

# COMPUTERIZED COGNITION SCREENING: WHY YOU SHOULD BE DOING IT

Friday, October 14, 2022

MAC

Kate Eimers, Au.D.



# NO FINANCIAL DISCLOSURES

I DO NOT WORK FOR OR RECEIVE PAYMENT FROM COGNIVUE.

OWN 2 PRIVATE PRACTICES IN BEAUTIFUL NORTHERN MICHIGAN!



# LEARNING OBJECTIVES

- Understanding what is cognition, cognitive impairment, dementia, and current stats.
- Understanding the relationship between hearing loss and cognitive decline and the benefits of hearing loss intervention.
- Current cognitive screening options and their limitations and how computerized cognition screening can overcome those limitations.
- Implementing cognition (Cognivue) into the audiology clinic, providing more patient-centered care.

# FIRST, WHAT IS COGNITION?

- American Psychology Association defines it as: “all forms of knowing and awareness, such as perceiving, conceiving, remembering, reasoning, judging, imagining, and problem solving.”



# COGNITIVE IMPAIRMENT

- Trouble remembering, learning new things, concentrating, making decisions that impact daily life
- Ranges from mild to severe impairment
  - Mild impairment may notice changes in cognitive functions, but still able to do everyday activities.
  - Severe lose ability to understand meaning/importance of things, ability to write or talk, which causes loss of independence.



Hearing?: Perceiving or Detecting Sound  
(Loudness Measure)

VS

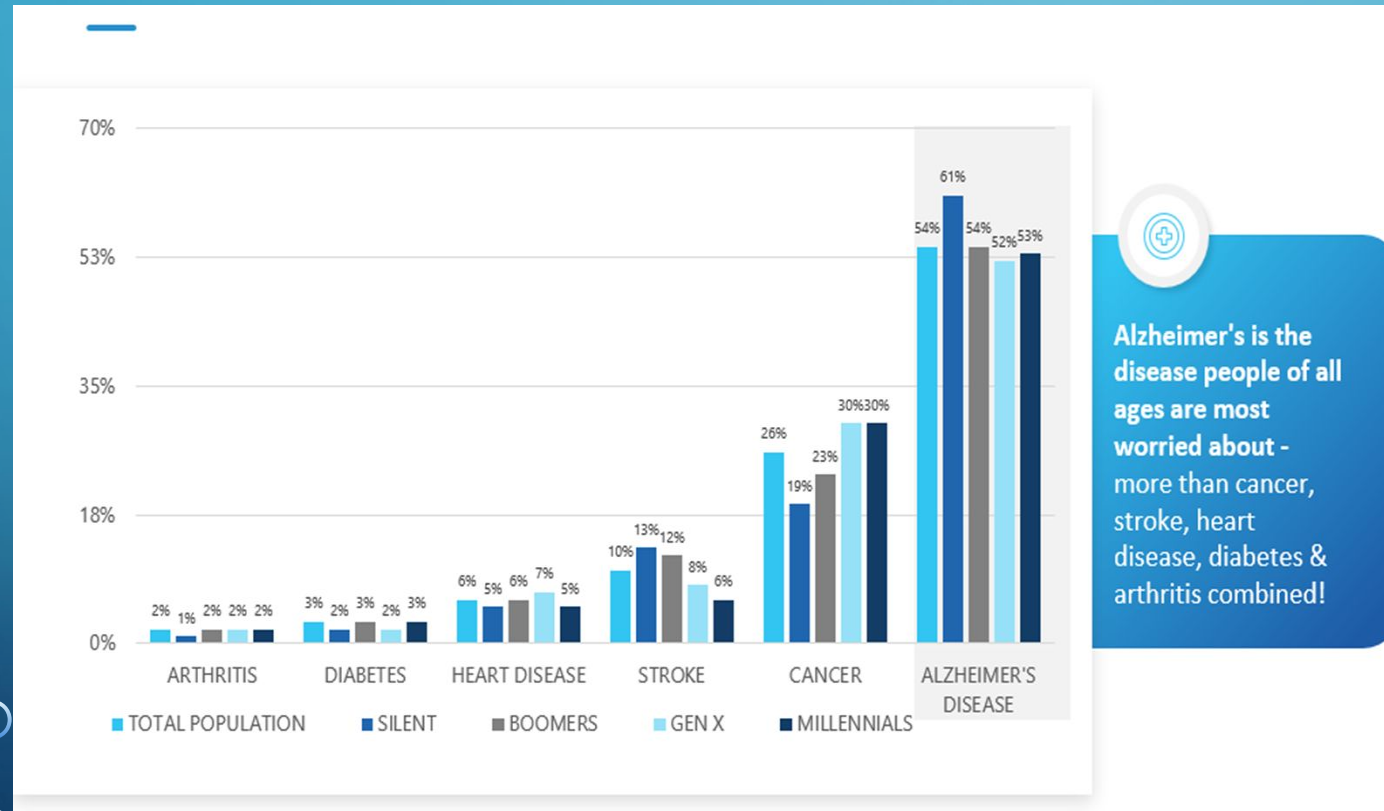
Listening?: Interpreting Sound  
(Clarity and Meaning)



# COGNITIVE IMPAIRMENT STATS

- More than 16 million people in the US live with cognitive impairment and 50 million globally.
  - Expected to triple by 2050
- People with cognitive impairment report more than 3x's as many hospital stays as those with other conditions.
- Alzheimer's disease and other related dementias are estimated to be the 3<sup>rd</sup> most expensive disease to treat (9x's higher for 65+).

# PEOPLE FEAR COGNITIVE DECLINE



Alzheimer's is the disease people of all ages are most worried about - more than cancer, stroke, heart disease, diabetes & arthritis combined!

- Americans fear losing cognitive function.
- 2x more fearful of losing mental abilities rather than physical.



# MILD COGNITIVE IMPAIRMENT (MCI) VS DEMENTIA

## MILD COGNITIVE IMPAIRMENT

(DSM CHANGE: MILD NEUROCOGNITIVE DISORDER)

- Low performance in one or more cognitive domains that is greater than expected for the patient's age and educational background.
- Does not substantially interfere with daily activities. Independence in daily life is preserved, with minimal aids or assistance.

## DEMENTIA

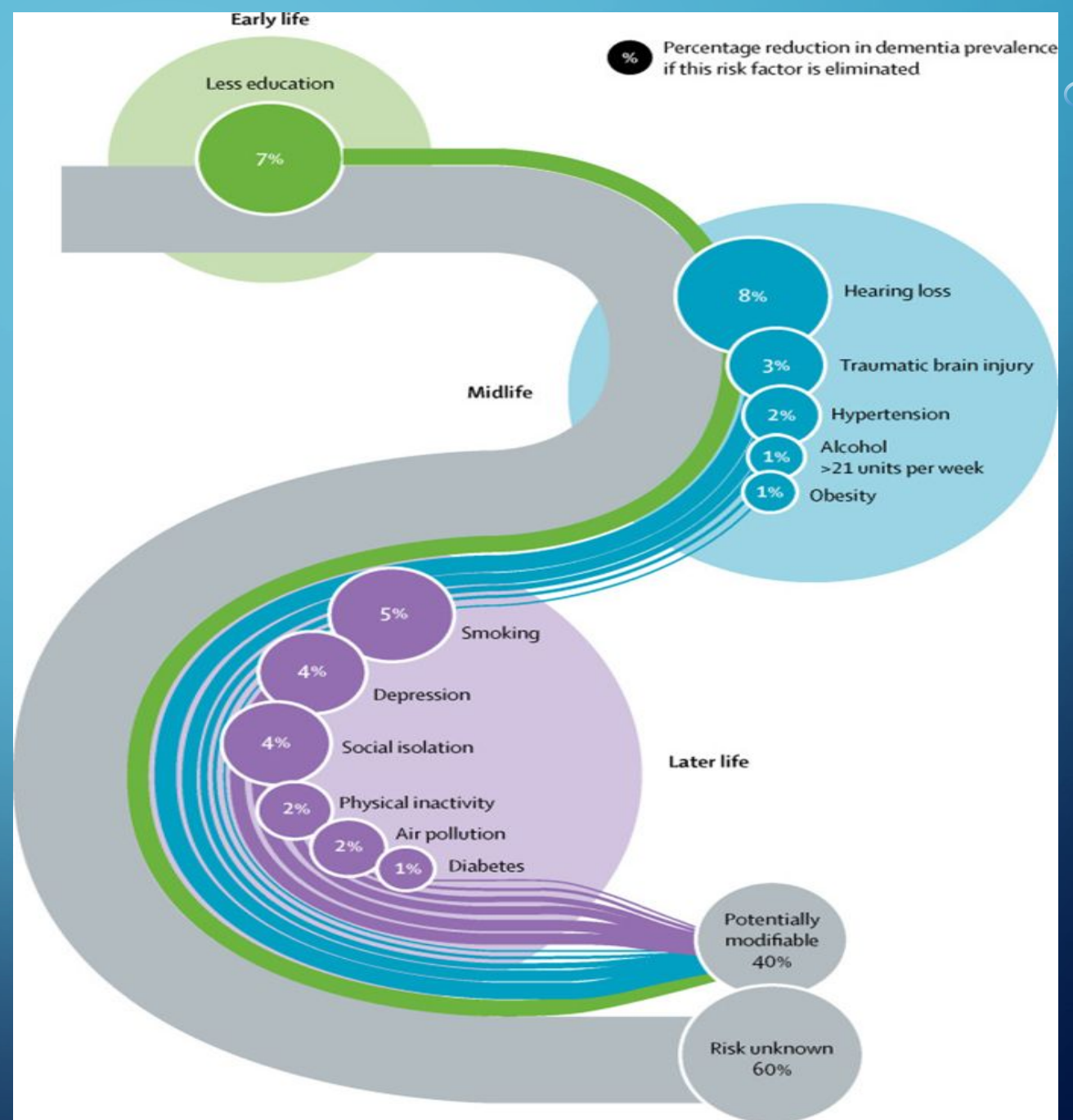
- Low performance in more than one cognitive domain that is greater than expected for the patient's age and educational background.
- Significant interference with the ability to function at work or at usual activities, but still able to carry out basic activities of daily living.

# WHY SHOULD AUDIOLOGISTS CARE?

Lancet 2017, hearing impairment was reaffirmed as the strongest modifiable risk factor for cognitive decline when identified and addressed in mid-life.

**Hearing loss is the leading modifiable risk factor for cognitive decline.**

Livingston G, Sommerlad A, Orgeta V et al. Dementia prevention, intervention, and care. Lancet 2017;390:2673–2734



# SOME PROPOSED CAUSAL RELATIONSHIPS.....UNDERLYING MECHANISM STILL UNKNOWN

- Cognitive Load Theory

- Must exert more cognitive effort to perceive and process auditory stimuli at the expense of other cognitive processes.
- Increased cognitive “load” exhausts neural resources normal devoted to their tasks, which contribute to clinical symptoms of cognitive decline.

- Structural Changes in the Brain

- Reduced auditory input may lead to under-stimulation of brain and gradual atrophy of auditory cortex.
- **Linked to accelerated brain decline.**

Trace, Chern, Golub. Hearing loss and cognition: something to think about, ENT & Audiology News, Volume 30(1), March/April 2021.

Lin FR, Ferrucci L, An Y, et al. Association of hearing impairment with brain volume changes in older adults. NeuroImage 2014; 90:84-92.

The background is a solid blue gradient. In the four corners, there are decorative white line-art elements resembling circuit traces or neural pathways. These lines connect to small white circles, creating a network-like pattern. The top-left and bottom-left corners have more complex, branching structures, while the top-right and bottom-right corners have simpler, more linear paths.

# HEARING LOSS TREATMENT AND COGNITION

# COGNITION AND HEARING AID USE

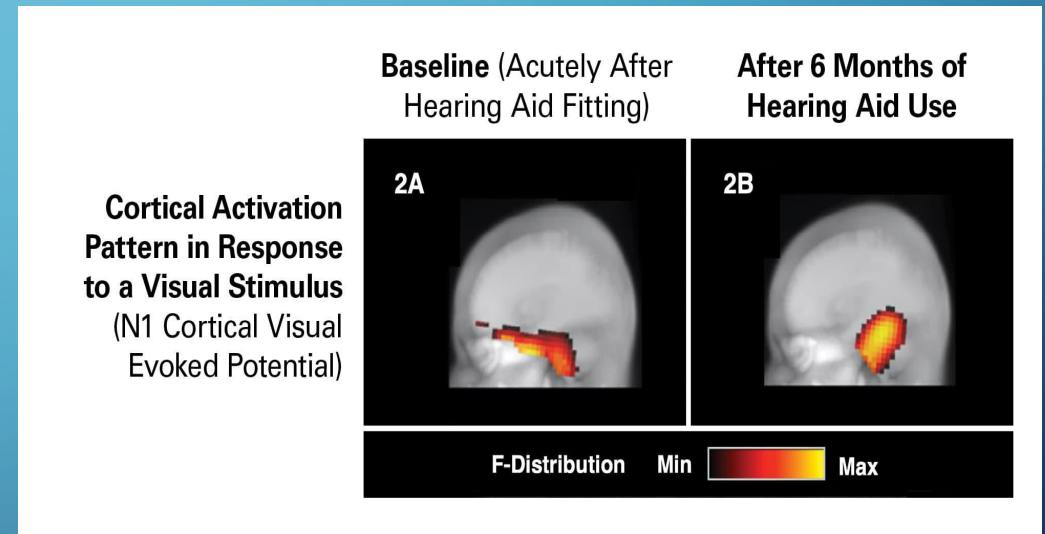
- The Lancet Commissions (2017 & 2020) encourage being ambitious about prevention: “management of hearing loss”
  - Reported that peripheral hearing loss risk factor for dementia.
- 2021 Study by Sanders. et. al. reported the following:
  - Strong association between hearing loss and cognitive decline, but the underlying mechanisms linking two are not fully clear.
  - Hearing aid use particularly benefits executive function.
  - Hearing loss impacts physical and mental health, hearing aids could benefit multiple dimensions (ex. depression, social isolation).



# COGNITION THE BRAIN AND HEARING AID USE...STUDY BY GLICK AND SHARMA

- Mild to moderate hearing loss show changes in cortical resource allocation during auditory tasks.
  - Lesser speech-in-noise recognition
- Global cognitive function, executive function, processing speed, auditory working memory, and visual working memory baselines worse for hearing impaired
  - 6-months hearing aids use, all areas improved except auditory working memory.

Glick H and Sharma A. (2022) The Ever-Changing Brain. Audiology Today Vol34(5):44-52



- Cortical Visual Evoked Potentials
- Baseline: increased activity and cross-modal recruitment suggesting effortful listening
- 6-month hearing aid use: reversal of recruitment, less activity, suggesting decrease in listening effort.

# COGNITION AND CI USE

Cochlear Implants show improvement too:

- 2018 review by Claes et. al. of 6 studies showed improvements in cognition in 5 out of 6 for CI users.
- 2022 study by Calvino et. al. found a significant improvement in cognition after 12 months of CI use.

The background is a gradient of blue, transitioning from a lighter shade at the top to a darker shade at the bottom. In the four corners, there are decorative white line-art patterns that resemble circuit traces or neural pathways, with small circles at the end of the lines.

AUDIOLOGISTS SHOULD BE DOING  
COGNITIVE SCREENINGS!

# BUT IS IT WITHIN OUR SCOPE?.....YES

## ASHA

### DIAGNOSTICS FOR HEARING, BALANCE, AND OTHER RELATED DISORDERS

Audiologists are responsible for the assessment of hearing, balance, and other related disorders, including tinnitus and auditory processing, across the lifespan that includes the following:

- Administration and interpretation of clinical case history.
- Administration and interpretation of behavioral, electroacoustic, and electrophysiologic measures of the peripheral and central auditory, balance, and other related systems.
- Administration and interpretation of diagnostic screening that includes measures to detect the presence of hearing, balance, and other related disorders. Additional screening measures of mental health and cognitive impairment should be used to assess, treat, and refer (American Academy of Audiology, 2013; Beck & Clark, 2009; Li et al., 2014; Shen, Anderson, Arehart, & Souza, 2016; Sweetow, 2015; Weinstein, 2017, 2018).

Reference this material as: American Speech-Language-Hearing Association. (2018). Scope of Practice in Audiology [Scope of Practice]. Available from [www.asha.org/policy](http://www.asha.org/policy).

© Copyright 2018 American Speech Language Hearing Association. All rights reserved.

Disclaimer: The American Speech-Language-Hearing Association disclaims any liability to any party for the accuracy, completeness, or availability of these documents, or for any damages arising out of the use of the documents and any information they contain.

## AAA

### Additional Expertise

Some audiologists, by virtue of education, experience and personal choice choose to specialize in an area of practice not otherwise defined in this document. Nothing in this document shall be construed to limit individual freedom of choice in this regard provided that the activity is consistent with the American Academy of Audiology [Code of Ethics](#).

.....

As a dynamic and growing profession, the field of audiology will change over time as new information is acquired. This Scope of Practice document will receive regular review for consistency with current knowledge and practice.

<https://www.audiology.org/publications-resources/document-library/scope-practice>





# SO WHY AREN'T WE DOING IT?.....

- 2020 SURVEY BY BLACK AND SOUZA OF AUDIOLOGISTS FOUND THAT MOST RESPONDENTS (88%) DO NOT ADMINISTER A COGNITIVE SCREENING.
- MOST COMMON REASON WHY: NOT COMFORTABLE.
- 17% REPORTED TRAINING IN GRAD SCHOOL



# WHY AUDIOLOGISTS ARE WELL POSITIONED FOR RECOGNIZING COGNITIVE DECLINE

- Diagnosis must be made by physician; audiologist can help assume role for detecting cognitive problems.
- Link between hearing loss and cognitive impairment could result in high incidence in our clinic setting over the general population.
- Audiologists' typical conversation centers around communication abilities, which are strongly influenced by cognition.
  - Cognitive decline critical factor in causing difficulty understanding speech, especially in noise
- Time
  - Average primary care provider office visit is 20 minutes and 21 minutes with specialized physician.
  - Audiology clinic setting has average of 1.2 hours of counseling during first 2 months for hearing aid fitting process.

The background is a solid blue gradient. In the four corners, there are decorative white line-art elements resembling circuit traces or neural pathways. These lines connect to small white circles, creating a network-like pattern. The top-left and bottom-left corners have more complex, branching structures, while the top-right and bottom-right corners have simpler, more linear paths.

# COGNITIVE SCREENING TOOLS

# COMMON SCREENING MEASURE

## MMSE

### MINI-MENTAL STATE EXAMINATION

Provider administered, 7-8 minute test-time, uses auditory stimuli

Paper/pencil, 30-point scale,

Evaluates orientation, word recall, language abilities, attention and calculation, and visuospatial ability

Education bias detected

Usually considered better for identifying more advanced cases (less sensitive)

## MOCA

### MONTREAL COGNITIVE ASSESSMENT

Provider administered, 10-15 minute test-time, uses auditory stimuli

Paper/pencil, 30-point scale

Developed as alternative to MMSE

Similar to MMSE with addition of clock drawing and trail test

Education bias detected

Considered more sensitive for early-stage dementia / MCI

## SLUMS

### ST. LOUIS UNIVERSITY MENTAL STATUS EXAMINATION

Provider administered, 6-7 minute test time, uses auditory stimuli

Paper/pencil, 30-point scale

Developed as alternative to MMSE

Testing areas similar to MoCA

Adjusted to education level

High sensitivity and specificity

# COMMON ISSUES WITH COGNITIVE SCREENERS

- Trained staff required to administer and score the test
- Possible human error in scoring process may lead to inaccurate results
- Education Level Errors
  - High level education=false negative misclassification
  - Lower education level=false positive misclassification
- Low test-retest reliability
- Multiple Bias: race, education level, socioeconomic factors
- **Difficulty detecting small changes over time in cognition**

Ranson, J. M., Wu Ling, E., Gagliardi, W., Munk, T. et al., Langa, L. M., & Swagerty, D. J. (2018). Predictors of dementia misclassification when using brief cognitive assessments. *Neurology: Clinical Practice, 9*(2), 109-117. doi:10.1212/cpj.0000000000000566

# BENEFITS OF COMPUTERIZED, ADAPTIVE, SELF-ADMINISTERED SCREENING OPTION

- Removes bias associated with traditional tests
  - Common bias includes race, education level, and other socio-economic factors that may affect contextual understanding and ability
- Removes environmental variability
  - Protects from distractions and light interference and provides the same testing environment between all testing sites
  - No ability to learn tasks; proven test-retest reliability
- Accounts for varying physical ability
  - Dynamically changes and adapts the test to the visual and motor ability of the user
  - Does not rely on auditory stimuli
- No training to administer
  - **Anyone on staff may initiate the testing**

Cahn-Hidalgo, D., Estes, P. W., & Benabou, R. (2020). Validity, reliability, and psychometric properties of a computerized, cognitive assessment test (Cognivue®). *World Journal of Psychiatry, 10*(1), 1-11. doi:10.5498/wjp.v10.i1.1

Ranson, J. M., et al. (2018). Predictors of dementia misclassification when using brief cognitive assessments. *Neurology: Clinical Practice, 9*(2), 109-117. doi:10.1212/cpj.0000000000000566.

• **Results are generated automatically and available immediately.**



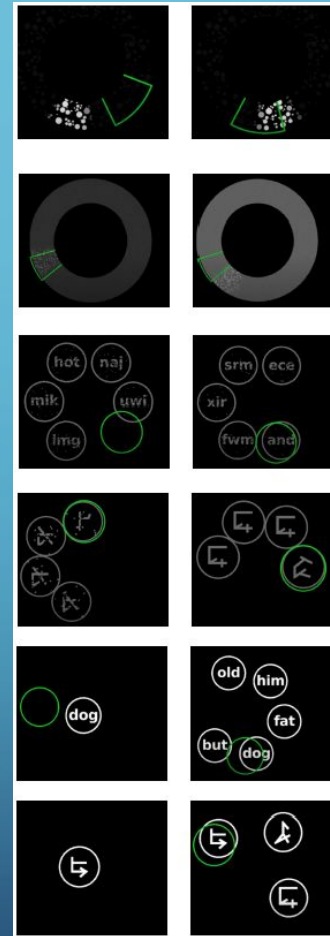
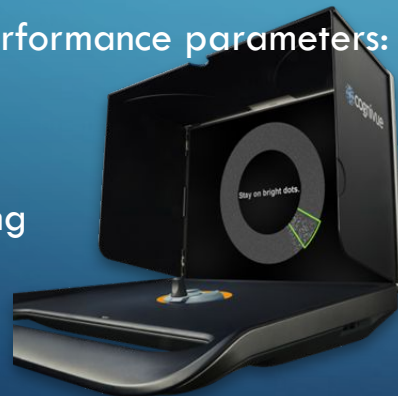


cognivue

# THE COGNIVUE THRIVE ALTERNATIVE

## Overview:

- 10-minute, self-administered, computerized test
- Evaluates 3 cognitive domains
  - Memory
  - Visuospatial
  - Executive function
- Measures 2 speed performance parameters:
  - Reaction time
  - Speed processing



Motor Skill

Visual Acuity

Word Perception

Shape Perception

Word Memory

Shape Memory

# COGNVIUE DEVICE

- CogniCover
  - Flips up when you open
  - Protects from distraction
  - Protects from glare
- CogniWheel
  - Rotates both ways
  - Only point of input for patient
  - Starting test
- Keyboard
  - Keying in demographics
  - Only for staff use
  - Retrieving data
  - Control of volume for intro video
- Evaluates 3 cognitive domains
  - Memory
  - Visuospatial
  - Executive function



# COGNIVUE INTRO VIDEO AND FIRST TEST





# CLINICAL STUDIES: COGNIVUE

Article:

Superior Test-Retest Reliability of Cognitive Assessment with Cognivue vs SLUMS During an 18-Month Longitudinal Study

Published:

January 25, 2021 in Neurological Sciences and Neurosurgery (Neurol Sci Neurosurg)

Key takeaway:

Cognivue demonstrated similar test scores over the course of an 18-month period, showing superior test re-test reliability compared to SLUMS.

## Superior Test-Retest Reliability of Cognitive Assessment with Cognivue® vs Slums During an 18-Month Longitudinal Study

John Andrefsky<sup>1</sup>, Diego Cahn-Hidalgo<sup>2</sup>, Reina Benabou<sup>3</sup> and Fred Ma<sup>1\*</sup>

<sup>1</sup>University Hospital Parma Medical Center, Ohio, United States

<sup>2</sup>Internal Medicine, New York, United States

<sup>3</sup>Cognivue Inc., New York, United States

### Abstract

**Background:** Cognivue® is an FDA-cleared computerized testing tool designed to assess early signs of cognitive impairment. In an FDA-regulated clinical study for device clearance, Cognivue demonstrated good agreement with the St. Louis University Mental Status (SLUMS) and other neuropsychological tests, and superior test re-test reliability compared to SLUMS across 2 sessions, 1 to 2 weeks apart (Cognivue regression fit:  $R^2 = 0.81$ ,  $r = 0.90$ ); SLUMS regression fit:  $R^2 = 0.67$ ,  $r = 0.82$ ). Further follow-up long-term data analysis within this cohort was done to study Cognivue's test re-test reliability vs SLUMS over time.

**Methods:** 238 subjects from the FDA-regulated clinical study for device clearance enrolled in the longitudinal study. They underwent the Cognivue test and SLUMS at up to 5 sessions over the course of 18 months. Sessions 1 and 2 were 1 week apart and were in addition to the FDA sessions. These were followed by sessions at 6, 12, and 18 months. An analysis of linear regression test-retest reliability was performed for both tests. In a separate sub-analysis, the medical records of those subjects were analyzed to determine the correlation, if any, between comorbidities or medication usage and Cognivue scores.

**Results:** Among these 238 patients, Cognivue demonstrated similar linear regression scores across comparisons (test session 1&2: regression fit:  $R^2 = 0.76$ ,  $r = 0.87$ ; test session 1&3: regression fit:  $R^2 = 0.72$ ;  $r = 0.85$ ; test session 1&4: regression fit:  $R^2 = 0.73$ ;  $r = 0.86$ ). The SLUMS test demonstrated greater variability in regression scores across test sessions (test session 1&2: regression fit:  $R^2 = 0.63$ ;  $r = 0.79$ ; test session 1&3: regression fit:  $R^2 = 0.43$ ;  $r = 0.65$ ; test session 1&4: regression fit:  $R^2 = 0.64$ ;  $r = 0.80$ ).

In the sub analysis, medical records of 203 subjects were analyzed. Overall, an increased co-morbidity count significantly decreased subjects' Cognivue scores (correlation -0.21;  $P=0.01$ ). Cardiopulmonary comorbidities had the largest impact on a patient's Cognivue score (78.0 average score for those without this comorbidity vs 67.1 average score for those with;  $P<0.001$ ). Use of anti-HTN medications was significantly correlated with a decrease in subjects' Cognivue scores (correlation -0.2;  $P=0.02$ ).

**Conclusions:** Cognivue demonstrated maintained superior test re-test reliability compared to SLUMS over up to 5 test sessions in a period of 18 months after the FDA-regulated clinical study for device clearance. An increased comorbidity count and cardiopulmonary comorbidities significantly decreased a subject's Cognivue.

**Keywords:** Cognition; Computerized Cognitive Testing; Neuropsychology; Cognitive Impairment; Memory; Motor Control; FDA-Regulated Clinical Study; Device Clearance; Perceptual Processing; SLUMS; Visual Salience

\*Correspondence to: Fred Ma, Cognivue Inc., New York, United States; Tel: 585.203.1969; Mobile: 216.469.5725; E-mail: fredma@cognivue.com

**Citation:** Andrefsky J, Cahn-Hidalgo D, Benabou R, et al. (2021) Superior Test-Retest Reliability of Cognitive Assessment with Cognivue® vs Slums During an 18-Month Longitudinal Study, Neurol Sci Neurosurg, Volume 2:1. 114. DOI: <https://doi.org/10.47275/2692-093X-114>.

**Received:** December 17, 2020; **Accepted:** January 09, 2021; **Published:** January 25, 2021

### Introduction

The US population living with cognitive impairment conditions is expected to grow in the years to come, as the population ≥65 years of age balloons from 53 million in 2018 to 88 million by 2050 [1]. The presence of these conditions increases the burden on the health system due to higher rates of long-term care utilization, per-member payments for insurance beneficiaries, and out-of-pocket spending [1]. Cognitive issues may be related to a number of causes, including life-style-related risk factors, underlying disease states, and prescription drug side effects [1-5].

Neuropsychological testing allows healthcare providers an opportunity to intervene in some cases of cognitive issues [1]. When testing uncovers mild cognitive impairment, healthcare providers can take steps to optimize existing cognitive function by accessing therapies that may preserve cognition; manage symptoms, medications, and comorbid conditions; and plan for future care [1-3,5]. Early detection of cognitive issues is key to successful intervention, with research indicating approximately 35% of dementias are attributable to modifiable risk factors [3]. By the time functional impairment manifests in people with cognitive issues, it may be too late to intervene and treat underlying disease processes [6].

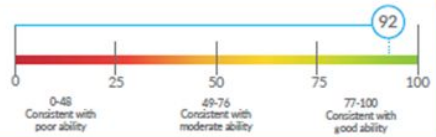
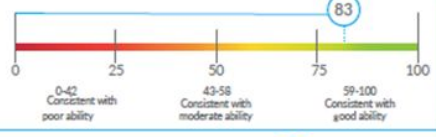

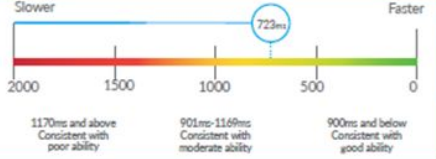
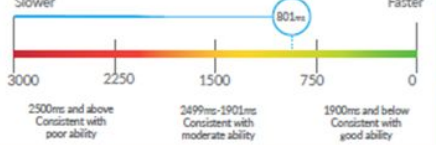


# THE THRIVE REPORT

## Key Components

- Breakdown of each domain screened.
- User-friendly format
- Immediate results

Name: Firstname Lastname Date of Birth: 00/00/0000 Test Date: 00/00/0000

Cognitive Domain Screened & Patient's Average Score	Normative Range Reference	Cognitive Domain Relevance
<b>Memory</b> 92		<b>Memory</b> is the ability to have information encoded, stored, and retrieved when needed. This score indicates that your ability to store and process information is normal.
<b>Visuospatial</b> 83		<b>Visuospatial</b> is the ability to process and interpret visual information about where objects are in space and in relation to ourselves. This score indicates that your ability to process and interpret visual information is normal.
<b>Executive Function</b> 71		<b>Executive Function</b> is higher-order cognitive processing, such as attention, problem solving, reasoning, judgment, inhibition, working memory and appropriate social behavior. This score indicates that you may have mild to moderate issues concentrating and/or problem solving.
Speed Performance Area	Normative Range Reference	Speed Performance Relevance
<b>Reaction Time</b> 723ms <small>*milliseconds</small>		<b>Reaction Time</b> is the time between the beginning of a stimulus and the beginning of a reaction to it. This score indicates a good ability to react in an appropriate and safe manner physically and quickly to situations as they occur.
<b>Processing Speed</b> 801ms <small>*milliseconds</small>		<b>Processing Speed</b> is the pace at which you take in information, make sense of it, and begin to respond. This score indicates a good ability to process a task and /or situations quickly and in an appropriate and safe manner.

Cognivue Provider Report

Disclaimer: Cognivue is not intended to be a substitute for professional medical advice, diagnosis, or treatment. Talk to your health care provider about optimal cognitive health management. Clinical contextualization required.

The background is a solid blue gradient. In the four corners, there are decorative white line-art elements resembling circuit traces or neural pathways. These elements consist of thin lines that branch out and terminate in small circles, creating a sense of connectivity and technology.

# INCORPORATING COGNIVUE INTO THE CLINIC

# RELATING COGNITIVE TO AUDIOLOGY

## Memory

- Ability to have information encode, stored and retrieved when needed.
  - Processing and understanding complex sentences.
  - Recognizing speech in challenging conditions.

## Visuospatial

- Ability to process and interpret visual information about where objects are in space: in relation to oneself, one's environment and of objects to one another.
  - Localizing sounds.
  - Utilizing visual cues effectively.
  - Processing complex sentences and recognizing speech in challenging conditions.

## Executive Function

- Higher order cognitive processes: attention, problem solving, planning, reasoning, judgement, inhibition, working memory.
  - Focusing on a single speaker in noise or multiple speakers at once.
  - Focusing on speech stimuli while ignoring irrelevant distractions.

## Reaction time

- The time between the beginning of a stimulus and the beginning of a reaction to it.
  - Responding quickly and appropriately.

## Processing speed

- The pace at which you take in information, make sense of it, and begin to respond.
  - Following rapid and/or complex conversations, particularly in challenging listening environments

# TALKING TO THE PATIENT

Managing any fears and expectations:

- Screening on how you process information.
- Cognivue is a screening tool, **NOT** a diagnostic evaluation.
- The screening is **NOT** intended to determine if you will have or will be getting dementia or Alzheimer's disease.
- The results are important to your audiologist so we may better understand and augment any hearing loss that may be contributing to any potential cognitive decline.

# TALKING TO THE PROVIDER

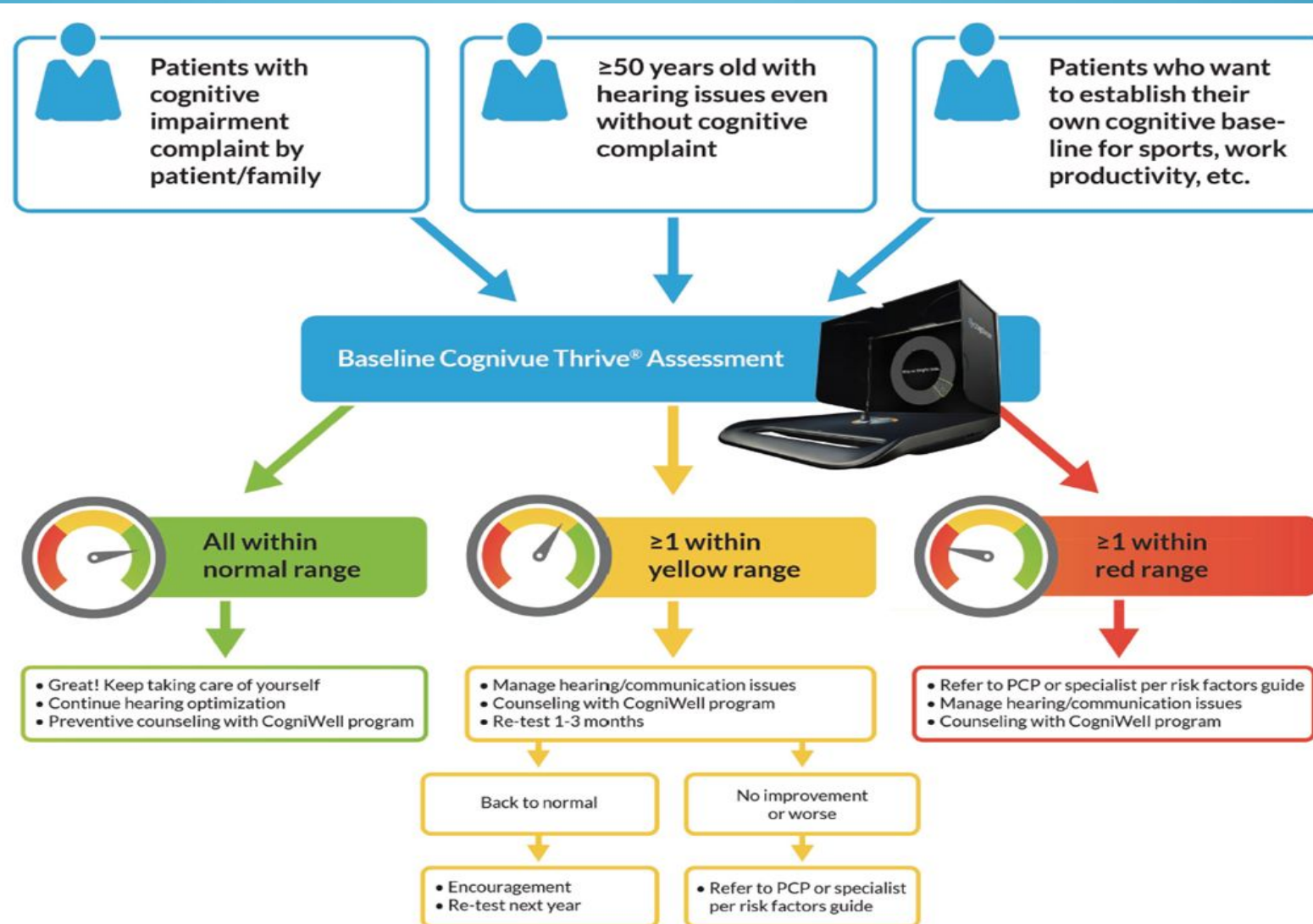
- **ALWAYS** include results in your report to referring provider.
- Greater than 1 yellow and red always refer patient back to their primary, as further assessment might be warranted.
- Great physician marketing tool.



# WHO COULD YOU OFFER COGNIVUE TO?

- New patients
  - Offering a comprehensive evaluation that looks beyond the peripheral auditory system to better understand how the patient is processing across the ear-brain pathway
  - Functional and Communication Needs Assessment / Functional Hearing Assessment
  - May guide device choice, settings, accessories, rehab
- Existing hearing aid patients
  - Measure improvements after wearing hearing aids (if took Cognivue pre-HA)
  - Ensure not an issue that was not previously identified that may affect expectations or need for accessories/rehab plans (long-time patients)
- Cochlear implant candidacy evaluations
  - Candidacy evaluations
  - Outcomes measures post implantation

# SUGGESTED PATIENT ALGORITHM FOLLOWING COGNIVUE ASSESSMENT



# HOW COGNITIVE PERFORMANCE INFORMATION COMPLETES THE AUDIOLOGIC ASSESSMENT:



More complete information leads to better patient care!

# IMPLEMENTING A MORE HOLISTIC APPROACH

## *Implementing a more holistic patient evaluation*

**Peripheral  
auditory system**  
(external, middle, inner ear)

**Central auditory  
system / Cognitive  
processes**



Basic audiologic workup

- Pure tone
- Word recognition in quiet

Expanded communications assessment  
to evaluate

- Listening skills
- Cognitive and linguistic interpretation
- Communication strategies



# COMMON ELEMENTS OF FUNCTIONAL NEEDS ASSESSMENT


- Medical case history
- Quality of Life questionnaire
  - depression, dizziness, hearing, hyperacusis, motivation, and tinnitus
- Vestibular screening
- Vision screening
- Dexterity screening
- Audiology testing:
  - comfortable level
  - acceptable level
  - unaided real ear
  - speech-in noise
- Auditory processing
- Cognitive screening

Patient-Centered Care



# RESOURCES FOR CLINICIANS

- Audiology to MD: Referral resources
  - Introduction Flyers
  - Letter Templates
- Educational Videos
- Clinic marketing materials
- Cogniwell: wellness coach
  - Available to all Audiology Clinics



### Why We Incorporate Cognitive Screenings as Part of Our Audiological Evaluations

**Strong Interrelationship Between Hearing and Cognition**

- Increasing evidence has linked age-related hearing loss to more rapid progression of cognitive decline and incidental dementia.<sup>1</sup>
- Long-term hearing deprivation of auditory inputs can impact cognitive performance by decreasing the quality of communication leading to social isolation and depression and facilitate dementia.<sup>2</sup>
- Limited cognitive skills from aging may reduce the cognitive resources available for understanding speech, especially in background noise.<sup>3</sup>

**Three Fundamental Processes Needed to Hear Well and Understand Speech**

Interface between the acoustic environment and the brain, detects and codes

- Peripheral Auditory System
- Central Auditory System
- Cognitive Processes

Modifies and analyzes

Enhances perception, understanding content, and storing information

### Efferent Top-Down Processing Critical to Speech Perception<sup>4</sup>

**Efferent Nervous System Top-Down Processing**  
Emphasizes certain aspects of the incoming signal, allowing for improvements in perception. Used to compensate for poorly resolved bottom-up sensory cues.

**Audibility**

**Afferent Nervous System Bottom-up Processing**  
Additional processing refines signal and extracts important elements that are used for higher-level processing. Neural signal passed up through auditory system. Sounds are initially coded.

## Hearing Loss Can Impact Your Cognitive Health

The Audiologist is your partner in cognitive health.




- Hearing loss has been linked with a decline in cognitive function.<sup>1,2,3,4</sup>
- Taking action in the management of hearing loss may delay or slow advancement of cognitive decline.
- New technology enables accurate screening by your Audiologist in this office.

Now available in this office!



**cognivue**  
cognivue.com

## Hearing ↔ Cognition



- Your Audiologist now offers cognitive screening that can measure your current cognitive performance while you are in the office.
- This is not an IQ test or list of questions, rather a simple, automated assessment that takes about eight to ten minutes to complete.
- The results can help your Audiologist determine your cognitive health and ensure your hearing correction solutions are right for you.
- Remember, untreated hearing loss can contribute to cognitive decline, **talk to your Audiologist today.**

1. Journal of the American Geriatrics Society, Longitudinal Relationship Between Hearing Aids Use and Cognitive Function in Older Americans.  
2. World Health Organization, Risk Reduction of Cognitive Decline and Dementia, WHO Guidelines 2019.  
3. Livingston G, Sommerlad A, Oranga V et al. Dementia prevention, intervention, and care. Lancet 2020;395:2050-2164.  
4. ACTA Otorinolaringologica Italica, A review of new insights on the association between hearing loss and cognitive decline in aging, 2016.

**cognivue**  
cognivue.com

Cognivue Think is an eductive test for assessing cognitive function. It is not a stand-alone diagnostic test.




# SUGGESTIONS FOR BILLING A COGNITION SCREENING

## My Practice

- 92700 Unspecified Code
  - Need to denote it is a cognitive screening
  - Have patients sign ABN (Medicare) or acknowledgement, GFE
  - Some insurances will cover, many do not.
- Some clinics bundle into another service

# BENEFITS OF IMPLEMENTING COGNIVUE

- More complete patient-centered care
- Differentiate your practice
- Expand service revenue
- Increase patient traffic
- Integrates audiologist more within the healthcare system

The background is a solid blue gradient. In the four corners, there are decorative white and light blue circuit-like patterns consisting of lines and small circles, resembling a printed circuit board or a network diagram.

Thank you to Dr. Al Turri for  
offering me guidance and  
assistance with this presentation.



# REFERENCES

- Claes AJ, Van de Heyning P, Gilles A, Van Rompaey V, Mertens G (2018) Cognitive outcomes after cochlear implantation in older adults: A Systematic Review. *Cochlear Implants Int* 19(5):239-254.
- A Systematic Evidence Review of the Signs and Symptoms of Dementia and Brief Cognitive Tests Available in VA. (2010). PsycEXTRA Dataset. doi:10.1037/e587092011-001.
- Getz, L. (n.d.). MMSE vs. MoCA: What You Should Know. Retrieved November 04, 2020, from [https://www.todaysgeriatricmedicine.com/news/ex\\_012511\\_01.shtml](https://www.todaysgeriatricmedicine.com/news/ex_012511_01.shtml).
- Ranson, J. M., Kužma, E., Hamilton, W., Muniz-Terrera, G., Langa, K. M., & Llewellyn, D. J. (2018). Predictors of dementia misclassification when using brief cognitive assessments. *Neurology: Clinical Practice*, 9(2), 109-117. doi:10.1212/cpj.0000000000000566.
- Cahn-Hidalgo, D., Estes, P. W., & Benabou, R. (2020). Validity, reliability, and psychometric properties of a computerized, cognitive assessment test (Cognivue®). *World Journal of Psychiatry*, 10(1), 1-11. doi:10.5498/wjp.v10.i1.1.
- Ranson, J. M., et al. (2018). Predictors of dementia misclassification when using brief cognitive assessments. *Neurology: Clinical Practice*, 9(2), 109-117. doi:10.1212/cpj.0000000000000566.
- Shen J, Anderson MC, Arehart KH, Souza PE. Using Cognitive Screening Tests in Audiology. *Am J Audiol*. 2016 Dec 1;25(4):319-33.
- Irace, Chern, Golub. Hearing loss and cognition: something to think about, *ENT & Audiology News*, Volume 30(1), March/April 2021.
- Lin FR, Ferrucci L, An Y, et al. Association of hearing impairment with brain volume changes in older adults. *NeuroImage* 2014; 90:84-92.q.
- Livingston G, et. Al (2017) Dementia prevention, intervention, and care. *The Lancet Commissions*, Volume 390: 2673-2734.
- Livingston G, et. Al (2020) Dementia prevention, intervention, and care: 2020 report of the Lancet Commission. *The Lancet Commission*, Volume 396:413-446.
- Andrefsky L, Cahn-Hidalgo D, Benabou R, and Ma F (2020) Superior Test-Retest Reliability of Cognitive Assessment with Cognivue vs Slums During an 18-month Longitudinal Study. *Neurol Sci Neurology*, Volume 2:1. 114.
- Black S and Souza P (2020) Cognitive-Screening Practices Among Audiologists. *Audiology Today*, Volume 21 (5): 44-51.
- Glick H and Sharma A (2022) The Ever-Changing Brain. *Audiology Today*, Volume 34 (5): 44-52.
- Sanders M, Kant E, Smit A and Stegeman I (2021) The Effects of Hearing Aids on Cognitive Function: A Systematic Review. *PLOS ONE* 16(12): e0261207.
- Calvino M, Sanchez-Cuadrado I, Gavilan J, Gutierrez-Revilla MA, Polo R and Lassaletta L (2022) Effect of Cochlear Implantation on Cognitive Decline and Quality of Life in Younger and Older Adults with Severe-to-Profound Hearing Loss. *European Archives of Oto-Rhino-Laryngology*, <https://doi.org/10.1007/s00405-022-07253-6>.
- Knopman D and Peterson R (2014) Mild Cognitive Impairment and Mild Dementia: A Clinical Perspective. *Mayo Clin Proc*. 89(10): 1452-1459.
- Cognitive Impairment: A Call for Action (2011). [www.cdc.gov/aging/healthybrain/index.htm](http://www.cdc.gov/aging/healthybrain/index.htm).



KATE EIMERS, AU.D.  
KEIMERS@DREIMERSHEARINGCLINIC.COM

