

News and Perspectives

On the Road Again: Virtual Reality for Poststroke Rehabilitation

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Abstract

Virtual reality (VR) has a long history in stroke rehabilitation. In this *News and Perspectives* article, JMIR Correspondent Jenna Congdon reports on one person's journey back to driving after a stroke, highlighting the strengths, limitations, and future of VR in rehabilitation.

Key Takeaways:

- Virtual reality (VR) driving simulators help stroke and brain injury survivors, as well as patients with certain disabilities and neurologic disorders, safely rebuild the complex cognitive, visual, and motor skills needed to return to driving and regain independence.
- VR rehabilitation encourages the brain to form new pathways through repeated, realistic practice tailored to each patient's needs.
- Access to VR rehabilitation remains limited by cost, availability, insurance coverage, and patient eligibility.

Amanda Shannon's enthusiasm is infectious; she laughs as she tells me about her first few sessions using a virtual reality (VR) driving simulator after she had a stroke at the age of 33: "You see [virtual] people walking, and then you have to try to remember not to hit them." Her resilience and humor have me laughing along with her; though it took years, Shannon has regained much of the independence she lost when she experienced a major stroke that affected her mobility and strength on the right side of her body, as well as some of her speaking ability. Relearning to drive using a VR simulator played a major role in her functional recovery.

More Than Just a Set of Wheels

Driving requires considerable [neurologic demand](#): to safely navigate the road, drivers must remember traffic laws, respond quickly to changing conditions, react to threats in real time, and coordinate complex muscle movements. Stroke may affect all or some of these functions, commonly impacting a person's motor strength and coordination, visual processing, reaction time, and decision-making.

Losing the ability to drive [represents more](#) than just the lack of a set of wheels: it can be an isolating experience that makes it more difficult to get to work or participate in social life in a meaningful way. Some stroke survivors may feel that not driving contributes to a [lost sense of autonomy](#), and many report increased feelings of depression related to the loss of self-identity. In Shannon's case, her goal was to once again safely get her kids to school, soccer practice, and dance lessons. Using VR provided an accident-free space to practice until she was confident in getting behind the wheel with her kids in tow.

Inside the Driving Simulator and Onto the Road

Christina Duncan, OTR/L, CDRS—an occupational therapist and certified driving rehabilitation specialist at Cleveland Clinic—uses a VR driving simulator to assist patients who are relearning to drive after a stroke or injury or are working to preserve their driving ability in the face of progressive neurologic disease. The simulator at her clinic uses a simple setup consisting of a bank of monitors that give the patient a wide view of the virtual road, as well as a steering wheel, gas pedal, and brake. She shares that even more immersive options exist, complete with chairs that tilt and vibrate as the road swerves or the car climbs hills.

During their sessions, Duncan helps patients practice with adaptive devices, such as a pedal setup that allows the driver to use their left foot or steering wheel attachments that make driving with one hand easier. Once a patient has mastered the virtual setup, they take a car equipped with a passenger-side brake out for a spin.

Duncan finds joy in watching her patients succeed: "I'm getting somebody back to doing something that they weren't able to do, so like in Amanda's case, getting her back to being in the role of a mother to be able to pick up her kids from school."

How the Brain Relearns Skills After Stroke

VR is emerging as an [effective method](#) for stroke rehabilitation, particularly for complex tasks, such as driving, thanks to

its ability to facilitate a safe, patient-specific practice space. Repeated practice encourages the brain to reorganize and adapt in response to injury—a process known as [neuroplasticity](#).

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VR is [effective in stroke rehabilitation](#) thanks to its ability to harness that neuroplasticity. At the heart of this process is [Hebbian learning](#), which is often summarized as “neurons that fire together, wire together.” Through immersive driving simulations, patients like Amanda trigger simultaneous activity across the brain, helping to create new pathways for motor control.

When a patient makes a mistake in the simulator, the brain learns through trial and error. This process refines predictive motor control, which in turn helps the driver improve their skills. [Mirror neuron systems](#) may also be engaged as patients watch the virtual representations of their movements, which further stimulates and retrains the motor cortex.

For Shannon and other patients like her, this means that the brain is not simply healing back to its prestroke state; rather, it's undergoing a process of reorganization and relearning. Through safe repetition, neural networks adapt to take over the functions once managed by the damaged tissue. This neuroplastic shift allows the patient to reclaim abilities they may have lost.

The Limits of VR Training for Rehabilitation

While VR rehabilitation offers many benefits to patients with stroke, brain injuries, disabilities, or neurologic disease, patients and providers still face hurdles. Cost, insurance coverage, and access remain [significant barriers](#). VR

equipment is expensive, limiting availability primarily to urban centers and creating disparities for patients in rural or underresourced areas. Duncan shares that even in her large metropolitan area, there are only a handful of clinics offering VR rehabilitation: “We’re scheduling two, three months out, sometimes more.” Meanwhile, patients miss the valuable opportunity to practice, and they have to rely on others for transportation while they wait.

Furthermore, not every stroke survivor is a candidate. Occupational therapists like Duncan play a critical role in clinical assessment: “I’m always going to check the person’s strength and range of motion and coordination, if they don’t have those things...it’s probably not going to work out.” Others may struggle with the cognitive side of driving or have impairments that make relearning to drive a potentially dangerous prospect. “That’s the worst part,” Duncan says, “...when I have to tell somebody [they are] not going to be able to get back to driving.”

The Future of VR Stroke Rehabilitation

The future of VR rehabilitation shows promise, with [emerging technologies](#), like AI-personalized programming, advanced haptic feedback, and precise eye tracking, tailoring therapy more closely to individual needs. While currently focused on driving, these immersive tools are expanding to support patients in relearning other [activities of daily living](#), balance, and gait control.

Back on the Road

Shannon’s new wheels demonstrate just how effective VR for poststroke rehabilitation can be. Her message to others going through the same thing is simply “never, never stop. Never forget, and never give up.” Her independence today highlights her persistence; she’s proud of the regained ability to manage her family’s daily life. While recovery remains an ongoing process, the combination of VR technology, Shannon’s own hard work, and the support of therapists and clinicians like Duncan made it possible for her to get safely back on the road after a life-altering stroke.

Updated 14 July 2026: An earlier version of this article omitted Christina Duncan's professional affiliation with Cleveland Clinic; this has been corrected.

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