

A Systematic Survey of
Cognitive-Communicative Evaluations

by

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ABSTRACT

Dementia is a syndrome resulting from an acquired brain disease that affects many domains of cognitive impairment. The progressive disorder generally affects memory, attention, executive functions, communication, and other cognitive domains that significantly alter everyday function (Quinn, 2014). The purpose of this research was to gather a systematic review of cognitive-communication assessments and screeners used in assessing dementia to assist in early prognosis. From this review, there is potential in developing a new test to address the areas that people with dementia often have deficits in 1) Memory, 2) Attention, 3) Executive Functions, 4) Language, and 5) Visuospatial Skills. In the field of speech-language pathology, or medicine in general, there is no one assessment that can diagnose dementia. Additionally, this review will explore identifying speech and language characteristics of dementia through speech analytics to theoretically help clinicians identify early signs of dementia.

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INTRODUCTION

Dementia is defined as a clinical syndrome characterized by progressive deterioration of cognition and memory, with an estimated 35.7 million people affected by dementia worldwide (Quinn, 2014). Dementia is not classified as a specific disease, rather a term for a decline in mental and cognitive abilities that are severe enough to interfere with daily functioning beyond normal aging (Kong, 2016). According to Swan et al. (2018), the Alzheimer's Association defined dementia as "an umbrella term for a group of conditions that affect various aspects of cognition, such as memory, language, or learning, due to the death of neurons in the brain" (pg. 836). There is an extensive body of research exploring the common causes of dementia and the chronic, global, nonreversible associated deterioration in memory, executive function, and personality. Often times, speech, behavior, and motor function in addition to nonreversible deterioration in memory, executive functions, and personality may also be impaired in persons with dementia (Butler, 2014). However, there is little literature regarding the relationship between diagnosing early states of typical aging and other potentially irreversible dementias. Because the incidence of dementia is an increasingly common phenomenon within today's aging population (Cunningham, 2015), there is a need for early detection of dementia types. This review was developed to provide speech-language pathologists and other medical professionals a systematic review of the available cognitive-communication assessments used to identify hallmark signs of dementia. Additionally, with the use of this resource, critical subtests can be chosen for new development in assessing cognitive impairments in elderly people using speech analyses, a clinical perspective that may increase communication and quality of life for persons with dementia.

REVIEW OF LITERATURE

COMMON PRIMARY DEMENTIAS

Alzheimer's (AD)

Accounting for nearly 56% of all diagnosed dementia, Alzheimer's disease (AD), is the leading cause of dementia resulting from an insidious neurodegenerative process of the nervous system (Chapey, 2008). According to Bayles (2005), Americans and speech-language pathologists (SLPs) were unaware of the disorder nearly thirty years ago, with little known about how to treat their communicative difficulties. In 2001, evidence-based practice standards for SLPs to serve individuals with dementia were recognized by the Academic of Neurologic Communication Disorders and Sciences (ANCDS). Today, AD is the fastest growing population segment due to the multiple cognitive deficits accompanied by the disease. Dementias are often categorized based on the neuroanatomic location of the causative lesion. AD is a cortical dementia, in that the pathophysiology of the disease primarily affects the cortical brain tissue (Chapey, 2008). Persons with AD, an irreversible condition, often exhibit deficits in cognitive functioning abilities and is typically present with three gradual phases. AD persons first begin to have episodic and declarative memory deficits as the hippocampus and entorhinal area are two of the first brain structures to be damaged (Rouse, 2016). This eventually leads to continually worsened memory accompanied by other cognitive functions (i.e., language comprehension deficits, difficulty with syntax, phonology), resulting in severe cognitive deficits (topic maintenance, lack of meaningful speech) and deteriorating motor ability (Manasco, 2017).

Multi-infarct Dementia (MID)

The second most common cause of dementia is that arising from multiple small vascular infarcts, known as multi-infarct dementia (McKay, 2017). MIDs are a result of thrombotic or embolic occlusions causing focal neurological symptoms, such as impairments of nerves, spinal cord, or brain function (Chapey, 2008). Individuals with MID, generally referred to as a cerebrovascular disease, present with sufficient severity in which various cognitive domains are impaired. Additionally, MID is often accompanied by slurred speech or dysarthria, word-retrieval difficulties, and following instructions. Executive function skills involving attention, perceptual speed, working and episodic memory are prominent for those with MID (McKay, 2017). Since MID is a result of many small or mini-strokes, sometimes without noticeable clinical signs, overall language, and cognitive function impairments will depend on the region of the brain that has been specifically affected (Ritchie, 2002).

Frontotemporal Disorders (FTD)

Frontotemporal disorders are a type of dementia caused by specific neurodegenerative brain diseases, collectively known as frontotemporal lobar degeneration (Ritchie, 2002). Frontotemporal dementia is the third most common dementia, but D'Alton (2014), describes the diagnostic challenges as it has been traditionally overshadowed by other common dementias such as AD. FTD has distinct features of behavioral variants or language impairment such as non-fluent or agrammatic speech as well as a broad pathology. The classification of FTD includes a variety of diseases present with dementia. FTD is only one of a series of disorders in which certain populations of neurons die off prematurely resulting in deterioration of cognitive function, cause and effect mentality, and daily living activities (Kirshner, 2014); some of which include, behavioral variant frontotemporal

dementia, Pick's disease, and primary progressive aphasia (PPA) (Ritchie, 2002). Persons with often FTD present with fasciculations, muscle atrophy, weakness, increased tone and reflexes. Additional motor speech abnormalities including dysarthria, apraxia, impaired language comprehension, and repetition may be present, such as those related to PPA (Kirshner, 2014). Due to the prefrontal cortical site of degeneration and dysfunction FTD, persons often lack emotional responsiveness and other executive functions such as judgment, abstract reasoning, and difficulty organizing, planning, and shifting cognitive sets, and working memory tasks may be impaired (Rouse, 2016).

Parkinson's Disease (PD)

Parkinson's disease dementia (PDD) is a progressive extrapyramidal movement disorder that can occur in people with Parkinson's disease, but not all people with PD will develop dementia (Rouse, 2016). This basal ganglia disorder involves degeneration of the substantia nigra resulting in PDD's primary site of degeneration and dysfunction in the subcortical structures (Chapley, 2008). The degeneration of these structures increases the loss of dopaminergic innervation of the striatum, resulting in akinesia/bradykinesia, resting tremor, and rigidity (Rouse, 2016). PDD is a complication due to the late stages of the disease, resulting in progressive worsening of connectivity within the major cortical neural networks as compared to those without dementia (Gratwicke, 2015). The degenerative disorder of the central nervous system characterized by tremors can either have a sporadic or gradual course. Persons with PDD typically present with mild cognitive impairments (MCI), affected memory, social judgments, reasoning and language complications (Ritchie, 2002). The low endurance of the facial muscles, such as reduced lip and tongue strength, are

additional factors that are associated with Parkinsonism resulting is slow, slurred speech, specifically hypokinetic dysarthria (Solomon, 2000).

Huntington's Disease (HD)

Huntington's disease is a progressive, degenerative, disorder of the central nervous system characterized by dementia, behavioral psychiatric disturbances, and unwanted choreatic movements (Roos, 2010). HD is an inherited disease with gradual onset of the basal ganglia resulting in subcortical dementia (Chapey, 2008). HD dementia is relatively common in younger individuals, but can occasionally be identified in older patients later in life with an uncertainty of clear family history (Quinn, 2014). Dementia is an inevitable consequence of HD in addition to speech and emotional deficits (Rouse, 2016). Similar to PD, damage to the basal ganglia system results in dyskinesias where the deterioration is observed through tremors and other dyskinesias (Rouse, 2016). Motor and psychiatric symptoms are commonly present in the early stages of the disease, which can highly negatively impact the function of those with HD dementia (Roos, 2010). Cognitive decline is a common symptom that can appear in very mild or far advanced stages, often related to cognitive changes in executive function such as goal-directed and planned tasks. Speech and language impairments may be present, such as hyperkinetic dysarthria, with variations in loudness and pitch, and harsh quality. Similar to AD, mutism in final stages and decreased communication, however, semantic memory can be spared to an extent (Roos, 2010).

Lewy Body (LBD)

Lewy body dementia is mixed dementia that typically begins after the age of 50, involving abnormal balloon-like protein deposits, called Lewy bodies (Ritchie, 2002). Dementia with Lewy bodies shares pathologies of PD and AD, resulting in two related conditions, dementia with Lewy bodies (DLB) and Parkinson's disease dementia (PDD). PDD was discussed earlier in this review, and DLB is another type of progressive dementia resulting in a decline of reasoning skills, thinking, and independent function. DLB typically occurs within one year of the onset of motor symptoms, before, or concurrently with parkinsonism (Walker, 2015). In this case, when both cortical and sub-cortical brain tissue is affected by the disease process, mixed dementia is considered (Chapey, 2008). Persons with DLB typically present with progressive dementia that may severely interfere with social skills, attention, executive function, visuospatial abilities as well as fluctuating cognition. Communication deficits could include disorganized speech, hypophonia, and spontaneous parkinsonism such as and rigidity (Walker, 2015).

COMMON SECONDARY DEMENTIAS

Multiple Sclerosis (MS)

Multiple Sclerosis is a chronic neurological disease that affects the central nervous system. This demyelinating disease strips down myelin from the nerve tract, leading to muscle weakness and can result in subcortical dementia (Rouse, 2010). Westervelt (2015), describes the challenges those with MS face, especially the early symptoms of cognitive dysfunction. Specific deficits described in the article include, slowed processing, difficulties with complex attention, and working memory. MS can result in a slow, drawn-out dysarthric speech that is sometimes completely unintelligible as well as speech with uncontrollable loudness and poor pitch control (Darley, 1972). Executive functioning and visuospatial skills are also a concern for those with MS dementia in addition to fatigue and weakness (Westervelt, 2015).

Traumatic Brain Injury (TBI)

In an article written by Gardner (2015), an estimated 42 million people suffer a mild traumatic brain injury or concussion. As a result of an external force applied to the head, brain-tissue damage in a more severe traumatic brain injury may be discrete and focal (Chapey, 2008). The external force of TBI can lead to a number of impairments in cognitive-communication skills. Kong (2016) explains that dementia and cognitive symptoms may include impaired attention and memory, reduced planning, and decreased rate of speed in mental processing, impaired judgment, and decreased self-awareness. Similar to following a stroke, the injury is diffuse and includes cortical and subcortical structures in multiple lobes

of the brain. Resulting in other cognitive-communication deficits, perceptual deficits, and short-term or long-term memory tasks (Chapey, 2008)

OTHER CAUSES OF DEMENTIA

There are numerous additional conditions that result in dementia, most relatively rare, but similarly due to progressive changes in brain function. According to the American Speech-Language-Hearing Association, other conditions that may cause dementia include, but are not limited to, chronic traumatic encephalopathy (CTE) due to repeated trauma, chemotherapy, Wernicke-Korsakoff syndrome secondary to chronic alcohol abuse, and human immunodeficiency virus (HIV). CTE, similar to TBI, is a result of trauma to the brain upon multiple concussions. Individuals with CTE who develop dementia have symptoms similar to those seen with PD such as poor coordination, slurred speech and similar to TBI behavioral changes, such as irritability (Ritchie, 2002). Chemotherapy is another condition in which dementia can occur. Though the literature is somewhat limited, chemotherapy-related cognitive impairment (CRCI) may occur after or during chemotherapy (Loh, 2016). The article, Chemotherapy-related Cognitive Impairments in Older Patients with Cancer argues that despite the gaps in the literature and the fact that CRCI related research is in high demand, CRCI is increasingly recognized and additional research should focus specifically on elderly patients with cancer and the effects of dementia.

Korsakoff syndrome (KS) is a chronic neuropsychiatric disorder caused by thiamine deficiency, most commonly a result of alcohol abuse and thiamine deficiency (Oudman, 2015). According to Ritchie (2002), studies suggest an increased risk of dementia for individuals regularly drinking large amounts of alcoholic beverages. The Wernicke-Korsakoff syndrome is unambiguous to the correlation in deficiencies associated with chronic alcohol abuse and dementia specific to Wernicke's area, the region of the brain that is important for language development. Damage to this area of the brain could result in severe auditory comprehension deficits, verbal jargon, and poor repetition abilities (Rouse, 2016). HIV-

associated dementia (HAD) can occur in individuals who have human immunodeficiency virus (HIV), a virus that damages white matter. As a result, neuropathy can be seen in HIV, which can be associated with cognitive impairments, dementia and if untreated, an acute onset (Quinn, 2014). Luckily, the incidence of HAD has significantly dropped, deferring individuals from demyelination and white matter damage which can lead to dementia associated with memory problems, social withdrawal, and difficulty concentrating (Ritchie, 2002). Although not thoroughly discussed in this review, the importance of identifying reversible conditions that can resemble dementia-like symptoms such as depression, drug use, infection, hearing loss, normal pressure hydrocephalus can be critical during clinical practice (Chapley, 2008).

COMPREHENSIVE EVALUATION

Case History

Unequivocal diagnosis of dementia can be difficult in some instances due to the large variety in etiology of the syndrome. Clinicians need to evaluate for the presence of dementia and its effect on communication skills. Relevant information should be gained from the case history and client interview regarding any current neurophysiological changes in addition to consulting with primary caregivers, such as a spouse (Chapey, 2008). Considerations regarding symptoms mimicking impaired performance and early dementia on cognitive tests may be an effect resulting from certain types of medications, psychosocial factors, and psychiatric conditions should also be considered (Quinn, 2014).

Assessments

According to Robinson (2015), no one brief cognitive assessment tool is more accurate than another and the initial evaluation should be timely. In addition to being brief, the assessment should be sensitive to the dementia syndrome in that they are active, nonautomatic, and depend on logical reasoning. Screening the patients mental and linguistic involvements in a creative way, such as a story retell, then staging the severity of dementia, and lastly, a comprehensive evaluation of cognitive-communicative functioning would be sufficient during the evaluation process (Chapey, 2008).

The Story Retelling subtest of the Arizona Battery for Communication Disorders of Dementia (ABCD); Bayles & Tomoeda, 1993) is an effective screening tool. Totalling fourteen subtests, this assessment can evaluate a linguistic expression, linguistic comprehension, verbal episodic memory, visuospatial construction, and mental status. Semantic and letter tests are among the most common types of fluency tasks (Chapey, 2008), favoring in the FAS Verbal Fluency Test (Borkowski et al., 1967). The Mini-Mental State

Examination (MMSE; Folstein, Folstein, & McHugh, 1975) is widely used as a helpful resource in evaluating a client's orientation, attention, calculation, language, memory, and visuospatial construction skills. When assessing severity, one of the most commonly used scales to stage dementia severity is the Global Deterioration Scale (GDS; Reisberg, Ferris, deLon, & Cook, 1981). Lastly, when assessing comprehensive cognitive-communication functioning, the Functional Linguistic Communication Inventory (Bayes & Tomoeda, 1994) can be used as a battery for testing individuals with dementia and measure the effects of cognitive deterioration, particularly memory deficits and communication.

COGNITIVE-COMMUNICATIVE SYSTEMATIC SURVEY

The assessments and screening tools listed below are amongst many that assess cognitive-communicative skills in adults. Table 1 is a survey of cognitive-communication assessments and Table 2 is a survey of cognitive-communicative short screeners. Both tables include an extensive review of target domains, typical and estimated length of time to administer as well as full name and abbreviated titles of the test. The tables were developed for clinicians, physicians, therapists, and other members involved in the assessment of dementia to utilize when determining the appropriate test for assessing their client's cognitive-communication impairments.

Table 1. Systematic Review of Cognitive-Communicative Assessments					
Test	Full Title	Description	Target Domains	Time (minutes)	Source(s)
ABA-2	The Apraxia Battery for Adults	Test uses six subtests to determine the presence and severity of apraxia in adults and adolescence.	Diadochokinetic rate, word repetition with increasing complexity, volitional movement of oral structures and limbs, production of multisyllabic words with picture stimulus, multiple productions of the same word, and connected speech.	20	(Dabul, 2000; Rohrer, 2009)
ABCD	Arizona Battery for Communication Disorders of Dementia	Standardized test used as comprehensive battery or screener for dementia, including 14 subtests.	Linguistic expression, linguistic comprehension, verbal episodic memory, semantic memory, visuospatial construction, and mental status.	45-90	(Bayles, 1993; Moorhouse, 1999)
ACE-R	Addenbrooke's Cognitive Examination-Revised	Brief battery that evaluates 5 cognitive domains to detect subtypes of dementia and mild cognitive impairment.	Orientation, attention, memory, verbal fluency, language and visuospatial ability.	20-25	(Mioshia, 2006)

ASHA FACS	American Speech and Hearing Association Functional Assessment of Communication Skills for Adults	Measures functional communication of adults with cognitive-communication impairments. Assesses functional communication according to independence.	Using a 7 point scale, the areas of are social communication, communication of basic needs, reading, writing and number concepts, and daily planning are evaluated for independence.	20	(Frattali, 1995)
BADS	Behavioral Assessment of Dysexecutive Syndrome	Predicts everyday problems associated with Dysexecutive Syndrome	Batter of executive function skills: inhibitory control and behavior monitoring, planning, priorities, problem solving, attention, and cognitive flexibility.	40	(Canali, 2007; Wilson, 1996)
BDAE-3	The Boston Diagnostic Aphasia Exam Third Edition	A standard neuropsychological battery examination to evaluate communication modalities for suspected aphasia or language disorder.	Language (auditory, visual, and gestural), processing functions (comprehension, analysis, problem solving), and response modalities (writing, articulation, and manipulation).	20-120	(Kaplan, 2000)
BNT-2	Boston Naming Test Second Edition	A wide range naming vocabulary test consisting of picture ordered from easiest to most difficult. This test assesses word retrieval skills and self-cuing abilities.	Confrontational word retrieval (naming) skills.	35-45	(Kaplan 2000)
CADL-2	Communication Activities of Daily Living	Assessment used to assess functional communication skills in simulated natural environments.	Social interactions, reading, writing, and using numbers, divergent communication, nonverbal communication, humor, metaphor and absurdity, and sequential relationships.	30	(Holland, 1999)

CADL-2	Communication Activities of Daily Living	Assessment used to assess functional communication skills in simulated natural environments.	Social interactions, reading, writing, and using numbers, divergent communication, nonverbal communication, humor, metaphor and absurdity, and sequential relationships.	30	(Holland, 1999)
CLQT	Cognitive Linguistic Quick Test	Assessment designed to gain information about cognitive linguistic functioning. It is composed of 10 tasks to assess the 5 cognitive-communication domains.	Attention, memory, language, executive functioning, and visuospatial skills.	15-30	(Helm-Estabrooks, 2001)
FAVRES	Functional Assessment of Verbal Reasoning and Executive Strategies	Standardized test designed to verbal reasoning and executive functioning using tasks that stimulate real world communication.	Verbal reasoning, complex comprehension, discourse, and executive functioning,	60	(Macdonald, 2005)
MIRBI	Mini Inventory of Right Brain Injury	The MIRBI is a standardized test used to evaluate areas typically impaired with right brain injuries.	Visual processing, language processing, emotion and affect processing, as well as general behavior and psychic integrity.	20-30	(Pimental, 1989)
PALPA	Psycholinguistic Assessments of Language Processing in Aphasia	A comprehensive (6 sections) psycholinguistic assessment of language processing in adults with acquired aphasia.	Spoken and written language structure such as orthography and phonology, fluency, comprehension, word and picture semantics and morphology and syntax.	60+	(Kay, 1992)
RBANS	Repeatable Battery for the Assessment of Neuropsychological Status	A brief battery to measure cognitive decline or improvement.	Immediate memory, visuospatial/constructional, language, attention, delayed memory	30	(Randolpph, 1998)

RBMT	Rivermead Behavioural Memory Test	Developed to detect impairment of everyday memory functioning and monitor change.	Immediate and delayed memory	30	(Wilson, 1985)
RIPA	Ross Information Processing Assessment	This test assesses memory and auditory processing in individuals who have sustained brain damage and is used to establish a baseline in auditory processing and can then be used to monitor change over time.	Immediate memory, recent memory, remote and recent temporal orientation, spatial orientation, orientation to environment, recall of general information, problem solving and abstract reasoning, organization, and auditory processing and retention.	60	Ross-Swain, 1996)
SCATBI	Scales of Cognitive Ability for Traumatic Brain Injury	This test is designed primarily for individuals with closed-head, traumatic brain injuries. It assesses a range of cognitive skills in five different testlets (subtests).	Perception/Discrimination testlet: differentiate between multiple auditory visual stimuli. Orientation testlet: express a current awareness of self, place, and time. Organization testlet: executive functions and sequencing. Recall testlet: various types of memory, including short- and long-term recall. Reasoning testlet: problem-solving, ability to analyze information, draw conclusions, and formulate solutions.	30-120	(Adamovich, 1992)
WAB	Western Aphasia Battery	The WAB is a standard examination used to assess linguistic skills most frequently affected by aphasia as well as nonlinguistic skills. Provides a baseline level of performance to measure change over time.	Spontaneous speech, auditory verbal comprehension, repetition, naming, reading, writing, apraxia, and constructional, visuospatial and calculation tasks.	30-60	(Kertesz, 1983)

Table 2. Systematic Review of Cognitive-Communicative Screeners					
Test	Full Title	Description	Target Domains	Time (minutes)	Source(s)
AQT	Alzheimer's Quick Test	A criterion-referenced assessment used to detect parietal lobe dysfunction indicative of mild cognitive impairments, acquired neurogenic disorders of language/communication, or degenerative neurological diseases.	Verbal fluency, language, memory, visuospatial ability, attention.	15	(Dsurney, 2007)
MMSE	Mini Mental State Examination	A widely used screener for assessing cognitive mental status. The MMSE represents a brief, standardized method by which to grade cognitive mental status.	Orientation, attention, immediate and short-term recall, language, and the ability to follow simple verbal and written commands.	10	(Folstein, 1975)
MoCA	Montreal Cognitive Assessment	A common screening assessment for detecting cognitive impairment.	Short-term and working memory, visuospatial skills, executive functions, orientation, verbal fluency, attention, and language.	10	(Bernstein, 2010)
7MS	Seven-Minute Screen	A short neurocognitive screening tool for diagnosing dementia.	Temporal orientation, language, memory recall, visuospatial skills, and verbal fluency.	8-22	(Meulen, 2004)

STROOP	Stroop Color and Word Test	Screeners to detect cognitive dimension, cognitive flexibility, resistance to interference from outside stimuli, creativity, and psychopathology.	Four parts to assess selective attention and cognitive flexibility.	5	(Golden, 1978)
SLUMS	Saint Louis Mental Status Examination	An effective, short screener to detect AD and other types of dementia.	Orientation, short-term memory, naming, language, visuospatial skills, recognition, and simple calculations.	5-10	(Fariq, 2006)

CONCLUSION

In conclusion, the Systematic Surveys of Cognitive-Communicative Assessments and Screeners are useful resources for clinicians and other medical professions to utilize when determining an appropriate assessment for their client's needs, current level of function, and overall severity of impairments. The purpose of this research was to develop a reliable, comprehensive, and valid review of cognitive-communicative tests specifically designed for screening, assessing, and potentially early prognosis of dementia. Many of the tools in this survey give us adequate information regarding certain cognitive domains in which people with dementia have, however, many of the assessments that were reviewed are lengthy, approximately forty to forty-five minutes to administer. They also cover a wide range of cognitive and communicative skills, likely quickly fatiguing the client. Due to this, future research is warranted to create efficient and timely assessments to improve classification of dementia types by looking at the five primary areas of cognitive-communicative breakdown in persons with dementia; 1) Memory, 2) Attention, 3) Executive Functions, 4) Language, and 5) Visuospatial Skills. As mentioned earlier, in the field of speech-language pathology, or medicine in general, there is no single assessment that can diagnose early signs of dementia. Given today's rapid use of technology and the known key characteristics of dementia (i.e., dysarthria type, language deficits, etc.) future research is warranted to explore identifying speech and language characteristics of dementia through speech samples to theoretically help clinicians identify early signs of dementia.

DISCUSSION

The article, *Automatic Speech Analysis for the Assessment of Patients with Pre-dementia and Alzheimer's Disease*, suggests a new phenomenon in assessing pre-dementia and Alzheimer's disease using automatic speech analysis. Alexandra König and colleagues evaluated the use of automatic speech analysis for the assessment of mild cognitive impairment and early-stage Alzheimer's disease and the results are fascinating. With approximate eighty percent accuracy in diagnosing dementia types using automatic speech analyses and detecting MCI and AD suggest new developments in noninvasive diagnosis methods. These new steps toward diagnosis could be used as an additional objective measure for elderly with cognitive decline, which could likely improve early dementia detection (König et al., 2015). This study and others suggest that if speech-language pathologists, medical professionals, and engineers work together in creating a short ten to fifteen-minute battery to analyze disordered speech through elicitation tasks, the first signs of dementia could be identified in early states. Through research, we know that speech characteristics in persons with dementia decline and using this noninvasive measure could detect these deficits. As clinicians, we know that treatment can stem the progression of the disease, and early prognosis through digitalization and a series of batteries completed with short speech samples may be the future of screening for dementia and potentially other diseases or illnesses.

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