

# Augmented Reality: Revolutionizing Rehabilitation for Neurologic Disorders

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**Augmented reality (AR) brings together real life and the digital world.**



It does this by creating a digital landscape or “canvas” around the user, in which digital content can interact with the user’s physical surroundings. This differs from typical augmented reality

(AR) or virtual reality (VR) applications, in which mobility is limited to a static interface, like a smartphone or tablet. While AR applications in healthcare have been largely concentrated in surgery, AR-based use cases are increasing rapidly throughout the entire continuum of care, including diagnostics, treatment planning, monitoring, mental health, and rehabilitation.

## Neurological Disorders Globally and in the U.S.

Neurological diseases and disorders are the leading cause of disability worldwide, with an estimated one billion people suffering from a neurological disorder. Additionally, a 2017 U.S.-based study showed that the burden of neurological diseases is increasing, due in large part to the aging population.

## Neurorehabilitation as a Tool for Improving Physical Function and Quality of Life

Neurorehabilitation's aim is to stimulate neural plasticity through targeted exercises. Such exercises can speed motor recovery, increase physical function, and improve symptoms following an injury to the nervous system. Multiple motor skills can be compromised following a stroke, or the progression of Parkinson's or other neurological diseases. Accordingly, neurorehabilitation programs can include multiple components to address mobility re-training and occupational therapy for upper limbs and lower extremities, and improve a patient's activities of daily living (ADL).

The expected growth of the rehabilitation market, including neurorehabilitation, is significant. In the rehabilitation equipment market, research firms have estimated a [compound annual growth rate \(CAGR\) ranging from 5.2% to 6.1%](#). In the neurorehabilitation device market, the estimated CAGR is considerably higher, [ranging from 15.1% to 16.4%](#). This growth is likely attributed to technological advancements, including robotics/exoskeletons, gamification, and VR. Such technological advancements, coupled with augmented reality, could improve the quality of neurorehabilitation and improve access to high-quality rehabilitation by enabling patients to complete programs in non-clinical settings including the home.

## AR as a Tool for Neurorehabilitation Assessment and Recovery

An important component of neurorehabilitation is the initial assessment. In both neurologic assessment and rehabilitation, healthcare providers require the ability to objectively quantify a patient's baseline status and/or track changes in a patient's neurological function, relative to a host of neuro-degenerative conditions. This functionality is intrinsic to effective, efficient care.

Current advancements of AR allow a patient to use an augmented reality headset like Magic Leap to complete a number of neurological assessments, including balance assessment, gait performance, ADL functionality screening, visual field screening, and other isolated or integrated neurological test components. Importantly, these same assessments can be feasibly implemented by a specialist from thousands of miles away, for nearly immediate results available for interpretation. The same AR ecosystem can then be used for real-time

rehabilitation methods, such as neuro-focused physical or occupational therapy, in a clinical or home environment.

AR can enhance current neurorehabilitation programs, along with the initial exam, as follows:

- Biofeedback can be used to provide real-time movement guidance to the patient, such as mobility training, movement kinematics, and gait and balance training. This guidance can improve movement quality during the rehabilitation session.
- Objective, quantifiable measurements can be used to track patient progress over the course of therapy treatments, thereby allowing healthcare providers to modify and individualize the rehabilitation program to the patient.
- Gamification, or adding games for patients to play virtually, in rehabilitation can make therapy more engaging for patients. This is a critical component of care, as rehabilitation programs can be repetitive and tedious and utilizing games can improve motivation and satisfaction, and increase the likelihood of completing the rehabilitation program.
- Device portability can enable unrestricted movement while interacting with digital content to improve usability and allow patients to complete rehabilitation from non-clinical settings. This is critical to increasing access to high-quality rehabilitation programs to patients in rural or underserved communities.

## **Magic Leap: Advancing AR for Neurorehabilitation**

Magic Leap supports and enables partners by allowing them to design and develop solutions that, utilizing the Magic Leap platform, can improve and expand currently available neurorehabilitation solutions. Specifically, Magic Leap technology can:

- Support parameter measurement, through the development of algorithms for gait, balance, eye tracking, and hand-eye coordination capabilities
- Enable transmission of 3D information and facilitate remote communication
- Monitor a patient's movement remotely
- Support mobility, which is especially important for lower limb movements, where monitoring must occur while the patient is moving, and not confined to a chair
- Develop algorithms and tracking to enable consistent diagnostic, monitoring, and physical therapies under the care of a general (primary care) healthcare provider, minimizing the burden of long-distance travel for office visits

## **The Path Forward**

Based on current neurorehabilitation research, traditional rehabilitation offerings have limitations that impact the features that can provide critical support to patients in the diagnosis, recovery, and management of their individual disease states. AR, combined with innovative technologies, addresses these limitations.

Enabling factors for adoption include training healthcare professionals in these new immersive technologies, working with providers to integrate the technology into existing healthcare environments, and securing reimbursement from insurers who will be eager to compare outcomes of AR-supported rehabilitation versus usual care. Other adoption factors include addressing regulatory requirements, especially for devices that are intended for use in the

home, and creating a body of evidence around safety and efficacy, as compared to traditional care.

The global population is aging and the patient population suffering from neurological disorders is increasing. Bringing innovative technology-based solutions to the healthcare market to improve quality of care, while taking into consideration cost and healthcare workforce constraints, will only become more important in the future.

Magic Leap is [forming partnerships](#) to bring augmented reality capabilities to healthcare that have enormous potential to improve the standard of care and positively impact patient lives.