to quantify performance, then one is able to systematically track it to an improved outcome.

How is this technology being used? VR can be used in training and to share expertise. It is especially useful in developing countries because travelling abroad for training is extremely costly, and beyond the budget of many teaching hospitals. The first use of VR in telesimulation was in partnership with Korle-Bu teaching hospital in Ghana in January 2014. Surgeons at the Toronto Western Hospital UHN delivered training to neurosurgeons in Ghana on how to treat hydrocephalus – an abnormal accumulation of fluid on the brain which has a high incidence in Ghana and predominantly affects children. The procedure can be life-saving but only around a tenth of paediatric patients in Ghana receive it. The live four-week training was the first of its kind worldwide, and was called a “milestone in effectively teaching neurosurgery skills through electronic means” by Marjorie Ratel, President of the Korle-Bu Neuroscience Foundation Canada.

WHERE NEXT? VR is a versatile tool that can be applied to many fields and areas. The next steps are to improve simulation and virtual reality simulators, allowing them to “talk” to each other, and improve the real-life rendering of patient-specific scenarios. This can be achieved by incorporating more high-quality data, allowing neurosurgeons to practise scenario-specific procedures before conducting them.

The team aims to drive excellence in patient care, and wants to push simulation into common use in medicine. Rolando del Maestro, Director of the Neurosurgical Simulation Research Centre at Montreal Neurological Institute and Hospital (MNI), and an early supporter of the NRC’s simulation research, predicts, “in the next 5-10 years, I expect every major neurosurgical centre to have simulation”. He adds that “transitioning this dream into an approachable reality will result in a worldwide improvement in the care of surgical patients.”