

BRIDGING THE GAP IN THE NEUROLOGY TOOLKIT:

*How Modern Cognitive Assessments
Improve Neurological Care*

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Important Information Before You Read This Document

Creyos Health provides a scientifically validated and objective measure of an individual’s cognition; however, it is not a diagnostic tool. Creyos Health should be used in conjunction with other information and clinical judgment to reach conclusions regarding an individual’s health. Ultimately, Creyos Health does not replace the judgment of a practitioner, and Creyos (formerly Cambridge Brain Sciences) does not assume responsibility for the outcome of decisions made based on Creyos Health data.

Introduction

Neurologists care for one of the most critical and elusive systems in the body. Over the last few years, there have been incredible advances in identifying and treating specific neurological issues, such as significant updates in neuroimaging analysis and new techniques for tackling drug-resistant disorders.^{1,2} However, when it comes to ongoing care, the tools available to neurologists today still have many limitations.

Meanwhile, it is now widely accepted that preventive actions and proactive monitoring in healthcare can drastically improve patient outcomes.³ By applying principles of preventive care in the neurology space, physicians can make a positive and ongoing impact on their patients' lives.

Cognitive deficits are a primary symptom of various neurological disorders and can be key to determining a diagnosis, making decisions about treatments, and assessing outcomes. To measure cognitive function throughout the patient journey, providers typically rely on traditional methods that are not particularly robust or flexible. Neurologists can be limited to specialized tools that are useful only in detecting severe impairments and offer limited insights, such as the MMSE or the MoCA, causing milder impairments or early symptoms to be missed. They may refer to a neuropsychologist, however, patients often face long wait times and lengthy evaluations. Of course, there is always the option of brain imaging, but this tends to be costly to both the patient and the healthcare system and may serve as only one piece of the puzzle alongside behavioral measures of cognition.

The unfortunate reality is that neurologists have had limited options to test for cognitive function, which means valuable information on cognition is often missed.

Now, with new digital technologies, neurologists have a better option to evaluate cognition.

¹New York-Presbyterian, [Advances in Neurology and Neurosurgery](#), 2022

²National Library of Medicine, [Recent Advances in Functional Neuroimaging Analysis for Cognitive Neuroscience](#), Jan 2018

³Annals of Internal Medicine, [Patient-Centered Decision Making and Healthcare Outcomes](#), April 2013

Challenges with Cognitive Assessments in Neurological Care Today

CURRENT ASSESSMENT OPTIONS LEAVE A GAP IN COGNITION DATA

Cognitive assessments in neurology are all or nothing. Complete neuropsychological evaluations and MRIs are often necessary when treating neurological conditions, but come with costs and complications that may deter referrals when impairment is not already established. At this point, quick pen-and-paper screening tools come into play. Unfortunately, those screening methods catch only severe impairment and reveal almost nothing about people within a normal range or only mildly impaired.

It's a bit of a Catch-22: cognitive assessments are performed only if an impairment is present, but objective impairment can be detected only in extreme cases.

This issue is multiplied in cases where cognitive impairment is not the main focus or is in early stages, such as with pain, Parkinson's, MS, epilepsy, and other disorders that neurologists treat. They need an "in-between" solution for routine cognitive assessments to fill these gaps.

COMPREHENSIVE EVALUATIONS ARE COSTLY

A full neuropsychological evaluation requires referral to a specialist. Adults wait for an average of 5 to 10 months to see a neuropsychologist, while children often wait for at least 12 months.^{4,5} These extensive wait times, along with a 4+ hour evaluation, make it difficult to leverage these evaluations for longitudinal monitoring.

MRI scans have similar limitations. Although they excel at identifying physical brain problems, such as injuries and disorders, they cannot always predict functional deficits with the accuracy of behavioral measures, and are incredibly time-consuming and expensive.

Neuropsychological evaluations and brain imaging are not conducive to regular assessments, given the high costs in terms of time and money. These are just a few of the factors that lead to an underutilization of cognitive testing and poor—or at least poorly measured—patient outcomes.

⁴International Scholarly Research Notices, *Neuropsychology in Multidisciplinary Stroke Care: Clinical Feasibility of the NINDS-CSN Vascular Cognitive Impairment Harmonization Standards*, July 2014

⁵Evidence-Based Practice in Child and Adolescent Mental Health, *Improving Wait Times for Pediatric Neuropsychology Services*, July 2020

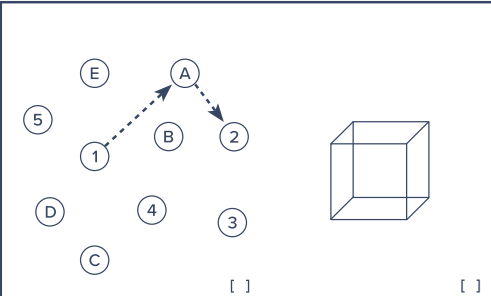
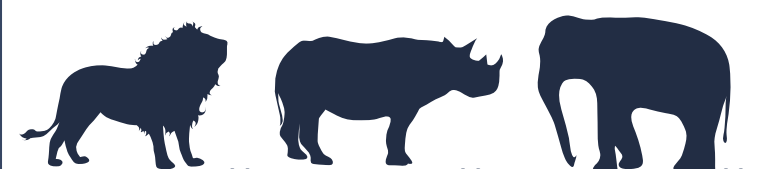
QUICK SCREENING METHODS ARE LIMITED

Aside from referring patients to a specialist, the other common option is to conduct screenings like the MMSE, MoCA, and SLUMS. These traditional assessments are quicker than a full neuropsychological evaluation and can provide an adequate starting point, but yield limited insights. Static items and in-person testing make routine assessments impractical and place patients in broad categories, making it difficult to obtain a complete patient profile. In addition, these exams don't allow for tracking changes over time and do not provide insights into different cognitive domains, both of which are critical to creating a comprehensive picture of cognitive health.

It is difficult to obtain dependable, quantifiable data via this method. In older educated adult patient populations, over 98% are not considered impaired on the MMSE, and over 50% score near perfect.⁶ The MMSE ultimately does not provide helpful diagnostic information about cognitive function unless there is severe impairment.⁷

Self-reports are another source of quick brain health information but limited in accuracy. For example, patients may complain of “brain fog” or that they “feel worse” before or after treatment. They may even deny any cognitive impairments at all, despite obvious signs noticed by clinicians and family. While self-reports are still valuable pieces of information to obtain, they are nonspecific, unreliable, and often wholly inaccurate compared to objective measures.

Over 43% of Parkinson’s patients eligible for a dementia diagnosis deny any functional impairment, and 93% of people with moderate to severe dementia overestimate their performance on cognitive measures.^{8,9}

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			___/3

Can you draw simple objects and identify common animals? Healthy or mildly impaired people find it easy to achieve a good score on traditional instruments, which do not provide useful information about cognition.

⁶ Diagnostics, *Thirty-Five Years of Computerized Cognitive Assessment of Aging—Where Are We Now?*, Sept 2019

⁷ Cerebrovascular Diseases, *Differences in Cognitive Profile between TIA, Stroke and Elderly Memory Research Subjects: A Comparison of the MMSE and MoCA*, 2012

⁸ Neurology, *Validity of the MoCA and MMSE in the Detection of MCI and Dementia in Parkinson Disease*, Nov 2009

⁹ Cognitive Brain Research, *Self-Reported Awareness of Performance in Dementia*, Sept 2005

Increasing Access to Brain Health Data with Modern Cognitive Assessments

Historically, neurologists have been left with limited options and no middle-ground solution. Neurologists need an assessment method that can measure cognitive function in detail; is appropriate for any patient, whether currently impaired or not; and is easy to integrate into routine processes and evaluations. Modern computerized cognitive assessments provide this middle ground by helping neurologists measure and monitor brain health accurately in all patients, including those with neurodegenerative diseases, chronic pain, and brain injuries.

Thanks to advancements in telehealth and broader adoption across the industry, digital solutions deliver advanced cognitive care more efficiently than ever before. Solutions like Creyos Health offer several benefits:




- **Objectively measure cognition** by directly tying cognitive assessment tasks to specific brain regions, adding confidence to diagnoses
- **Easily administer assessments** through an internet browser, at home or in a clinic, and without involving a third party, saving valuable practice time
- **Grant access to insightful health data** without adding excessive administrative burden
- **Integrate cognition data with other health data**, such as cognitive function tests included alongside standardized mental health and self-report questionnaires, making assessments easy for patients without administrators juggling multiple stacks of papers



Cognitive Assessments Across the Patient Journey

Cognitive assessments provide critical information throughout the patient journey. Regular evaluations can drastically improve patient care and outcomes, from strengthening diagnostic decisions to long-term monitoring for at-risk patients.

SUPPORTING DIAGNOSTIC DECISIONS




 <p>Importance</p>	<p>Determining a diagnosis is often the first step to understanding what is going on with a patient and developing a treatment plan. For example, if a patient has concerns about cognitive decline or dementia, early detection and diagnosis are critical, and every delay in treatment impacts patient outcomes.</p>
 <p>Current Methods</p>	<ul style="list-style-type: none">• Refer to specialist• Screening tools (MMSE, MoCA, SLUMS, etc.)• Self-reporting
 <p>Benefits of Modern Cognitive Assessments</p>	<p>Modern cognitive assessments offer a middle ground. They do not replace clinical judgment or a neuropsychologist, but they can provide more detailed information than a screener or a self-report by assessing across a variety of cognitive domains and comparing patient results to an extensive normative database of age-matched cohorts.</p>

Example: Diagnosing Dementia

Clinicians who see patients with suspected cognitive decline or dementia use objective assessments like Creyos Health as a diagnostic aid to provide detailed information about a patient's function. They provide information similar to a neuropsychological evaluation, but in less time, and can be administered directly in a neurologist's practice without waiting for a specialist.¹⁰ Computerized assessments help determine whether subjective self-reports have merit, whether further evaluation by a neuropsychologist is necessary, and whether cognitive symptoms of dementia are present. While a short, computerized assessment will not be the sole determinant of a dementia diagnosis, it can act as a diagnostic aid when making decisions about these complex conditions.

¹⁰ ResearchGate, [Validation of a Novel Computerized Test Battery for Automated Testing](#), Dec 2013

MEDICATION MANAGEMENT AND PROGRESS

 <p>Importance</p>	<p>Cognitive assessments are useful in ongoing care, as they can help track patient progress and therapy effectiveness. It is not common or practical, however, to administer full neuropsychological assessments at each point when a change in cognition is likely to occur. Screening tools have limited forms, practice effects, and crude scoring, making it difficult to assess subtle changes over time. This means critical information is not being collected when it is most valuable, such as:</p> <ul style="list-style-type: none">• When medication is taking effect• As adjustments are being made to avoid side effects• When a patient begins experiencing subjective improvements
 <p>Current Methods</p>	<ul style="list-style-type: none">• Subjective impressions from patients or caregivers• Re-administration of screening tools• Appointment follow-ups and interviews
 <p>Benefits of Modern Cognitive Assessments</p>	<p>Modern cognitive assessments provide a solution to these constraints. Neurologists can administer tests quickly and repeatedly, ensuring that cognitive data is collected at precisely the right time. Computerized testing allows for the random generation of test items on the fly, minimizing practice effects. Results can be automatically scored and compared to a large normative database that takes repeated testing into account and helps identify when a change from one time point to another is meaningful. Comorbid issues like mental health conditions and self-reported symptoms can be included in an integrated assessment flow to improve decisions about medication and improve patient care and outcomes. With an efficient method for tracking cognition, neurologists can easily assess treatment efficacy, manage medications, and track overall status.</p>

Example: Medication Management for Neurodegenerative Disease

Ongoing monitoring is vital when treating neurodegenerative diseases, such as Parkinson's. These diseases are often characterized by cognitive decline and other long-term symptoms. For example, up to 80% of Parkinson's patients develop dementia.¹¹ The available medications to treat such symptoms have varying impacts and may ease cognitive symptoms or cause side effects.¹² The pattern of cognitive deficits can be different in Parkinson's patients on or off medication. It can also differ in patients with related diseases that cause dementia, such as Alzheimer's.

Furthermore, the pattern of deficits can shift over the course of treatment.¹³ In one study, only medicated patients with severe symptoms were impaired in a paired-associate learning task, while medicated and non-medicated patients were impaired in a working memory task.¹⁴ Working memory declined further in patients who withdrew from medication. Results like these highlight the importance of measuring multiple cognitive domains to assess the effects of Parkinson's symptoms and medication on brain health.

¹¹ UCSF, *Parkinson's Disease Dementia*

¹² NPJ Parkinson's Disease, *Cognitive Impairment in Parkinson's Disease: A Report from a Multidisciplinary Symposium on Unmet Needs and Future Directions to Maintain Cognitive Health*, June 2018

¹³ Brain, *A Comparative Study of Visuospatial Memory and Learning In Alzheimer-Type Dementia and Parkinson's Disease*, June 1988

¹⁴ Neuropsychologia, *Visuospatial Memory Deficits at Different Stages of Parkinson's Disease*, July 1993

MONITOR COGNITION AND MENTAL HEALTH OVER TIME



Importance

Several neurological disorders result in a devastating reduction in cognitive function. Traditionally, long-term follow-up or ongoing tracking have not been easily available. It has been particularly challenging to track subtle changes that occur after treatment of a condition that may—or may not—have chronic effects. Reduced cognitive function and poor mental health also predict adherence to treatment and reliance on unhealthy coping mechanisms such as substance abuse.^{15, 16} As a result, by the time decline is uncovered, the patient's condition has often reached a state where treatment will be more complicated than it would have been if cognitive issues had been caught early.



Current Methods

- Self-report questionnaires
- Waiting for patients to take action or re-engage with a physician



Benefits of Modern Cognitive Assessments

Modern cognitive assessments can automate long-term follow-up. Using solutions like Creyos Health in long-term follow-up scenarios can help determine:

- If a patient reporting memory decline actually performs worse in objective memory tests
- If the symptoms of a neurological condition, injury, or medication are getting worse or better
- If there are early warning signs that a decline in cognition could lead to complications, failing to follow recommendations, or unhealthy coping mechanisms

Automated assessments allow neurologists to quickly capture the patient's status and help improve long-term outcomes. If early signs are detected, neurologists can proactively offer additional services or justify further treatment. If a patient's treatment is working, long-term follow-up can help demonstrate that the treatment has lasting effects, which can serve as valuable data for communicating the benefits of treatment. It also acts as a feedback loop for assessing whether other treatments might be effective. Mental health assessments or substance abuse questionnaires can also be included to capture a range of effects neurological conditions have.

Example: Monitoring the Long-Term Effects of Chronic Pain

Chronic pain has a variety of effects on cognition. Cognitive decline can indicate a change in a patient's pain level, making it critical to measure cognition after treating a patient whose pain is a direct or indirect symptom. Ignoring these signs can have long-term impacts. For example, the odds of cognitive impairment increase by 21% for every two years of chronic pain.^{17, 18} In the case of a traumatic brain injury, chronic pain can linger long after the immediate effects on the brain have subsided.¹⁹

Cognition is the key to successful recovery from chronic pain, yet there is rarely a long-term follow-up period that includes brain health assessments. Warning signs of relapse or side effects of treatments are also missed. Between 30% and 60% of chronic pain patients show evidence of relapse after successful treatment, which plays a role in the opioid crisis.^{20, 21} These additional gaps in the patient journey can be partially filled with the use of modern, automated brain health assessments.

¹⁵ Journal of Behavioral Medicine, *Treatment Adherence in Multiple Sclerosis: Association with Emotional Status, Personality, and Cognition*, Feb 2010

¹⁶ Addiction Science & Clinical Practice, *Addiction and Cognition*, Dec 2010

¹⁷ Journal of the American Geriatrics Society, *Persistence of Pain and Cognitive Impairment in Older Adults*, Feb 2022

¹⁸ Progress in Neurobiology, *The Effect of Pain on Cognitive Function: A Review of Clinical and Preclinical Research*, March 2011

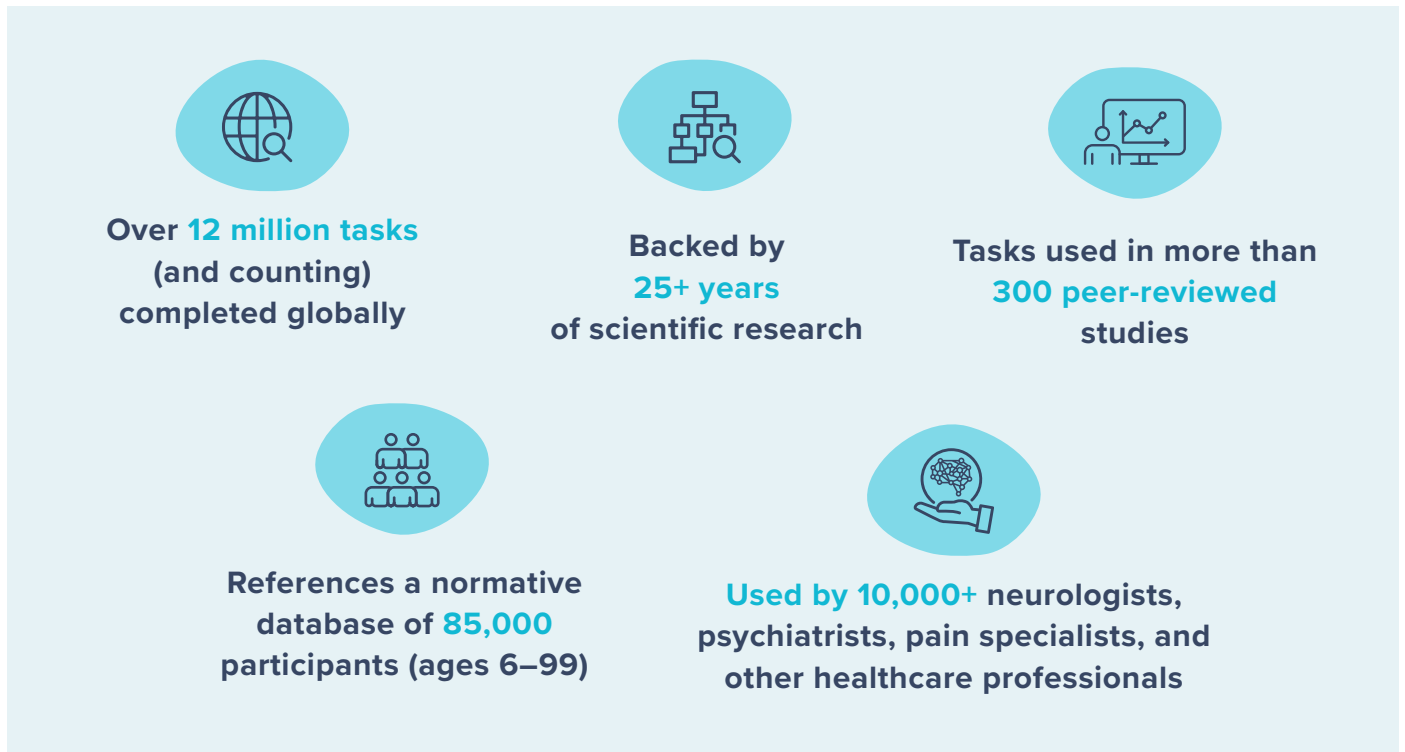
¹⁹ Pain Medicine, *Chronic Pain After Traumatic Brain Injury: Pathophysiology and Pain Mechanisms*, July 2018

²⁰ Pain, *Relapse Prevention: Still Neglected After All These Years*, Feb 2008

²¹ Frontiers in Psychiatry, *Overlapping Mechanisms of Stress-Induced Relapse to Opioid Use Disorder and Chronic Pain: Clinical Implications*, May 2016

Creyos Health: A Modern Cognitive Assessment Solution

Creyos Health provides neurologists with a trusted and efficient method of testing and monitoring cognitive function. Creyos Health measures the cognitive domains known to be associated with neurological disorders, using tasks that are scientifically validated, easy to administer, and sensitive to change.



ROOTED IN ACADEMIA

The Creyos (formerly Cambridge Brain Sciences) cognitive tasks were developed in the lab of Dr. Adrian Owen, former Canada Excellence Research Chair in Cognitive Neuroscience and Imaging. Dr. Owen is a pioneer in neuroscience, having combined neuroimaging and neurophysiological studies to unravel the secrets of the human brain over the last 30 years. He was one of the first to develop digital versions of well-established and trusted neuropsychological tasks to evaluate reasoning, memory, attention, and verbal ability. His work has been published in leading academic journals covering topics ranging from focal lesions to awareness in persistent vegetative states to mental health, and he is regarded as a global thought leader in neuroscience.



Dr. Adrian Owen, Neuroscientist

Founder and Chief Scientific Officer (CSO) of Creyos

TRUSTED AND VALIDATED COGNITIVE ASSESSMENTS

The Creyos cognitive tasks have been scientifically validated and repeated over 10 million times to create an extensive normative database of over 85,000 people aged 6 to 99—and these numbers continue to grow. The tasks are used by leading healthcare practitioners and researchers around the world to obtain accurate, quantified measures of cognition and have proven to be efficient and accurate measures of cognitive capacity based on validation from:

- Patient studies
- Brain imaging studies of healthy volunteers
- Large-scale public studies recruiting tens of thousands of volunteers

The Creyos tasks have been refined over time to take advantage of data from newly available technologies, like brain imaging, to ensure that each task is associated with specific brain regions. As a result, each task provides detailed insights about brain function, while maintaining the familiarity and neuroscientific validity of classic tests. Creyos Health has also expanded to include standard questionnaires to measure mental health conditions, substance abuse, lifestyle factors, and more, providing an all-in-one solution for measuring patient brain health.



Scientifically Validated Neurocognitive Tasks

A landmark study published in *Neuron* uncovered that variation in cognitive performance could be summarized in terms of three domains that each utilized distinct brain networks:²²



Reasoning

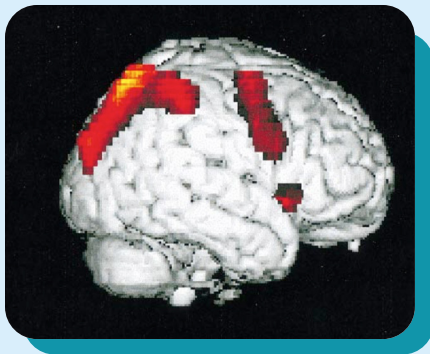


Short-Term Memory

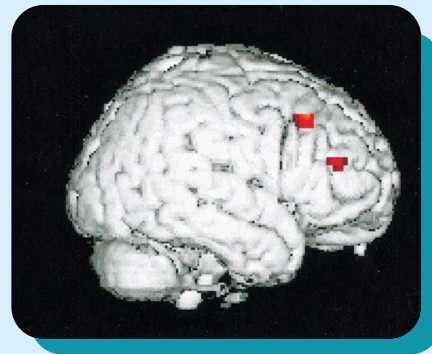


Verbal Ability

It was then determined that any given task could utilize multiple networks to varying degrees, meaning that the brain mixes and matches from the different networks within the frontal, parietal, and temporal regions for different tasks. Real-world activities are therefore not tied to a single brain region, but instead, distinct neural networks are active to varying degrees based on the requirements and stages of a task.



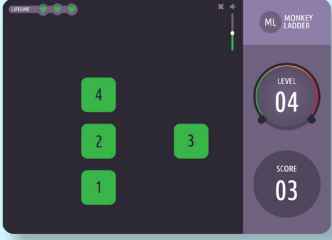
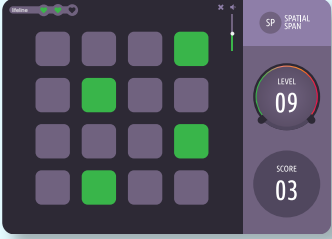
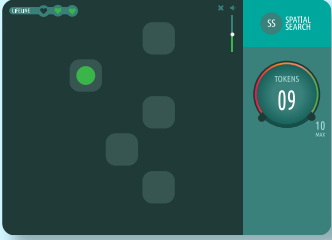
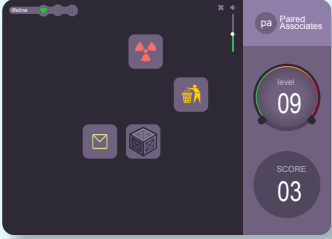
Compared to a simple visuomotor task, the Spatial Span Creyos Health task recruits these areas of the brain, highlighting the regions needed to perform well on spatial short-term memory tasks.



Token Search is similar to Spatial Span, but also involves working memory and some degree of strategy. These regions of the brain are recruited when a task requires manipulation of information in memory, over and above simple memorization and recall.

²² Neuron, *Fractionating Human Intelligence*, Dec 2012

Further imaging research has tied every Creyos Health task to specific regions of the brain to better understand cognitive function. These tasks were developed from the ground up with the brain in mind:

	Task	Outcome Measure	Related Brain Regions
<p>Monkey Ladder</p>		<p>Visuospatial Working Memory: The ability to temporarily hold spatial information in memory and manipulate it based on the goals of the task at hand.</p>	<ul style="list-style-type: none"> • Prefrontal cortex/mid-dorsolateral prefrontal cortex • Premotor cortex • Posterior parietal cortex
<p>Spatial Span</p>		<p>Spatial Short-Term Memory: The ability to temporarily store spatial information in memory.</p>	<ul style="list-style-type: none"> • Right mid-ventrolateral area • Parieto-occipital regions
<p>Token Search</p>		<p>Working Memory: The ability to store spatial information in memory, then reason about how to best update and make use of items in memory as circumstances change.</p>	<ul style="list-style-type: none"> • Frontal lobe • Temporal lobe • Amygdalo-hippocampal region • Mid-ventrolateral frontal cortex • Mid-dorsolateral cortex • Premotor cortex
<p>Paired Associates</p>		<p>Episodic Memory: The ability to learn and recall specific events, paired with the context in which they occurred, such as identifying when and where an object was encountered.</p>	<ul style="list-style-type: none"> • Left dorsolateral prefrontal cortex • Ventral and anterior left prefrontal cortex regions • Ventral prefrontal cortex • Ventral region of the parietal cortex

	Task	Outcome Measure	Related Brain Regions
Rotations		<p>Mental Rotation: The ability to efficiently manipulate mental representations of objects in order to make valid conclusions about what objects are and where they belong.</p>	<ul style="list-style-type: none"> • Intraparietal sulcus • Medial superior precentral cortex
Polygons		<p>Visuospatial Processing: The ability to effectively process and interpret visual information, such as complex visual stimuli and relationships between objects.</p>	<ul style="list-style-type: none"> • Right dorsolateral prefrontal cortex • Right hemisphere
Odd One Out		<p>Deductive Reasoning: The ability to apply rules to information in order to arrive at the correct logical conclusion.</p>	<ul style="list-style-type: none"> • Anterior frontal cortex • Anterior insula/frontal operculum • Inferior frontal sulcus • Anterior cingulate • Presupplementary motor area • Intraparietal sulcus
Spatial Planning		<p>Planning: The ability to act with forethought and sequence behavior in an orderly fashion to reach specific goals.</p>	<ul style="list-style-type: none"> • Frontal lobe • Mid-dorsolateral frontal cortex • Caudate nucleus • Thalamus • Lateral premotor • Anterior cingulate

	Task	Outcome Measure	Related Brain Regions
Grammatical Reasoning		<p>Verbal Reasoning: The ability to quickly understand and make valid conclusions about concepts expressed in words.</p>	<ul style="list-style-type: none"> • Frontal operculum • Posterior temporal lobe • Superior parietal lobe • Dorsal prefrontal cortex • Ventral prefrontal cortex
Digit Span		<p>Verbal Short-Term Memory: The ability to temporarily store linguistic information in memory.</p>	<ul style="list-style-type: none"> • Mid-ventrolateral prefrontal cortex
Feature Match		<p>Attention: The ability to draw upon mental concentration and focus in order to monitor for a specific stimulus or identify differences.</p>	<ul style="list-style-type: none"> • Mid-ventrolateral frontal cortex • Right inferior frontal gyrus
Double Trouble		<p>Response Inhibition: The ability to concentrate on relevant information in order to make a correct response despite interference or distracting information.</p>	<ul style="list-style-type: none"> • Right prefrontal cortex • Dorsolateral region

Want to dive into the detailed supporting data?

[READ MORE →](#)

The Creyos Health Platform

USING COGNITIVE ASSESSMENTS IN NEUROLOGY TO MAKE EVIDENCE-BASED DECISIONS

Creyos Health offers an evolution in comprehensive care in neurology, psychiatry, and primary care by providing a solution that can assess cognition to strengthen neurological exams, adjust treatments, and easily monitor for changes in brain health. The web-based tool is used by neurologists to accurately measure cognitive function using classic neuropsychological tasks that have been converted into a user-friendly computerized evaluation.

Neurologists can administer 12 core tasks of cognitive function as well as many standard self-report questionnaires, including:

- **Rivermead Post-Concussion Symptoms Questionnaire (RPQ)**
- **PTSD Checklist for DSM-5 (PCL-5)**
- **Adult ADHD Self-Report Scale (ASRS)**
- **Patient Health Questionnaire (PHQ-9) for depression**
- **Generalized Anxiety Disorder (GAD-7) questionnaire**
- **Perceived Stress Scale (PSS)**

Assessments are easy to administer and don't require clinical supervision. This means assessments can be performed in the traditional clinic setting or sent electronically to be self-administered by the patient in the comfort of their home. The tasks are highly gamified and engaging, and each takes only 1.5 to 3 minutes to complete. They also adapt to the patient's abilities, becoming easier or harder depending on performance. In addition, there are near-infinite problem sets within each task such that no attempt is ever the same, leading to strong test-retest reliability metrics and minimal practice effects. With a set baseline, clinicians can monitor patients consistently for performance stability and begin to track an objective indicator of cognitive change. Numerous brain imaging studies have directly linked neural activity in specific regions with each task, giving clinicians the tools needed to connect performance with brain disorders, injuries, and deficits.

Creyos Health offers a quick and simple solution that provides more data and reliable insights than traditional pen-and-paper screening tests. While a neuropsychologist's evaluation may still be required depending on severity, Creyos Health provides the missing middle ground assessment that can help easily determine if additional specialists are needed, saving time and resources for patients and physicians.

Creyos Health offers a long-awaited solution to conducting cognitive assessments.

Improve Clinical Decision-Making

Cognitive deficits are a primary symptom of many disorders neurologists treat, and cognitive assessments provide important behavioral information to complement medical tests, patient history, and brain imaging. For many neurologists, existing cognitive assessments detect only severe impairment or require multiple hours of in-person testing and specialized training. Creyos Health is a quick, automated behavioral assessment of cognitive performance that compares any patient’s memory, reasoning, verbal, and attention abilities to an age-matched normative database without involving a third party.

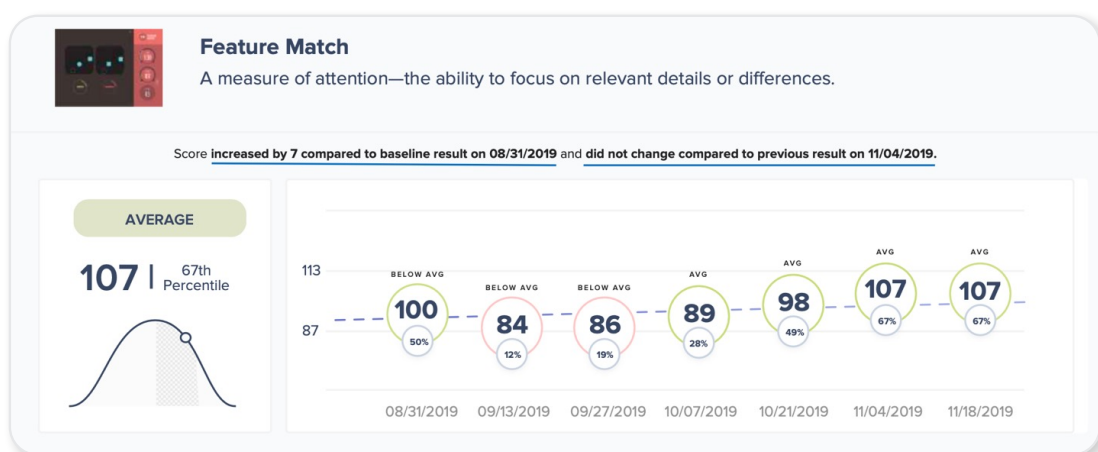
With a quantified measure of a patient’s brain health, neurologists can better identify deficits and strengths to assist in diagnosis, then track recovery as treatment progresses.

After the assessment, Creyos Health produces an easy-to-read report to facilitate teamwork among neuropsychologists, neurosurgeons, and other specialists, making evidence-based decisions about the best next steps for a patient.

Detect Meaningful Changes and Drive Data-Based Choices

The Creyos Health platform provides infinite problem sets within each task and has proven sensitivity to changes in cognition, with built-in comparisons to norms that can help identify a meaningful difference in performance from baseline or the previous assessment. This allows Creyos Health to produce reports that objectively track a patient’s cognitive function over time. By consistently monitoring for stability in cognitive performance, it is easier than ever to get an early indication of cognitive decline and get ahead of long-term problems. Longitudinal monitoring also allows neurologists to measure the effects of interventions like medication, psychotherapy, sleep, or other lifestyle changes to see if the patient is improving or maintaining their cognitive function in the target domains based on data-driven meaningful change indicators.

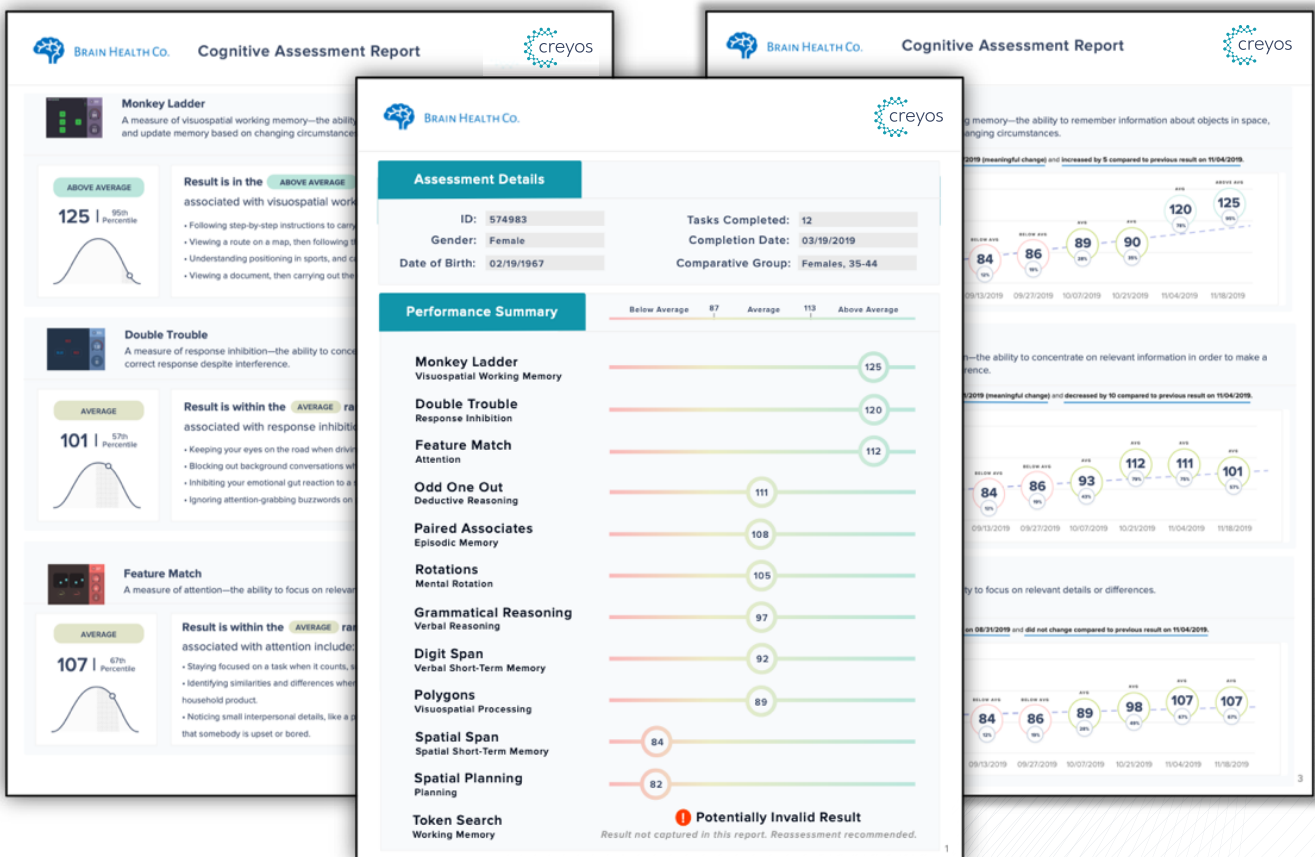
The comprehensive Creyos Health assessments allow neurologists to gain a more complete view of cognitive function, making it easy to quantify deficits, then track recovery and stability by establishing a personalized baseline.



Additionally, any patient with acute, chronic, or evolving impairment in cognition, or one who is at risk for such impairments, can benefit from regular assessment of cognitive function. The easily repeatable nature of the assessments complements existing diagnostic tools for neurological conditions such as brain injuries, diseases of the central nervous system, and pain. A patient’s diagnosis can be further strengthened by quantifying their symptoms based on the cognitive domains key to their quality of life, such as memory, reasoning, verbal ability, and concentration. This also provides an opportunity to catch future declines early, or monitor for the need to re-engage with the patient.

Access to longitudinal data means improved patient care decisions and better collaboration across the care ecosystem of neuropsychologists and other clinicians.

In addition, Creyos Health’s comprehensive yet simple report offers quantitative data that becomes a valuable communication tool when talking with patients, family members, and caregivers.



BEYOND CLINICAL VALUE: THE BUSINESS BENEFITS OF CREYOS HEALTH

Reduce Administrative Burden

A complete neuropsychological evaluation takes a lot of time, money, and resources. Creyos Health offers much of the same information from a neuropsychological examination—results from a 30-minute battery of computerized tests are highly correlated with results from a 2- to 3-hour neuropsychological battery.²³ Creyos Health measures many of the same core cognitive domains essential to a patient's quality of life, but each task takes only minutes to complete. While the assessments will not replace an in-depth evaluation, they can be used as a starting point and can provide valuable clinical data about any patient—not only those who require a more comprehensive evaluation.

The Creyos cognitive tasks have been validated for in-clinic and at-home administration—with no significant difference detected in results.²⁴

Increase Convenience with Teleneurology

In any busy clinic, time is severely limited. Practitioners and admins can save time and effort by automating tasks, like sending regular scheduled assessments via email, maintaining and storing data, scoring and interpreting results, and finding patient reports. Some of your existing questionnaires, such as the PHQ-9 and GAD-7, can be included directly in Creyos Health to save the hassle of combining reports from different platforms. Sending assessments remotely can save in-clinic time or reach patients who would otherwise not be able to receive in-person care without significant hassle. Creyos cognitive tasks are modernized versions of classic tests based on decades of scientific research, making them easily accessible over the web, but with minimal differences between in-person and remotely administered assessments.²⁴ Neurologists can save valuable time with Creyos Health by quickly screening for impairment and homing in on the cognitive domains requiring further examination.

With the rise of telehealth, Creyos Health offers an opportunity for specialists to expand their geographical reach or continue business operations even when patients cannot be seen in person.

INCREASE REVENUE WITH REIMBURSABLE ASSESSMENTS

Creyos Health makes it easy to add new services and reach new patients. Many specialists receive reimbursement for services, including:

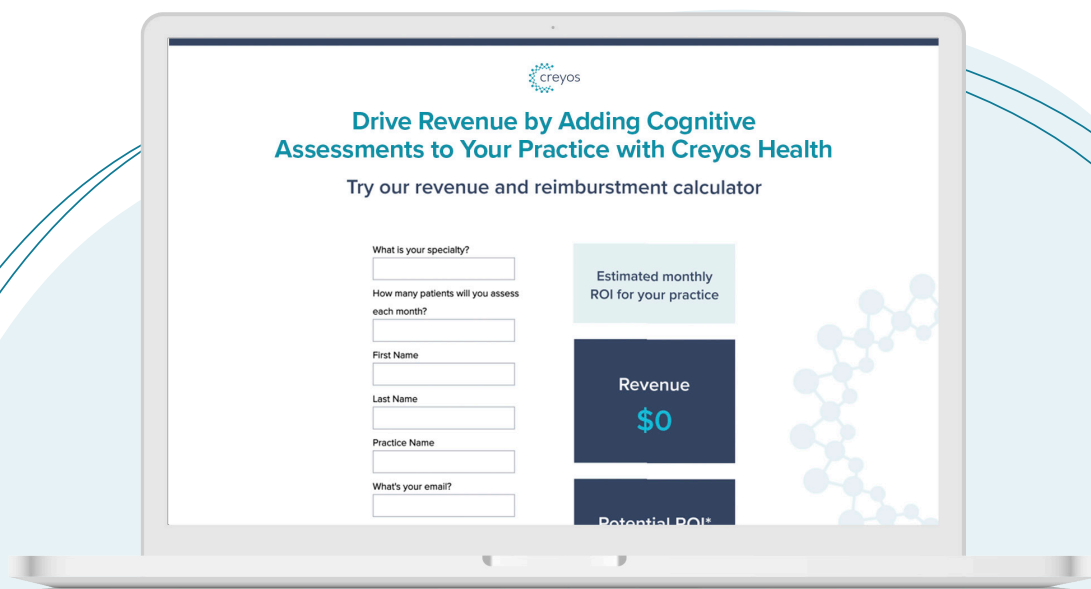
- **Establishing a reliable baseline** by leveraging assessments for patient intake and treatment planning
- **Determining a diagnosis** to begin establishing an appropriate treatment plan
- **Telehealth services** to provide consultations and other remote services
- **Add-on services** like rehabilitation programs and lifestyle optimization follow-up services

²³ Canadian Stroke Congress Conference, *Validation of a Novel Computerized Test Battery for Automated Testing*, Dec 2013

²⁴ Diagnostics, *Thirty-Five Years of Computerized Cognitive Assessment of Aging—Where Are We Now?*, Sept 2019

Creyos Health is a subscription-based platform with a predictable annual fee that works whether you are operating a small private practice or an extensive group practice. There are no added fees for additional practitioners, so colleagues and staff in the clinic can use the same subscription.

The administration and interpretation of assessments are easy to incorporate into revenue models and are covered by many insurance providers like Medicare, Medicaid, Blue Cross, Aetna, United, and a variety of others.²⁵ Cognitive testing through the Creyos Health platform is reimbursable through various CPT testing codes (such as 96132 and 96133) for administering the assessment and interpreting the results. Thus, by combining the benefits of reimbursement and reduced administrative burden, implementing Creyos Health has the potential to be a revenue generator.



Curious about costs and reimbursement with Creyos Health?

Try our revenue calculator.

WHAT'S MY REVENUE? →

²⁵ Creyos, [Creyos Health Reimbursement Guide](#), Aug 2021

Easily Incorporate Neurocognitive Assessments with Creyos Health

For physicians, the decision to bring a new solution into their practice is not a casual one. Any new method must offer improved patient results without increasing administrative workload or costs. Creyos Health provides a tested and proven advancement in neurological care that can be implemented within days. The platform offers valuable insights about a patient's brain function, becoming a valuable aid for diagnosis and tracking of symptoms. With these assessments in your toolkit, essential information about patient brain health becomes less elusive—and the way forward more certain.



Interested in seeing
the Creyos Health
platform in action?

GET A DEMO →



About Creyos

Creyos (formerly Cambridge Brain Sciences) leads the field when it comes to accurately quantifying brain function and brain health. Our proprietary cognitive assessments have been taken millions of times and have been used in over 300 studies published in leading academic journals over the last 30 years. Owing to years of rigorous academic development, Creyos possesses one of the world's largest normative databases of cognitive function developed from 12+ million cognitive task scores. Our cognitive assessments and health questionnaires—all delivered and scored digitally—are used by healthcare practitioners treating mental health conditions, brain injuries, aging, and other patient populations throughout the world, as well as by leading researchers.

Our assessments were developed by Dr. Adrian Owen, chief scientific officer of Creyos, and one of the leading authorities on cognition. Professor Owen is the head of the Owen Lab at the Western Institute for Neuroscience (WIN), a cutting-edge cognitive neuroscience research center at Western University in Ontario, Canada.