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Advancing Dementia Detection and Care With Creyos

Evidence-Based Comparisons and Clinical Impact

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Despite decades of progress in cognitive neuroscience, the way brain health is assessed in clinical practice has remained curiously stagnant. Research has shown that traditional cognitive screeners—while fast and familiar—can trade precision for convenience, sometimes failing to detect the subtle impairments that mark the earliest stages of dementia. At the other end of the spectrum, gold-standard neuropsychological evaluations offer depth, but their time-intensive nature renders them inaccessible for the very populations who could benefit from earlier intervention.

This paper, put together by a team of accredited neuroscientists, examines the published limitations of traditional approaches to cognitive assessment in a primary care setting and offers a science-driven alternative that brings together decades of empirical research, digital innovation and real-world clinical utility.

The case made here is not just for innovation's sake, but for the sake of better outcomes—for patients, providers and systems under growing strain. If we're serious about early dementia detection, equity in access and delivering care informed by real cognitive science, this paper lays out what's possible with the right approach.

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Introduction

Dementia is now one of the most pressing public health challenges of our time. As a leading cause of disability and dependency among older adults, its impact extends far beyond the individual, placing significant strain on families, caregivers and already overburdened healthcare systems. The condition, which is characterized by progressive impairments across memory, executive function and reasoning, has devastating consequences on an individual's quality of life and independence.

As the population ages, the scale of this challenge is increasing exponentially. The World Health Organization projects that **by 2050, approximately 139 million individuals worldwide will be living with dementia**—nearly triple the current estimate (World Health Organization, 2021). This trend presents a significant challenge for health systems, particularly given the current limitations of early detection and diagnosis.

In many cases, dementia is not identified until its later stages, delaying care and missing a critical window of opportunity for effective intervention. Standard assessment tools, often reliant on subjective reporting and brief, general screens, can lack sensitivity to detect subtle cognitive changes signaling early stages of disease progression. This can delay access to care planning, therapeutic options and support services.

The growing availability of dementia research points to the importance of early detection, allowing for more timely intervention and preventative strategies such as lifestyle modifications, pharmacological treatment and care planning. These strategies can slow disease progression, extend independent living and meaningfully reduce care costs in the long term (World Health Organization, 2017). To achieve early detection, improved tools are needed that not only leverage scientific advances to identify disease earlier but also translate these advances into practical solutions suitable for high-volume clinical settings.

Recent innovations in digital cognitive assessment technologies have made it possible to develop tools that are accurate, efficient and accessible. High-quality digital solutions, like Creyos, offer objective, domain-specific measurements of cognition and are designed to integrate into existing clinical workflows. Through flexible remote or in-clinic administration and without the need for clinical supervision, the Creyos solution makes earlier and accurate identification of at-risk individuals more feasible. This represents a critical advancement in this space: a digital platform designed to

deliver rapid, objective and highly reliable cognitive testing that is both clinician- and patient-friendly.

This report examines one such solution—the Creyos dementia protocol—within the context of legacy and emerging tools for cognitive assessment. By supporting earlier and more accurate identification of cognitive impairment, this paper demonstrates how digital tools can play a critical role in improving patient outcomes while helping healthcare systems better manage the growing demands of an aging population.

I. The Need for Innovation in Dementia Assessment

Challenges in Current Approaches to Dementia Detection

Healthcare professionals have traditionally relied on two main types of tools for diagnosing dementia: brief screening tests and comprehensive neuropsychological evaluations. Yet both approaches present significant limitations—either lacking the sensitivity to detect early decline or requiring time and resources that make widespread use impractical.

1. Challenges With Traditional Screening Tools

Traditional screeners, like the MMSE, MoCA or Mini-Cog, have the advantage of being fast, but studies have also identified several challenges:

- **Limited sensitivity to mild impairments and lack of detail:** Traditional screeners tend to give an all-or-nothing result—labeling someone as either impaired or not based on a single cutoff score. However, research shows that fixed cutoff scores miss the full picture of brain health and the complex spectrum of cognition (Series & Burns, 2025). As a result, traditional screeners may overlook subtle impairments and do not give enough detail into the cognitive domains most indicative of early impairment (Mueller & Cammermeyer, 2023).
- **Limited specificity and false positives:** In addition to failing to detect mild impairment, traditional screeners may falsely identify impairment in patients who are healthy or who have conditions other than dementia. For example, studies have indicated that the MoCA can have a specificity of 50% or lower, depending on the population (Kansagara & Freeman, 2010).
- **Manual administration and scoring:** While some traditional screeners have digitized, most are still administered and scored with pen and paper, adding hands-on time and effort to every session. In addition, manual administration involving fine motor actions like drawing can introduce barriers to accurate testing particularly in the 40% or more of adults over age 65 who have motor or sensory impairments (Hill-Briggs et al., 2007).

- **Influenced by culture and education:** Many screeners require specific knowledge that may be cultural or influenced by education, such as identifying animals. Crude score adjustments to correct for education effects have been questioned (Pugh et al., 2018).

- **Learning effects:** Screener questions can be memorized or practiced, which impacts their reliability for tracking cognitive changes over time. While rotating through different versions can help, some studies have pointed to the challenge of managing which versions have been used and controlling who has access to testing outside of the clinic (Lei et al., 2022).

2. Challenges With Neuropsychological Evaluations

Comprehensive neuropsychological assessments—such as the Wechsler Adult Intelligence Scale (WAIS-IV) or the Neuropsychological Assessment Battery (NAB)—provide detailed insights into a patient's cognitive profile. These tools assess multiple domains, including memory, attention, language, executive function and visuospatial abilities, and are often considered the gold standard in diagnosing dementia and other forms of cognitive impairment. However, the depth of information these evaluations provide comes at asubstantial cost:

- **Time-intensive administration:** Full neuropsychological evaluations can take three hours or more to administer, and when combined with intake interviews, scoring and interpretation, the full process is highly time-consuming and resource-intensive (Sweet et al., 2002). This level of time commitment makes these assessments impractical for widespread or routine use—particularly among older adults who may experience fatigue, frustration or difficulty completing long testing sessions.

- **Long wait times and specialist shortages:** Access to a licensed neuropsychologist often involves lengthy referral pathways and waitlists that can span several months to over a year, depending on geography and provider availability (Han et al., 2014; Cass et al., 2020). For individuals exhibiting early signs of cognitive decline, these delays may result in missed windows for intervention or planning.

- **Cost burden and referral leakage:** Comprehensive neuropsychological evaluations require significant time and specialized expertise, making them a high-cost service for health systems to deliver. Because these assessments are often

conducted by external specialists, referring patients out of the system can lead to referral leakage, where patients receive follow-up care elsewhere, resulting in lost revenue and poor continuity of care.

Together, these constraints make full neuropsychological testing an unsustainable option for large-scale early detection despite its diagnostic accuracy.

II. The Promise of Digital Cognitive Tools

Digital diagnostic tools have emerged as a faster, more scalable solution to address the limitations of traditional dementia assessments. While innovations such as biomarker testing and imaging technologies require specialized equipment and trained professionals, digital tools stand out for their accessibility and cost-effectiveness.

Digital assessment solutions offer the compelling potential of quicker and more automated testing that can be deployed at scale. This is enticing for overburdened healthcare systems and individuals with limited access to specialized services. These tools have the advantage of rapidly processing large amounts of data to identify subtle patterns, offering insights for early detection of disease and improved care.

> **As digital tools become more common in clinical settings, it's worth examining what truly differentiates those that are scientifically rigorous from those that are simply commercially available. Not all digital assessments are created equal—and in clinical practice, that distinction matters.**

Diagnostic outcomes influence treatment pathways and carry significant implications for a person's long-term health and well-being. As such, digital diagnostic solutions must be held to a high scientific standard. Tools that are rigorously validated, reliable and grounded in established cognitive science are essential. In an increasingly crowded market, it is important to differentiate between platforms built on robust empirical evidence and those developed rapidly to meet commercial demand without sufficient validation.

- **Lack of scientific validation:** Without rigorous research and peer-reviewed studies, tools may produce unreliable or misleading results, leading to misdiagnosis or inappropriate treatment decisions. Many digital tools are new, and still in the early stages of validation. A key differentiator lies in the strength of their normative data, with few platforms having access to large-scale, demographically representative datasets—an essential foundation for accurately interpreting individual results in a clinical context.
- **Superficial assessments:** Tools that simply replicate pen-and-paper tests in a digital format fall behind tools with major technological advancements, such as cognitive tasks that adapt to performance in real time, or machine learning that assists with advanced algorithms for detecting impairment.
- **Limited clinical relevance:** Solutions must provide actionable insights within today's clinical and billing healthcare landscape. Without alignment with the DSM-5 diagnostic criteria, the data generated has limited usefulness for providers.
- **Poor accessibility and usability:** To be practical in a clinical setting, solutions must work with diverse patient populations across varied backgrounds, languages, geographical areas and physical and cognitive abilities. Tools that lack an inclusive design face significant limitations in widespread implementation and real-world impact.
- **Lack of integration with existing workflows**: Digital tools must seamlessly integrate into existing clinical workflows and electronic medical records (EMRs) for implementation at scale.

III. Applying Cognitive Neuroscience in Clinical Practice: The Case of Creyos

Derived from digitized, evidence-based psychometric tests, Creyos represent one approach to operationalizing cognitive neuroscience for clinical settings. The platform's highly validated, evidence-based psychometric tests have been used for decades to assess cognitive function across memory, attention and executive function domains. These scientifically backed tasks have been further validated through brain imaging technology and used in over 400 peer-reviewed studies to detect subtle changes in cognitive functioning.

A Scientifically-Validated Approach to Cognitive and Behavioral Health Assessment

- **85,000** individuals in the normative database
- **14M+** cognitive tasks completed across studies
- Supported by **400+** peer-reviewed publications
- Based on **35+** years of cognitive neuroscience research

Scientific validation is a critical criterion in evaluating any cognitive assessment platform. Creyos is built on decades of research and real-world data, enabling healthcare providers to assess cognitive and behavioral health with confidence. Its depth of evidence ensures that every result is both meaningful and clinically actionable.

Condition-focused protocols, such as the dementia protocol, are built from these evidence-backed tasks to accurately assess the cognitive domains typically affected by the condition, delivering results in a fraction of the time required for a traditional neuropsychological exam. Powered by a rigorously tested algorithm, the Creyos dementia protocol effectively differentiates between unimpaired and impaired individuals, balancing high sensitivity for early detection of cognitive impairment with high specificity to minimize false positives and negatives.

Evidence Base for Digital Cognitive Tools: The Case for Creyos

Early Cognitive Screening for Individuals on the Alzheimer's Disease Continuum (Urian et al., 2025)

This study uses data from patients with age-related cognitive impairment to validate that the Creyos screener has a very high sensitivity for detecting dementia and identifies age-related decline specifically.

Thirty-Five Years of Computerized Cognitive Assessment of Aging—Where Are We Now? (Sternin et al., 2019)

Assessing Capacity in the Elderly: Comparing the MoCA With a Novel Computerized Battery of Executive Function (Brenkel et al., 2017)

Studies found that task scores from the Creyos platform were significantly correlated with the MoCA and MMSE, while also providing additional diagnostic insight.

For a more detailed overview of these key studies, as well as additional research supporting Creyos for dementia care, refer to the sections The Creyos Dementia Screener and Assessment and Scientific Validation of Creyos Cognitive Testing.

Using Machine Learning for Proven, Transparent Outcomes

At Creyos, we believe that machine learning (ML) and artificial intelligence (AI) should complement human expertise, not replace it. Transparency should be a top priority when these tools are used so that practitioners and patients can have confidence in their results and can understand how they were produced. The Creyos dementia protocol exemplifies this position by using ML as one of several tools to generate a patient's final results.

Specifically, the Creyos dementia screener leverages a pre-trained ML algorithm to determine which patients are most likely to have objective cognitive impairments using the data from only two cognitive tasks. Importantly, the screener does not indicate whether an objective impairment has been detected or not; rather, it suggests who should go on to complete additional testing. The screener algorithm was designed to be explainable, as opposed to one that produces "black box" results, by training a linear classifier (i.e., a linear support vector classifier) to distinguish cognitively healthy individuals from patients with suspected cognitive impairments using only four data features from the two cognitive tasks. Positive results from the screener (i.e., individuals flagged for additional testing) can usually be explained by some combination of poor performance and/or long or variable response times.

On the other hand, and as detailed in the Creyos Dementia Protocol Science Overview, the results of the full dementia assessment are based on a simple comparison between the patient's cognitive scores and an age- and gender-matched sample of healthy individuals from our normative database. An objective cognitive impairment is detected if two or more scores are more than one standard deviation below the mean of the comparative group. This simple rules-based algorithm is intended to provide fully transparent and easily interpretable results. Furthermore, cognitive results are displayed alongside other diagnostic criteria for dementia, aligning with standard classification systems in the DSM-5 and NIA-AA recommendations.

Finally, it is important to note that the Creyos normative database is static and not updated from client data. Similarly, the screener algorithm's ML model is only trained offline using proprietary data. The algorithm's parameters are not updated and its state does not change as it processes client data. As a result, task performance has a predictable relationship with report outcomes, and there is no risk of "hallucinations" or other unpredictable responses often associated with artificial intelligence. The same performance will always lead to the same outcomes. Any updates to the algorithms are extensively validated by human scientists.

Beyond its robust scientific foundation, the dementia protocol is designed for efficient, unsupervised clinical administration. This enables providers to confidently identify potential dementia at the primary care level without referral to a specialist. The assessment delivers neuropsychological insights across multiple cognitive domains while incorporating DSM-5 criteria necessary for diagnosing dementia.

The solution is built with enhanced accessibility strategies to accommodate diverse patient populations, including older adults and individuals with low literacy levels to support patient-led administration. Digital administration also enables electronic health record (EHR) integration and flexible configurability to fit various clinical workflows, ensuring ease of adoption in healthcare settings.

Enhancing Access: Accessibility and Integration Features

Accessible design: Assessments are built with accessibility strategies to support diverse groups of patients, such as the visually or motor-impaired or populations with low literacy levels. All assessments adhere to the Web Content Accessibility Guidelines (WCAG).

Patient-led administration: Patient-friendly tutorials and audio instructions enable patients to complete testing independently, minimize medical professional-led time and support both remote and in-clinic workflows.

Multi-device compatibility: This can be administered on tablets, desktops and laptops without requiring specialized hardware or downloads, ensuring flexible access for patients in any setting.

Inclusivity ccross languages and populations: Multilingual capabilities and culturally neutral assessments drive accurate testing across diverse care environments.

EHR integration: It seamlessly integrates with EHRs, including athenahealth, Epic, AdvancedMD and eClinicalWorks, allowing results to flow directly into existing clinical workflows.

IV. The Creyos Dementia Screener and Assessment

Creyos offers a comprehensive, multi-part solution to assist with dementia care: a screener, an assessment and care planning.

1. **Screener:** A two-task, five-minute screener to check for signs of age-related cognitive decline, and determine the need for further testing. The screener provides similar information to an MMSE, MoCA or Mini-Cog using the validated Creyos tasks.

2. **Assessment:** A detailed assessment that builds on the screener with additional tasks that assess more cognitive domains associated with age-related decline. This task-based cognitive testing is complemented with optionally included questionnaires to provide DSM-5-aligned diagnostic information related to MCI and dementia. The assessment provides similar information to a neuropsychological assessment in less time. It addresses multiple criteria for the DSM-5's definition of major neurocognitive disorder (dementia), including:

    - **Objective cognitive decline:** Objective cognitive testing across multiple domains to quantify the presence of significant decline.
    - **Subjective cognitive decline:** A questionnaire (the IQCODE) to establish concern that there has been cognitive decline—a requirement for diagnosing MCI or dementia.
    - **Functional impairment:** A scale to measure lack of independence with instrumental activities of daily living (IADLs)—a requirement for a dementia diagnosis.
    - **Neuropsychiatric symptoms:** Instruments to quickly measure symptoms of depression and anxiety, to help rule out alternative causes for cognitive symptoms, or quantify comorbid mental health symptoms.

3. **Care planning:** A set of questionnaires and checklists designed to assist dementia patients and their caregivers make proper care plans after a diagnosis is confirmed.

For easy integration into existing clinical workflows, the protocol is configurable, allowing organizations or providers to choose which components they administer at one time.

See the Creyos Dementia Protocol Science Overview for detailed information about the protocol's validation and development and the Creyos Dementia Protocol Interpretation Guide for guidance on its clinical usage.

Mapping Digital Cognitive Assessment to DSM-5 Diagnostic Criteria

DSM-5 Criteria to Diagnose Major Neurocognitive Disorder (Dementia)	Creyos Dementia Assessment
Evidence of significant decline in cognitive function in one or more domains--including executive function, attention, learning or memory	Digitized versions of gold-standard neuropsychological tests to objectively assess executive function, attention and memory—providing quantifiable insights into cognitive impairment and decline
Concerns from the patient, an informant or the provider of cognitive decline	IQCODE questionnaire to assess subjective concerns of cognitive decline
Functional impairment that interferes with independence in daily activities	IADL questionnaire to evaluate whether cognitive deficits interfere with independence in daily activities like shopping and managing finances
Cognitive deficits not explained by another mental disorder	PHQ-9 and GAD-7 questionnaires to assess neuropsychiatric symptoms that may explain impairments

Validation of the Creyos Screener

The Creyos dementia screener uses a machine learning algorithm that has been trained and tested on multiple large datasets to distinguish cognitively normal individuals from patients at neurology clinics with concerns about cognitive decline. Using multiple performance metrics related to accuracy and speed from both cognitive tasks, the screener algorithm classifies an individual as potentially impaired (positive) or unimpaired (negative). In multiple internal analyses, the screener demonstrated good performance in distinguishing patients from neurology clinics with concerns about cognitive decline from members of the general population, with **sensitivity ranging from 0.71 to 1.0 and specificity ranging from 0.81 to 0.86, suggesting that it is accurate for detecting even mild signs of age-related decline.**

A validation study (Urian et al., 2025, preprint) reviews traditional screening tools and then introduces the Creyos screener as an improvement over pen-and-paper screeners.

Using data from patients with potential or confirmed age-related cognitive impairment, the paper shows that the Creyos screener:

- **Has very high sensitivity for detecting dementia:** When the same model was applied to a small sample of patients diagnosed with Alzheimer's disease, all 14 of them were classified as potentially impaired (positive), corresponding to 100% sensitivity. In a corresponding case-matched sample drawn from healthy norms, only 14% were flagged, yielding 86% specificity. Note that only 13 out of 14 patients were flagged as impaired according to the MMSE.
- **Is specific to age-related decline:** The probability of being flagged as potentially impaired increased with age. Furthermore, healthy participants, and even those with conditions that may cause different types of cognitive impairment, such as concussion and hypertension, did not tend to be flagged more often on the Creyos dementia screener.

V. Scientific Validation of Creyos Cognitive Testing

Comparing Creyos With the MMSE and the MoCA

While tools like the Mini-Mental State Examination (MMSE) and the Montreal Cognitive Assessment (MoCA) are commonly used to support dementia diagnosis, research has highlighted some limitations in their sensitivity, specificity and clinical efficiency. Creyos provides a digital option that captures the same core diagnostic information, with a strong scientific foundation and added precision—while remaining easy to use in everyday clinical practice.

Beyond Traditional Cognitive Screeners: Evidence for a More Sensitive Approach

Traditional cognitive screening tools like the MMSE and the MoCA remain common in clinical practice due to their ease of use and familiarity. However, growing research suggests these tools may not reliably detect subtle or early cognitive changes. Digital platforms like Creyos have emerged as suitable alternatives, offering high sensitivity, domain precision and clinical efficiency. Recent studies highlight the value of incorporating Creyos into routine cognitive evaluations to help address gaps left by traditional screeners.

Creyos vs. the MoCA

Sternin et al. (2019)

- Found strong correlations between specific Creyos task combinations and MoCA scores
- Crucially, Creyos added value by identifying impairments in individuals with borderline MoCA scores (23–25), helping stratify them into clearly impaired or unimpaired categories

Brenkel et al. (2017)

- Found additional correlations between Creyos tasks and the MoCA
- Showed that Creyos captured cognitive variation not evident in MoCA scores alone, especially useful in patients with uncertain or intermediate results

Creyos vs. the MMSE

Spencer et al. (2013); Devenney and Hodges (2017)

- Highlighted risks of the MMSE, including poor sensitivity to early impairments, low reliability and significant educational and cultural bias
- These observations are validated by Creyos studies, in which educated adults consistently scored near-perfect on the MMSE—limiting its diagnostic usefulness

Sternin et al. (2019) and Brenkel et al. (2017)

- Observed ceiling effects in MMSE results from educated individuals
- Reported that there was too little variability in MMSE scores to meaningfully compare with Creyos—highlighting the MMSE's inability to provide detailed information about cognition

Hosseini et al. (2023)

- Studied patients with Parkinson's-related cognitive decline
- Found that Creyos detected impairments even in patients who appeared unimpaired using the MMSE. Urian et al. (2025) have described a similar case of an Alzheimer's disease patient flagged by the Creyos screener, but who performed normally on the MMSE
- Suggested that Creyos offers greater utility in tracking Parkinson's-related dementia

These studies demonstrate a consistent theme: Traditional cognitive screeners can miss subtle yet clinically relevant impairments. This can lead to delayed diagnoses, undertreatment or misclassification of cognitive status, especially in patients with atypical presentations or populations with wide variation in education or literacy levels.

Comparing Creyos With Traditional Neuropsychological Testing

After an initial cognitive screener flags a potential concern, the next step is often to gather more detailed information to confirm the presence of impairment and better understand its nature. Traditionally, this has required referral for full neuropsycho-

logical evaluation—a process that can be time-consuming, resource-intensive and inaccessible for many patients.

Creyos has been validated as a more scalable and efficient alternative. It provides detailed insights into specific cognitive domains in a fraction of the time required for a full neuropsychological battery. Its tasks have demonstrated strong correlations with gold-standard neuropsychological tests, offering high convergent validity and supporting its use as an informative follow-up to initial screening.

- **Creyos correlates with classic high-level intelligence tests:** In a foundational paper (Hampshire et al., 2012), a standardized average of Creyos tasks correlated significantly with the Cattell Culture Fair Intelligence Test, a common measure of classic IQ or the g factor. The magnitude of the correlation (r = .65) is similar to how strongly other IQ tests correlate with each other, suggesting that, overall, Creyos testing is capturing the same key aspects of brain health as well-established intelligence tests.
- **Creyos matches detailed pen-and-paper batteries when it comes to identifying age-related decline:** In one study (Levine et al., 2013), a computerized battery including Creyos was highly correlated with a traditional battery including Wechsler scales, the Wisconsin Card Sorting Task, Trail Making Test and the Rey Auditory Verbal Learning Test. Perhaps more importantly, the two batteries were equally predictive of age.
- **Creyos tasks are related to WAIS subtests:** The Wechsler Adult Intelligence Scale (WAIS) is a common IQ test, commonly a key part of a neuropsychological evaluation—it is often considered the gold standard when it comes to measuring cognitive function. In a study comparing the WAIS with Creyos and other computerized tests (Kochan et al., 2022), a Creyos composite score "demonstrated robust psychometric standards for reliability [...] and convergent validity with a gold standard battery."

Creyos should not always replace a full neuropsychological evaluation that takes three hours or more, but research has shown that Creyos tasks capture much of the same information in a condensed battery—making it a valuable solution for faster decision-making, earlier intervention and broader access to cognitive care.

VI. How Neuroimaging Validates Creyos Cognitive Testing

Creyos tasks are meant to measure brain function. Correlating with other assessments meant to measure brain function helps validate Creyos tasks, but technology has provided tools to even more directly validate relationships with the brain: neuroimaging. Technologies like functional magnetic resonance imaging (fMRI) and positron emission tomography (PET) have revealed that Creyos tasks are linked with the function of the brain in both healthy people and clinical patients, demonstrating high construct validity.

- **Creyos was built with the brain in mind:** Creyos's chief scientific officer, Adrian Owen, built some of the first computerized cognitive tasks specifically to quantify the deficits associated with damage to certain areas of the brain. As neuroimaging became available to researchers in the 1990s, the tasks were refined and confirmed to measure the functioning of specific areas of the brain (Owen et al., 1996a; 1996b; 1996c; 1996d; 1997; 1998; 1999).

- **Functional neuroimaging confirms that Creyos measures important domains in the brain:** A landmark paper (Hampshire et al., 2012) compared behavioral data from over 40,000 participants taking Creyos tasks to a cohort of participants performing the same tasks while estimates of brain activity were measured and localized with functional magnetic resonance imaging. Behavioral data and imaging data agreed on a logical domain structure that aligned with specific brain networks—Creyos uses these data-driven domains in its dementia assessment today.

- **Brain biomarkers correlate with Creyos tasks**: Conditions like dementia cause changes in the brain. One of those changes is the width of sulci—the grooves in the cerebral cortex that give the brain its characteristic shape. One study (Thienel et al., 2024) demonstrated that a self-administered online Creyos battery was significantly related to these physical measurements of brain health, with poorer performance linked with wider sulci. Furthermore, the 30-minute online battery was just as good at predicting brain health as a two-hour in-person assessment administered by trained neuropsychologists.

These studies, and many more, demonstrate that the Creyos cognitive tasks are directly related to the underlying phenomenon—brain function—that they were designed to measure. This direct connection with the brain ensures that any condition that affects the brain will affect performance on the Creyos tasks.

VII. Measuring Dementia Symptoms With Creyos

Cognitive deficits are core features of conditions like mild cognitive impairment (MCI) and dementia, making it essential that any assessment solution accurately measures specific impairments. Aligning what we measure with what defines the condition is key to effective detection, monitoring and management.

Several large-scale studies have shown a strong relationship between Creyos task scores and dementia. These findings highlight the potential for Creyos to detect patterns of cognitive decline, offering a practical way to flag risk, guide care planning and monitor patients with greater confidence.

- **Creyos is capable of detecting genetic risk for Alzheimer's disease:** One of the largest dementia cohort studies in the world (Lupton et al., 2023) used Creyos to assess cognitive function in middle-aged adults alongside genome-wide genotyping. Genetic risk for Alzheimer's disease—even before any noticeable symptoms arise—was associated with lower scores in several tasks. The researchers confirmed the utility of online cognitive testing as "a cost-effective alternative to in-person testing for large-scale studies and the potential for [use] as a pre-screening approach to identify those at high risk of Alzheimer's disease."
- **Age-related cortical changes are reflected in Creyos results:** As mentioned in the previous section, Thienel et al. (2024) found that sulcal width is linked with Creyos testing results, confirming that biomarkers of aging are picked up by online testing. The width of the grooves in the brain changes as a result of normal aging, and wider grooves predict a more rapid progression of Alzheimer's disease. Creyos may pick up on the cognitive performance deficits associated with that deterioration, especially in the majority of patients who do not have MRI results to directly measure dementia-related

brain biomarkers. In the authors' words, "Online cognitive testing could lead to more equitable early detection and intervention for neurodegenerative diseases."

- **Creyos used to evaluate cognitive outcomes in dementia prevention trial:** Another large research trial called *Maintain Your Brain* (Brodaty et al., 2025) used Creyos tasks as the primary outcome of an online coaching program designed to prevent cognitive decline in older adults. Published in *Nature Medicine,* the results of the randomized controlled trial showed that in a sample of over 6,000 at-risk older adults, those who took part in the three-year intervention had improved cognition relative to controls. In addition to detecting dementia-related deficits, Creyos is sensitive to subtle improvements from lifestyle interventions targeting decline in older adults.

VIII. Use of Creyos in Healthcare

Dementia Screening and Early Detection in Senior Primary Care

A common implementation of the Creyos dementia protocol is during routine annual wellness visits. All eligible patients aged 65 and older complete the brief screener, typically administered on a tablet by a medical assistant. Results are automatically generated, shared with the provider and added to a patient's chart during the visit, streamlining the workflow and enabling real-time discussions about a patient's cognitive health.

If a patient shows signs of potential impairment during the initial screener, healthcare providers can proceed with a more in-depth Creyos assessment. This progressive protocol supports clinical decision-making by evaluating additional cognitive domains, such as memory, attention and executive function, alongside daily functioning, fulfilling DSM-5 criteria for diagnosing dementia.

In this approach, primary care providers are equipped with the step-by-step criteria to confidently detect, assess and document cognitive impairment—improving early intervention while reducing the need for specialist referrals.

A Common Goal Framework for Physician Groups and Health Systems Looking to Integrate Scientifically Validated Digitized Dementia Screening and Assessment

1. **Reduce Assessment Subjectivity**

   Too much subjectivity with human administration and interpretation of results from paper tools

2. **Address Access Disparity**

   Process relied on patients having access to specialty care; difficult with the patient population

3. **Increase Provider Confidence**

   Primary care physicians were not confident in delivering initial diagnosis of dementia

4. **Improve Health Equity**

   Mini-Cog/SLUMs are tested and validated but not necessarily appropriate for all patient populations

Tracking Cognitive Change Over Time

Ongoing cognitive assessment is a critical component of managing progressive conditions such as dementia. By administering regular, objective and quantified testing during routine appointments, providers can monitor subtle changes in a patient's cognitive function over time with high precision. Unlike subjective reports or infrequent in-depth evaluations, consistent use of digital cognitive assessments provides a continuous, data-driven view of a patient's cognitive health.

With each reassessment, Creyos automatically generates trend reports of cognitive performance over time. This allows clinicians to identify early signs of decline that may otherwise go unnoticed, promoting early-stage intervention that may slow disease progression, improve quality of life and proactively support caregivers.

Supporting Risk Stratification in Population Health

Creyos provides healthcare organizations with a scalable way to support cognitive health initiatives at the population level. When integrated into primary care workflows, routine

cognitive assessments offer a consistent method for collecting objective data across large patient groups.

This data can enhance existing risk stratification models by helping identify individuals at greater risk for cognitive decline—including those showing early signs of mild cognitive impairment, those with comorbid conditions or individuals affected by social drivers of health. By making cognitive data more accessible and actionable, Creyos supports organizations in adopting more predictive, targeted approaches to care.

When paired with EHRs and care management systems, Creyos data contributes to population-level insights that can inform resource planning, care coordination and preventative strategies. As patterns emerge, organizations are better equipped to implement interventions—like community-based programs or enhanced follow-up care—for those at highest risk.

In value-based care environments, this approach can help healthcare systems strengthen early detection efforts, support management of comorbidities and reduce preventable hospitalizations—ultimately improving patient outcomes and lowering costs.

Comparative Table of Creyos and Key Alternatives

Feature	Creyos	Traditional Screening Tools	Neuropsych Eval	Other Digital Tools
Scientific Validity	**High**	High	High	Low to Moderate
DSM-5 Alignment	**Very strong**	Moderate	Very strong	Minimal
Sensitivity to MCI	**High**	Low	High	Variable
Time to Administer	**~10 minutes**	~15 minutes	3+ hours	~10-30 minutes
Executive Function Coverage	**Comprehensive**	Limited	Comprehensive	Limited to Moderate
Scalability	**High**	Moderate	Low	High
Cost vs. Return	**Low**	Low	High	Moderate to High

Conclusion

As the prevalence of dementia continues to rise, the need for efficient, accurate and scalable detection tools has never been greater. Current standards of care often fail to detect early cognitive impairments, leading to delayed diagnoses and missed opportunities for intervention. Early detection is critical, allowing for proactive care strategies that can slow disease progression, improve quality of life and reduce the burden on caregivers and healthcare systems.

The Creyos dementia screening and assessment protocol offers a scientifically validated, clinically practical tool that enhances the efficiency and accuracy of cognitive testing in primary care.

By integrating rapid, sensitive and domain-specific assessments, Creyos enables providers to **identify cognitive impairment earlier, implement interventions** when it matters most and better manage dementia at scale.

Important Information About This Document

Creyos (formerly Cambridge Brain Sciences) 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 does not assume responsibility for the outcome of decisions made based on Creyos Health data.

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