CENTRE FOR NEURO SKILLS®

Neurological Consequences of COVID-19: Practical Treatment Considerations

Gary S. Seale, PhD, LPA, LCDC, CBIS-T
Regional Director of Clinical Services

Disclaimer

DISCLAIMER

The views and opinions expressed in the written materials and in any of the presentations at this conference are those of the presenter and do not necessarily reflect the official policy or position of the State of Nevada or the Department of Business and Industry, Division of Industrial Relations. The Division does not warranty the materials' completeness or accuracy. Further, the content should not be taken as medical or legal advice and is for informational purposes only.

Learning Objectives

- Describe how COVID-19 can cause neurological injury
- List at least 5 neurological symptoms of COVID-19
- Describe Long-COVID and 3 risk factors for Long-COVID
- Discuss treatment interventions for COVID-related neurological symptoms
- Discuss the importance of individualized and interdisciplinary rehabilitation in recovery from Long-COVID

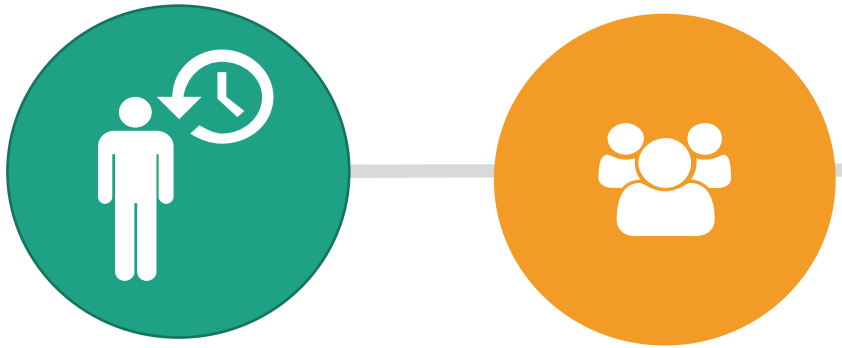
Acquired Brain Injury (ABI)

An ABI is any injury to the brain that is not hereditary, congenital, degenerative, or induced by birth trauma.

Traumatic brain injury (TBI) is a subset of ABI and is caused by trauma to the brain from an external force.

Statistics

Traumatic Brain Injury Incidence/Prevalence in the US



One person every 15-22 seconds

2.5 million every year

2.2 million are treated and released from an Emergency Department

284,000 are hospitalized

Approximately 53,000 die

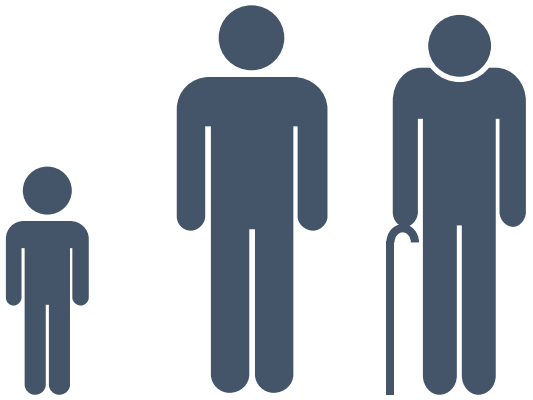
90,000 develop a TBI-related disability each year

More than 6 million Americans live with a disability from TBI

Brain Injury Association of America & Center for Disease Control
https://www.cdc.gov/traumaticbraininjury/get_the_facts.html

TBI Statistics – Continued

Primary causes of TBI:



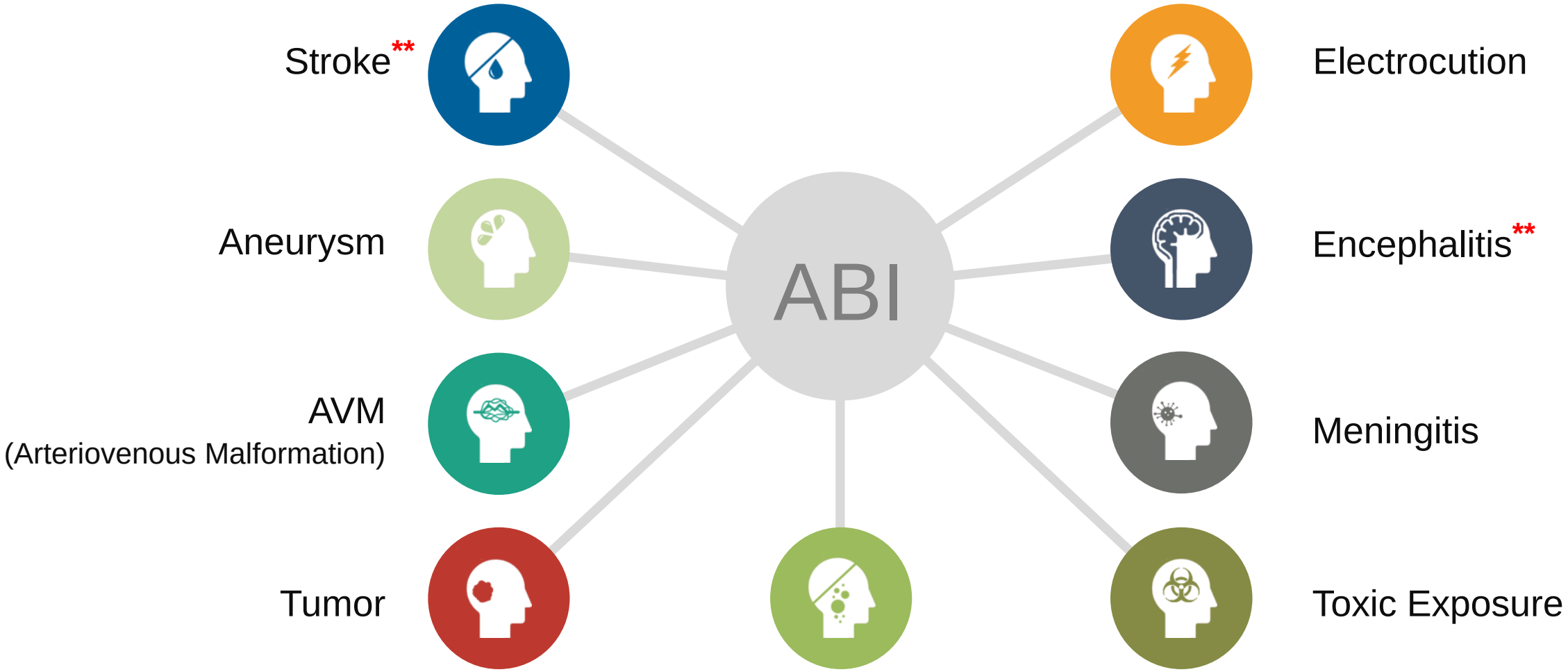
< 4 15-24 65+

Peak incidence ages

- 48% from falls
- 13% from motor vehicle accidents
- 17% from blows to the head (including sports injuries)
- 10% from firearms and assaults
- 13% other/unknown

- 80 – 90,000 survivors develop chronic disabilities each year (physical, cognitive, emotional) stemming from brain injury
- 5.3 million Americans live with disabilities from TBI

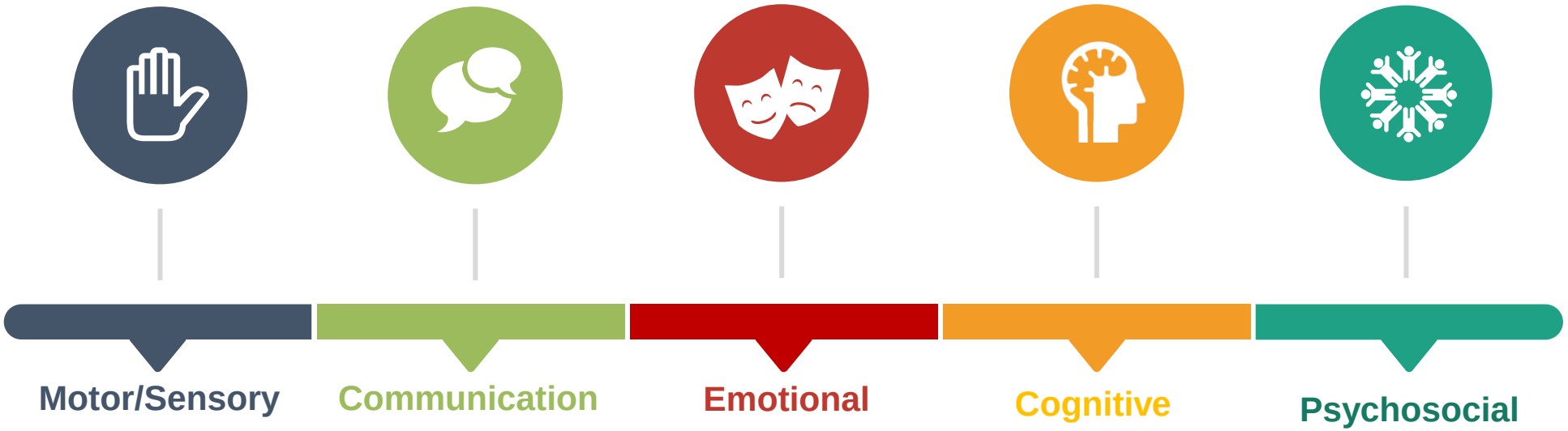
Causes of Acquired Brain Injury



** *Possible Covid-19 contributors*

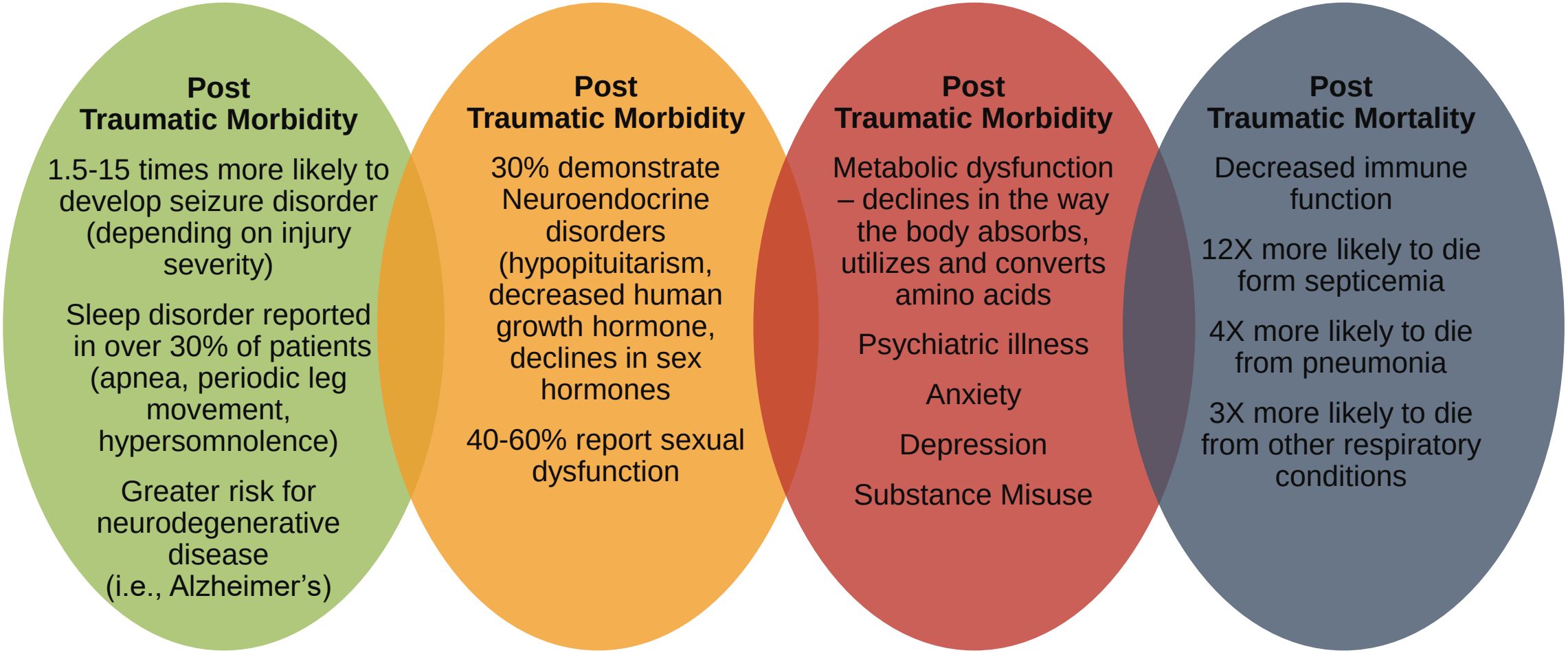
Acquired Brain Injury Risk Factors

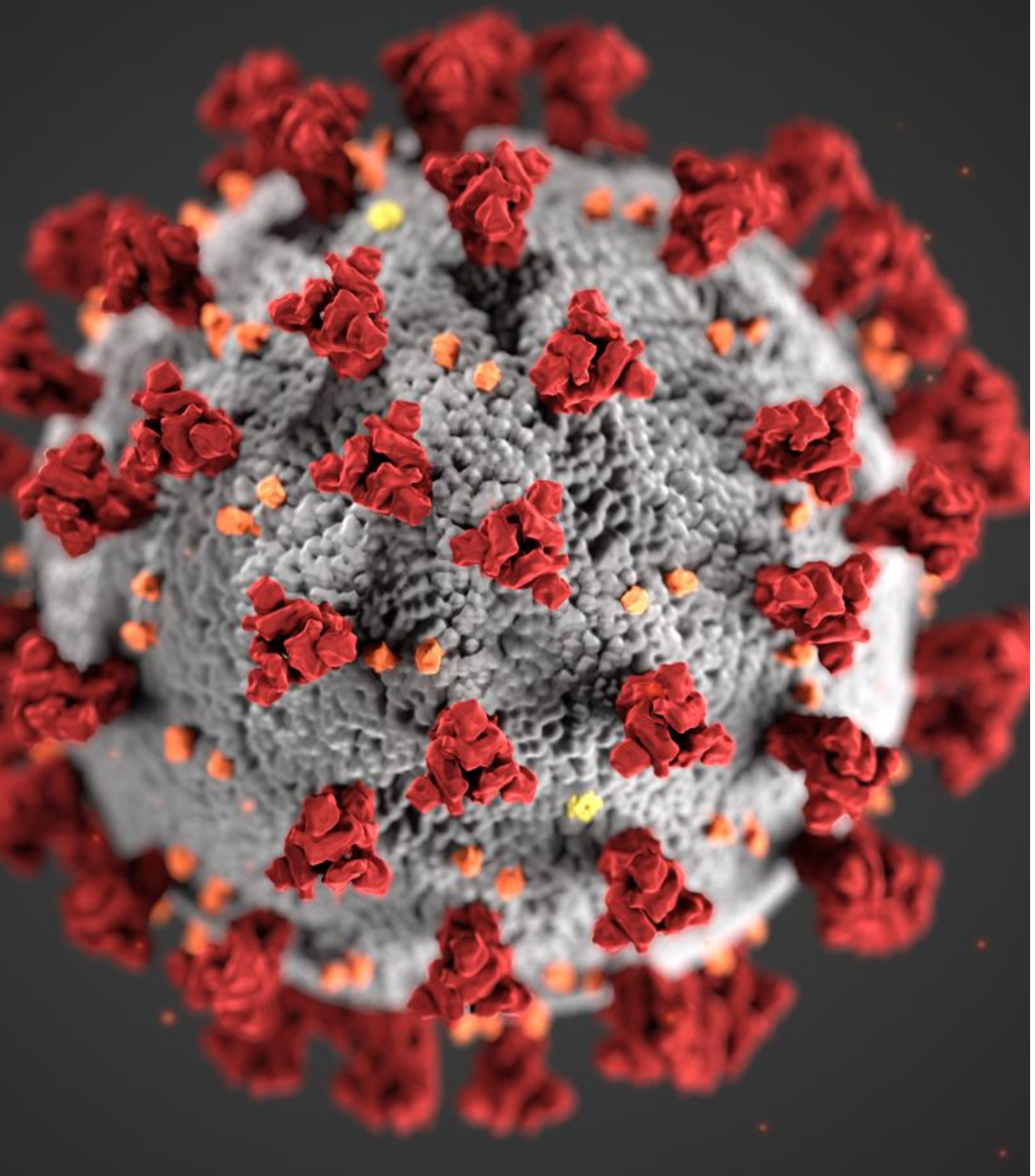
Consequences of Brain Injury



Medical Complications

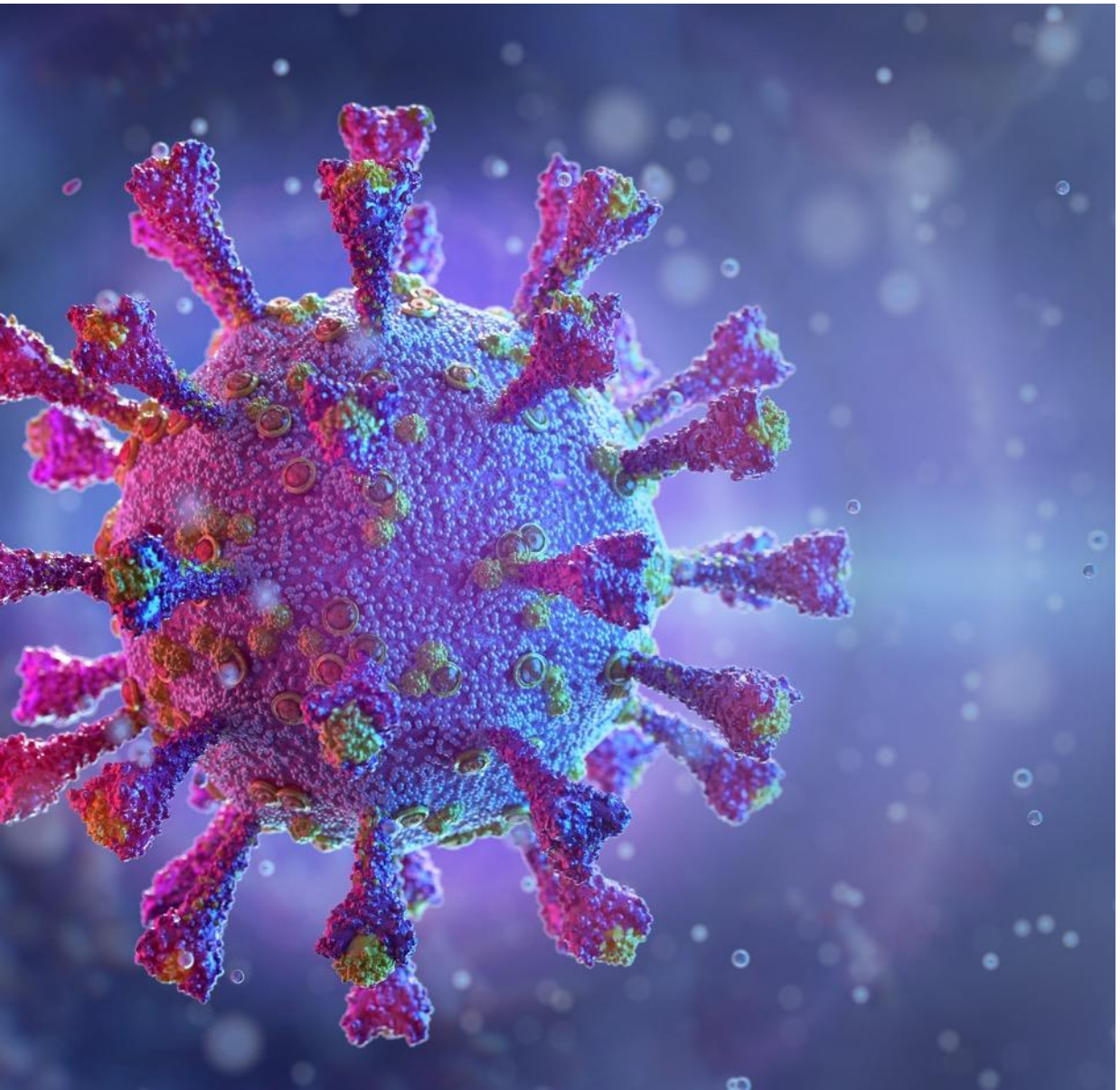
(Masel & DeWitt, 2010)





Covid - 19

COVID-19 Pandemic



- ABI population among the most vulnerable
- “Stay at Home” orders issued to slow the spread
- ABI patients risk regression, isolation, depression if not treated
- Dilemma: How to provide therapy while reducing risk for exposure?
  - ✓ Many programs pivoted to TeleRehabilitation technology

COVID-19 Pandemic

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)

- Considered a respiratory pathogen that can lead to respiratory distress, decreased O2 saturations, pneumonia, etc.

- Also associated with neurological complications: confusion, stroke, neuromuscular disorders during acute COVID-19
- Neurological Consequences of COVID-19

COVID-19 Statistics

As of June 15, 2022,

85 million cases of COVID-19 had been reported in the US

It is estimated that between 10%-20% of people who had COVID go on to develop lasting symptoms (8-16 million)

Those who develop Long-COVID **80%** report **cognitive deficits.**

People diagnosed with Long-COVID rank cognitive issues and mental health issues at the top of “concerns list” .

Persistent Symptoms = Long COVID

Long COVID, Post-COVID Conditions, or Ongoing Symptomatic COVID include a wide range of new, returning or ongoing health problems. People may experience symptoms more than 4 weeks after infection.

If symptoms persist for longer than 12 weeks, and cannot be explained by another condition (i.e., chronic fatigue syndrome, post-Lyme disease, etc.), the term is, “Post-COVID Syndrome”.

Persistent Symptoms = Long COVID

In a June 2021 AMA special meeting, a policy was adopted to support the development of an ICD-10 code or family of codes to recognize Long-COVID, or Post-Acute Sequelae of SARS-CoV-2 infection, or PASC

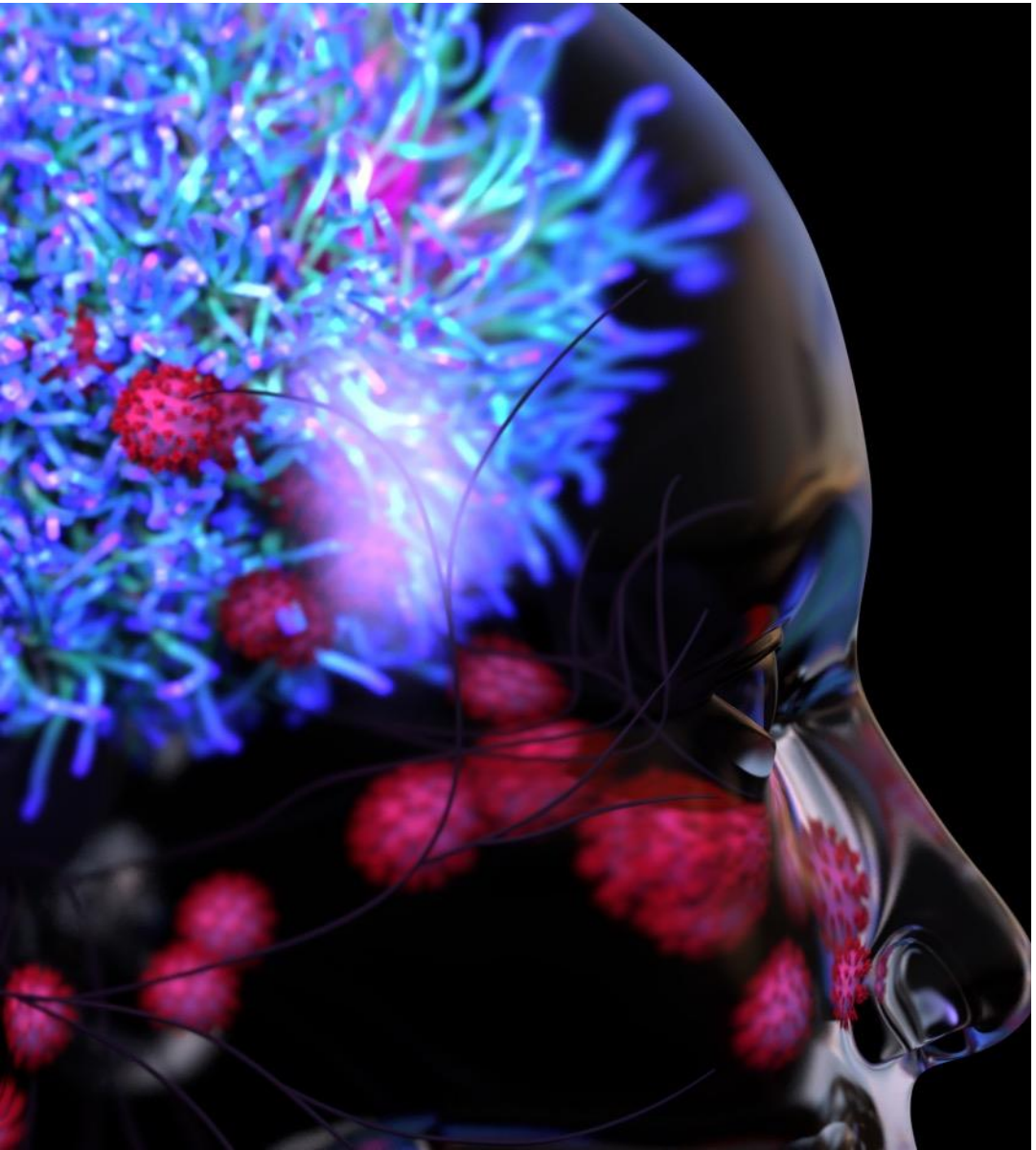
As of July, 2021 Long-COVID, aka Post-COVID Conditions, can be considered a disability under the ADA

Risk Factors for Long-COVID

Who is likely to develop it?

- More severe COVID; hospitalized
- Underlying health conditions
- People with disabilities
- Unvaccinated
- No/mild symptoms, never hospitalized
- Younger than 50; healthy and active prior; female gender

COVID-19 and Brain Function



- Virus likely enters via nasal passages; when it reaches the olfactory bulb it can travel along this nerve pathway to other areas of the brain
- Inflammatory response – cytokines are molecules produced by the immune system to fight infection; excessive/uncontrolled inflammatory reaction can interfere with communication between neurons
- Poor heart and lung function can lead to hypoxia
- ICU treatments, sedation, intubation, multiple medications, can impair cognition (“brain fog”)

Common Neurological Consequences of COVID-19

- Impaired concentration
- Headache
- Sensory disturbance (taste & smell)
- Mood disorders (anxiety & depression)
- Insomnia
- Fatigue & “brain fog”

No Organ / Organ System is Spared

Fatigue (51%)

Poor concentration (28%)

SOB & Chest tightness (36%)

Abdominal pain & Nausea

Joint & muscle pain; numbness

Sleep disorders

Headaches

Anxiety & Depression

Cough, tinnitus, sore throat

Decreased appetite & weight loss

Skin rashes & hair loss

Palpitations – slow or fast heart rate

Types of Long COVID

There are 3 categories

COVID-19

Can result in Long-COVID due to cell damage in multiple organs/organ systems caused by the virus.

Chronic hospitalization

When the person is in the hospital, or bed-bound for weeks.

- Muscle weakness
- Fatigue
- Cognitive dysfunction due to hypoxia
- Psycho-social stress (post-ICU syndrome)

Symptoms appear after recovery from infection.

Various patient factors involved, as well as the interplay between the immune system and inflammatory markers.

Long-COVID Presentation Can Vary...

- Effects of COVID can last weeks or months after recovering from initial infection
- Reported symptoms vary widely
- Some symptoms can last 5-7 months with a small percentage of people reporting symptoms at 12 months post infection

General Treatment Considerations

General Treatment Considerations

Due to variation in reported duration and etiology of symptoms, an individualized approach is indicated

Ask how the condition is impacting patient:

1. *What aspects of your condition most affects your life?*
2. *What are you hoping to get back to?*
3. *If you did not have these symptoms, what would you do (be doing) today?*

Interdisciplinary approach, with case management, to coordinate therapies & medical specialties.

- **Physical therapy** – fatigue, weakness, decreased endurance, joint and muscle pain
- **Counseling** – pain, anxiety/depression, poor sleep patterns, PTSD (post intensive care)
- **Occupational therapy** – establishment of positive daily routine, dietary considerations
- **Speech Language/CR** – attention/concentration, memory, executive functions
- **Nursing** – medication management; other symptom management

Physical Therapy

- Strengthening
- Balance and gait training
- Endurance training
- Treat muscle/joint pain with stretch, yoga, heat, Tens Unit
- Fatigue Management:

- Pacing and taking breaks
- Time activities during “best” hours
- Don’t stop, but gradually increase
- Extra cardio sessions/exercises
- Watch for POTS

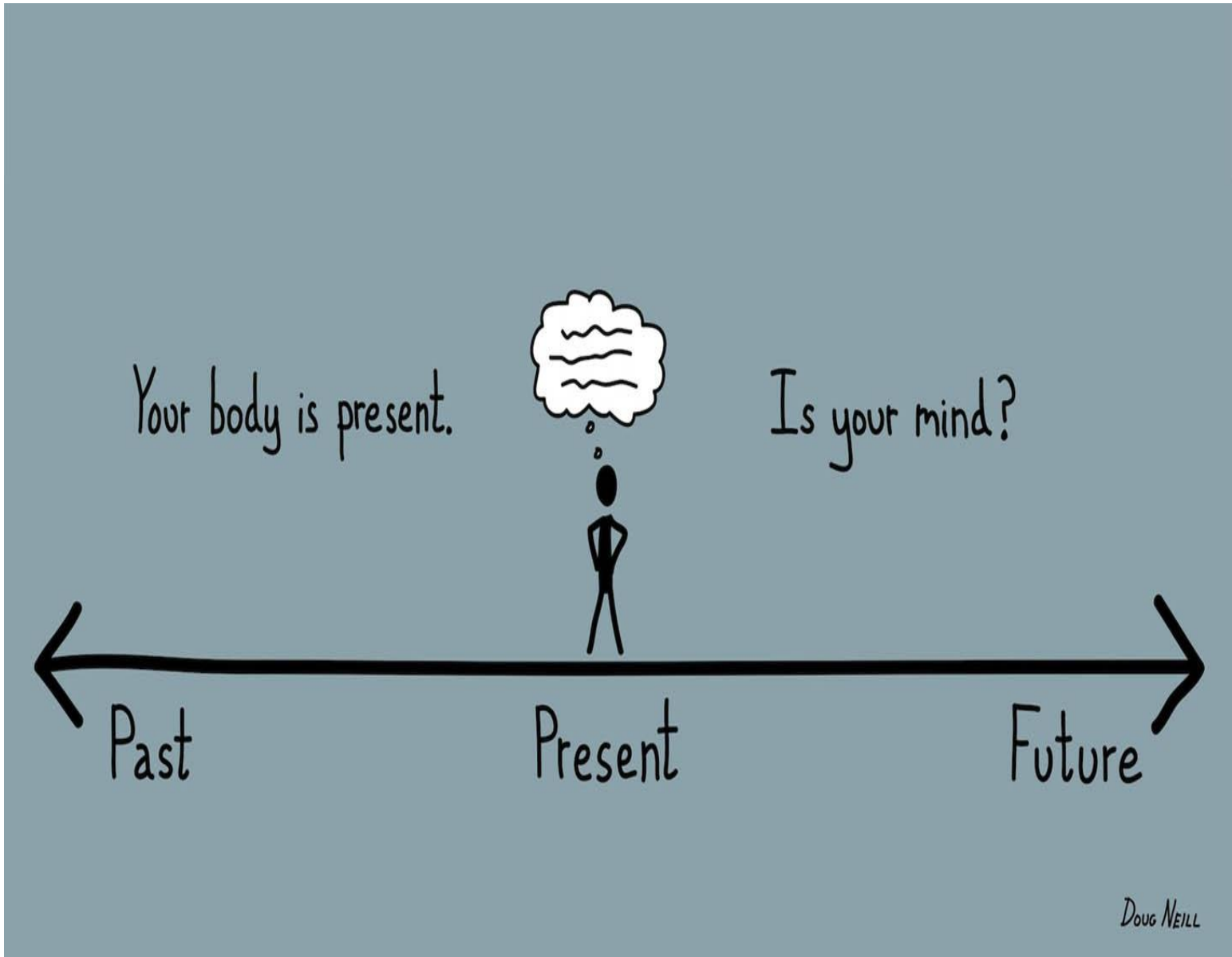
Counseling

Effective Techniques include:

- Trauma based therapies
- Cognitive-Behavior Therapy (for anxiety; establishing new behaviors)
- Acceptance and Commitment therapy (for dealing with uncertainty)
- Positive Psychology Practices
- Adaptive (approach-oriented) coping strategies for managing frustration

Relaxation Through Mindfulness, Breathing, & Imagery

- "*A mental state achieved by focusing one's awareness on the present moment, while calmly acknowledging and accepting one's feelings, thoughts, and bodily sensations*"
- What's a mindfulness practice?
- Examples of simple mindfulness practices



Positive Psychology Practices

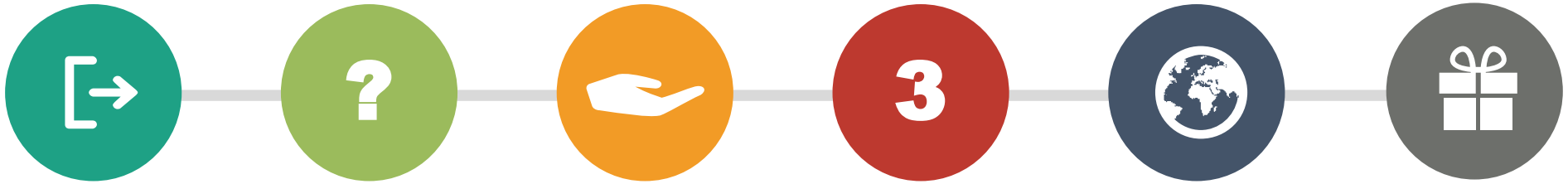
- Start a gratitude list and review it
- “Three Good Things”
- Write a letter of thanks to someone and deliver it personally
- Complete a BAT (Blessings, Achievements, Talents) exercise – keep it close by and review it often

Boost the Positive with Intentional Actions

- Start and end on a “positive”
- Help others
  (random acts of kindness)
- Downward comparisons
  (rather than thinking, “I wish I….”, think about “I’m glad I’m not…”). Then think about ways you can help
- Join a cause (become a part of something greater than yourself)

Positive Coping

Positive strategies are problem-focused or approach-oriented and include:



Dealing directly with the situation

Obtaining information

Seeking assistance

Active problem-solving (3-step process)

Altering the environment

Reappraising the situation as positive (what is the gift or lesson to be learned)

“Blank Spaces”

Common complaint after hospitalization

- Family “fill in gaps”; use information from diaries, show pictures
- Medical team/medical records document recovery
- Newspaper articles, YouTube videos, etc. to bring person “up to speed”
- Review current events and what transpired prior

Counseling - PICS

Post Intensive Care Syndrome

Sedating medications, immobility, intubation, isolation

- Symptoms include:
  - Cognitive (attention, memory)
  - Emotional (anxiety, depression, PTSD)
  - Physical (fatigue, difficulty breathing, insomnia)

Trauma-based therapy techniques and Cognitive Behavior therapy techniques (CBT) have been effective

Fear Not (*let not your heart be troubled*)

Our brains are built to scan the environment for threats

Threats trigger “fight or flight”

- Impairs judgment and limits response repertoire
- Fear often breeds more fear
- About 93% of the things we worry about never come to pass
- *“I’ve been through some terrible times in my life, a few of which actually happened”*

  - Mark Twain

Building Resilience and Self-Efficacy

Self–Efficacy

High assurance in capabilities

Approach difficult tasks

- Foster interest
- Sustain effort

Doubt capabilities

- Shy away from challenge
- Low aspirations
- Dwell on personal deficiencies
- Give up quickly

Recap – Counseling Interventions

Focus on the things in your control vs. those that are not

Engage in those practices that help you feel safe; practice self-care

Stay in the present; maintain proper perspective

Engage in Positive Psychology practices

*Gratitude lists

*"Three good things"

*Help others

Get outside and enjoy nature

Stay connected and don't be afraid to ask for help

Engage in Resilience Practices

*Think about a time when you overcame adversity

*Create a resilience library

*Engage in your spiritual practice

Cognition – What is it?

The mental action and process of acquiring knowledge and understanding through thought, experience, and the senses.

Mental activity, such as:

- Attention, perception, comprehension, remembering, or using language.
- Ability to mentally represent, organize, or manipulate the environment.

Cognitive Rehabilitation

Systematic and hierarchical application of therapeutic and medical interventions to remediate or compensate for deficits.

Interventions

Encourage patients to:

- Attend to, select, understand, and remember relevant information
- Apply the information appropriately

Cognitive Rehabilitation

Generally carried out as part of a service delivery system that is interdisciplinary in nature.

Services are tailored to meet individual needs and relevant to person receiving services.

Bring about change that impacts daily functioning in the community.

Cognitive Rehabilitation

Cognitive Remediation

("restorative")

- Re-establish or strengthen specific cognitive skill or process

Strategy Training

("compensatory strategies")

- Development and strategies that compensate for residual cognitive deficits

Goals of Cognitive Rehabilitation

Assess the kinds and limits of learning

- Sensory/motor function
- Attention/concentration
- Memory
- Academic performance
- Visual spatial skills
- Language
- Executive functions
- Emotional/ behavioral functioning

Repeated practice of skills

Use of strategies and self-monitoring in “real life” environments

Re-establish or strengthen cognitive skills.

Develop proficiency and reliability of compensatory strategies

Principles of Cognitive Rehabilitation

Environmental Stimulus

Quiet

to

Distracting

Task Complexity

Simple

to

Complex

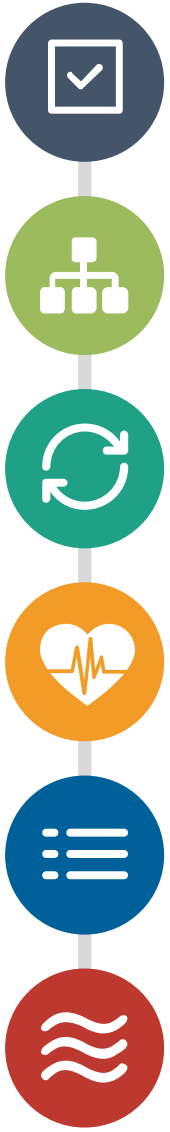
Cognitive Distance

Concrete

to

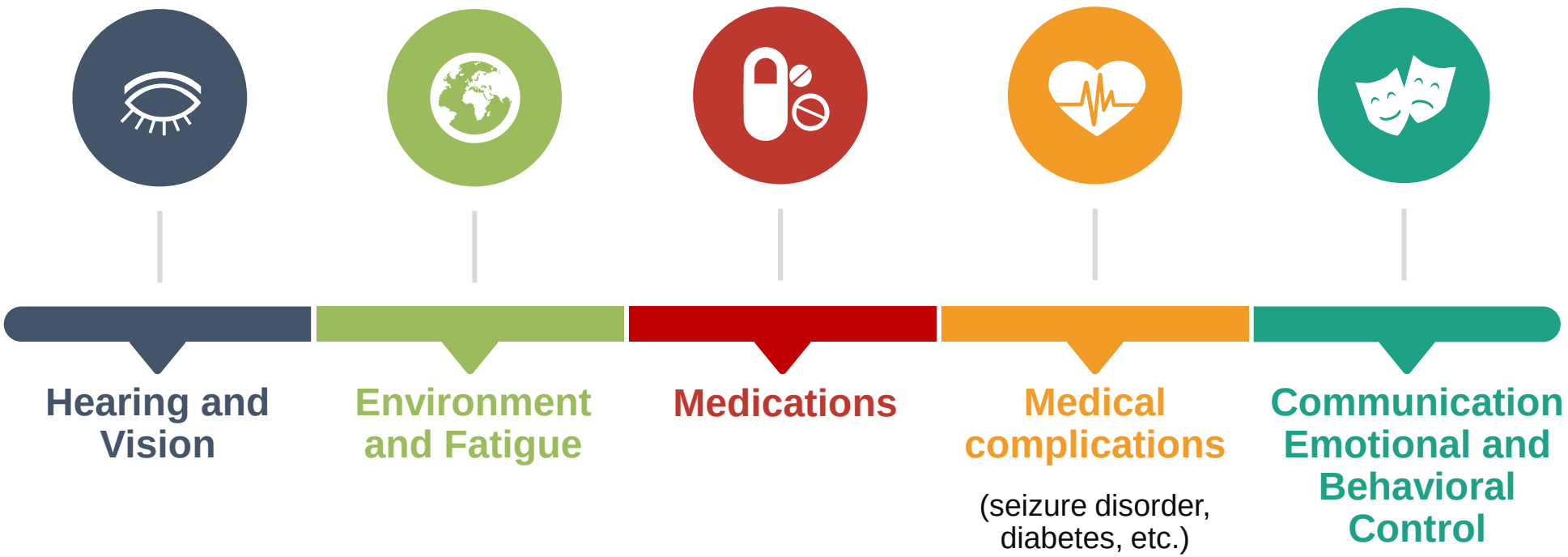
Abstract

Therapy Principles – Evidence-based Treatment



- Treatment must be grounded in theory/based on evidence-based literature
- Therapy activities organized hierarchically
- Provide consistency and repetition
- Treatment decisions based on patient performance
- Facilitate generalization
- Be flexible/adapt therapy format to patient

Other Variables to Consider



Attention Process Training; Memory

Acquisition

Patient taught a technique or strategy and how it relates to goal or outcome

Application

Using technique in a controlled environment until mastery is achieved

Adaptation

Using technique in multiple environments; generalize to community or DC placement

Cognitive Deficits Executive Functions

- Decreased self monitoring/self awareness
- Planning/sequencing deficits
- Time Management deficits
- Decreased functional problem-solving
- Decreased initiation

Strategies - Executive Functions

Planning deficits - planning sheets (leisure outings, mobility, shopping, etc.)

Sequencing deficits - detailed checklists

Time management deficits - time estimation/prediction, alarms, use of above strategies (i.e., planning sheets, checklists)

Decreased self-monitoring/self-awareness – three levels of awareness; prediction/debriefing; direct feedback; group/peer feedback; videotaping; “guided failure”

Strategies - Executive Functions (cont.)

Decreased problem-solving

Modified Ben Yishay problem-solving model:

- Identify problem
- Generate multiple solutions
- Evaluate consequences of each
- Choose best option and implement.

Decreased initiation –

Alarms, environmental cues and prompts, physical prompts (usually first step in sequence)

Experience-Dependent Learning

Neuroplasticity Principles

Cortical Reorganization

- Requires structure, repetition, & consistency
- Experienced/trained staff
- Practice: effort to perform, meaningful, functional

Neuronal circuits are modified by experience and learning. Harnessing this inherent ability for neuronal circuit change may be essential to maximize the benefit of rehabilitation.

Kimberly et al JRRD 47/9, 2010

Experience dependent change can occur at multiple levels of the central nervous system, from the molecular or synaptic level to the level of cortical maps and large-scale neuronal networks.

…nor is substantial recovery or restitution of function likely in the absence of targeted intervention.

Kelly, Foxe, Garavan, APMR 87/2, 2006

Sleep Disturbance Following COVID-19

>30% of patients with moderate-to-severe TBI will experience sleep disorder

- Failure to progress through the stages of sleep/REM sleep = daytime hypersomnolence
- Periodic leg movement
- Sleep Apnea

Quarantine and “lockdowns” disrupted circadian rhythms

THE DANGERS of SLEEP DEPRIVATION

By APage

Just one week of insufficient sleep alters the activity of our genes, which control our response to stress, immunity, inflammation and overall health. Here are the hidden health hazards caused by sleep deprivation.


HIGHER RISK OF HYPERTENSION
Sleeping between 5 and 6 hours a night increases the risk of having high blood pressure.
1
2
3
4
5
HIGHER RISK OF HEART DISEASE
When we sleep our blood pressure drops. Not experiencing this nightly drop in pressure is a risk factor for heart disease.
HIGHER RISK OF STROKE
Lack of sleep negatively affects cardiovascular health, increasing the risk of restricting blood flow to the brain.
FRIES
INCREASED RISK OF BREAST CANCER
Late night exposure to light is linked to reduced melatonin production, which disrupts estrogen production. Too much estrogen promotes the growth of breast cancer.
HIGHER RISK OF DIABETES
Lack of sleep triggers our stress response, leading to the release of the stress hormones cortisol and norepenephrine, which are associated with insulin resistance.
UNHEALTHY CRAVINGS
Sleep helps maintain a healthy balance of the hormones that make you feel hungry (ghrelin) or full (leptin). Lack of sleep causes ghrelin levels to increase and leptin to decrease.
HIGHER RISK OF INJURY

http://www.healthcentral.com/sleep-disorders/cf/slideshows/5-health-issues-that-arise-from-sleep-deprivation/hypertension-risk-increases/
http://www.nhlbi.nih.gov/health/health-topics/topics/sdd/howmuch.html
http://www.nhlbi.nih.gov/health/health-topics/topics/sdd/signs.html
http://www.medicalnewstoday.com/articles/256912.php

HealthCentral

Proper Sleep Hygiene

Get 7-8 hours of quality sleep

- Keep a consistent routine
- Go to bed a little earlier
- Turn off electronics 30 minutes before bed/limit light exposure
- Keep room at a cool temperature
- Turn clock face away from view
- If your mind “races” use a relaxation technique/get out of bed until you are tired
- Use your bed for sleep and sex

Tools

Residential Rehabilitation/Treatment

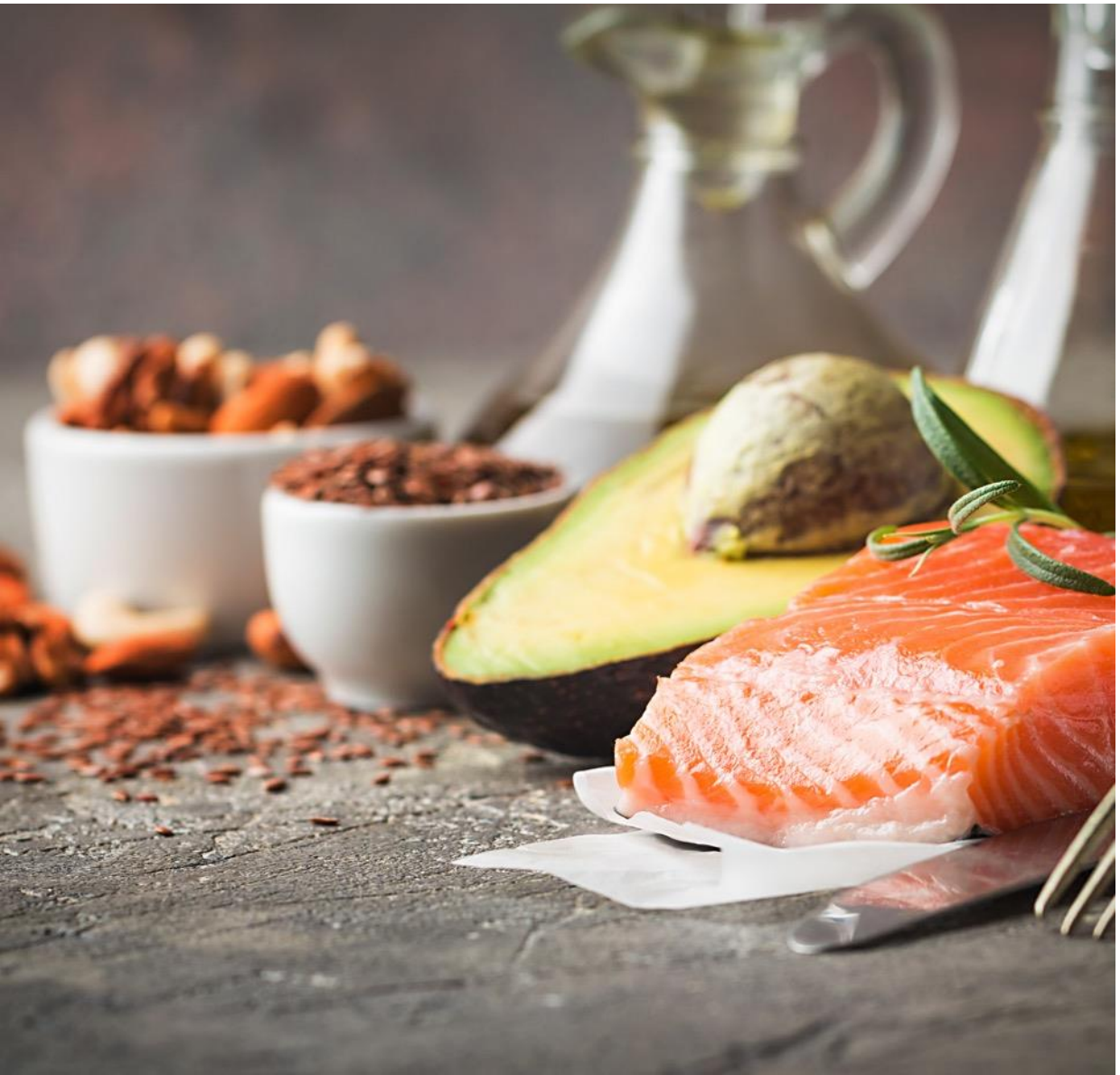
Synchronization of biological rhythms **becomes unstable** when the level of activities of daily living *decreases*.

- Heart rate
- Body temperature regulation
- Sleep-wake rhythm

Strengthening sleep-wake rhythm increases competence of stroke survivors living in the community.

Motohashi, Kyushu University Press, 1999

Other Considerations - Diet



Eat to reduce inflammation

Reduce intake of pro-inflammatory foods: processed foods, sugar, saturated fats, ETOH & caffeine

Increase intake of Omega 3's (fish, beans, nuts), fresh fruits and vegetables (Mediterranean diet) and hydrate

Proper diet also shown to have a positive impact on anxiety, depression, sleep disorders and musculoskeletal pain

Between therapy sessions – THP's

- Practice breathing exercises
- Play brain games
- Stay active – walk, light exercise
- Use good sleep hygiene practices
- Get outdoors and enjoy nature
- Connect with supports
- Stay motivated – set small goals, track progress & build in rewards

Acquired Brain Injury and “Malingering”

What is exaggerated \ over-reporting and what is the best approach?

What is real ?

Definition/understanding:

Malingering is pretending to have an illness in order to get a benefit. The feigned illness can be mental or physical. Malingering is also when someone exaggerates symptoms of an illness for the same purpose. Malingering is an act, not a condition.

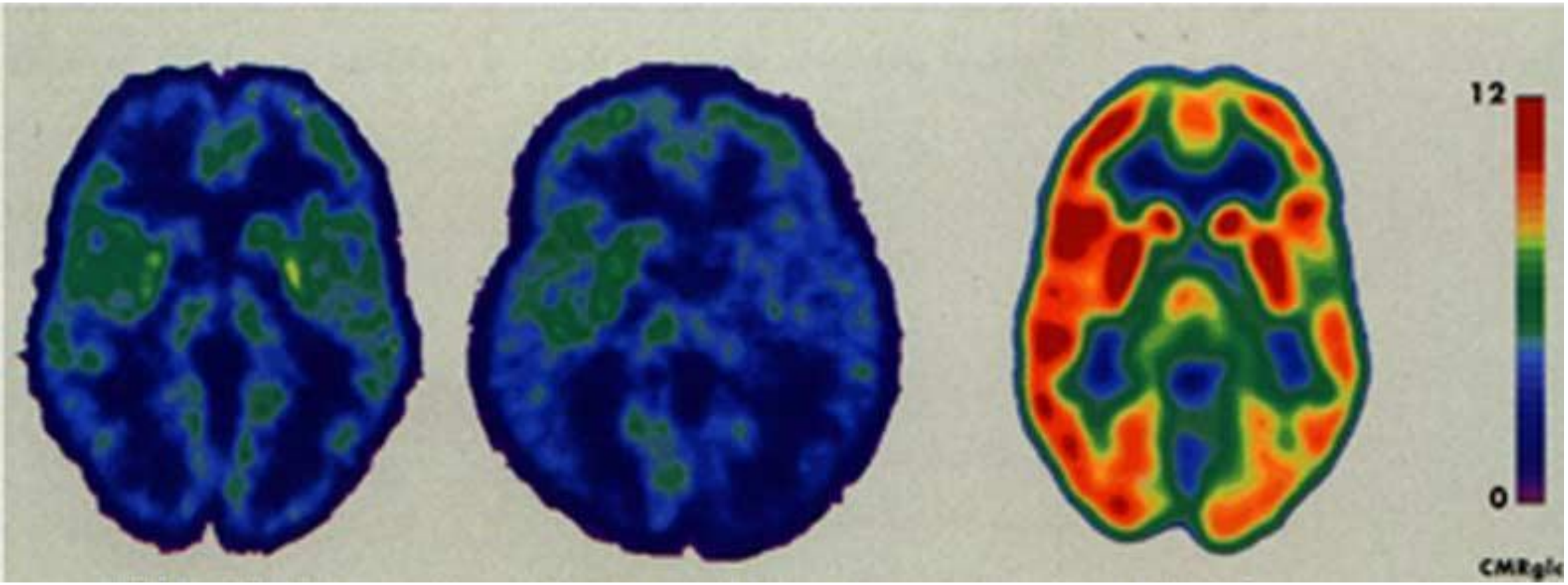
Malingering was first used to describe soldiers who tried to avoid military service in the 1900s. The meaning has expanded to include those who feign illness for other reasons. But it is easier to define malingering than it is to identify it.

Acquired Brain Injury and “Malingering”

Why do some patients appear to be “malingering”?

- No loss of consciousness
- No evidence of injury on usual scans
- Exaggerations, over-reporting etc.
- Inconsistent reporting and performance; not expected considering the nature of the injury
- Focus on complaints, problems
- Not wanting to return to work
- Legal representation
- Talk about money and lawsuits

Imaging PET Scan



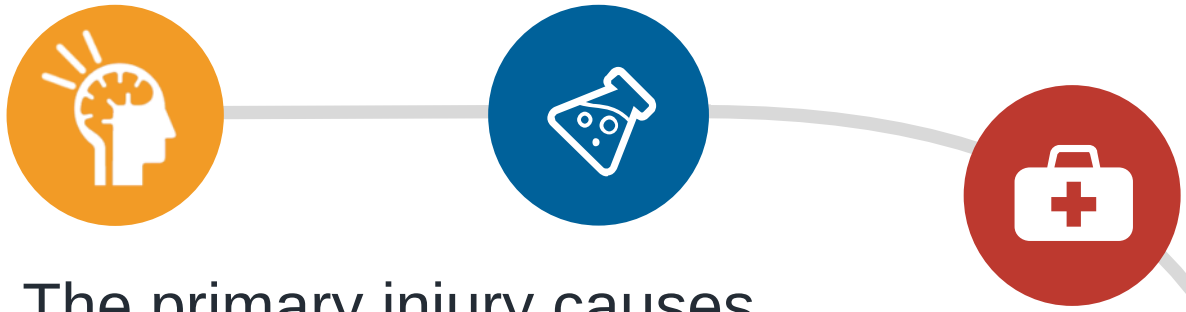
Mild
Head Injury

Severe
Head Injury

Normal

Bergsneider, UCLA

Secondary Damage



The primary injury causes a chemical cascade

(cerebral blood flow, glucose, excitatory neurotransmitters) of adverse events leading to a secondary brain injury such as:

- Cerebral edema
- Prolonged, elevated ICP
- New bleeds
- Infections
- Hydrocephalus

Other considerations

- **Somatoform Disorders**: Hypochondriasis, conversion disorder, pain disorder
- **Major Depressive Disorder**: Diminished motivation, cooperation, memory and attention, cognitive slowing
- **Anxiety Disorder/PTSD**: Lack of cooperation, avoidance, irritability, anger outbursts, mood disturbance, decreased concentration, memory failures, delayed onset of symptoms

Testing for “Malingering”

What Are the Signs of Malingering?

- The person is in a medical or legal situation that could be improved with a certain diagnosis.
- Observers can see a difference between what the person claims to be feeling and physical signs of illness.
- The subject doesn't follow treatments or go for follow-up care.

How to Test for Malingering

- Excessive impairment and unexpected patterns (poor performance on simple items; produce response patterns that are not typical or unlikely, or that violate basic learning principles)
- Reporting of rare or improbable symptoms, or symptom combinations that rarely occur
- Validity scales imbedded in Personality inventories and other measures
- Structured Interview of Reported Symptoms (SIRS); Structured Inventory of Malingered Symptomotology (SIMS)
- Direct observation conflicts with reported symptoms or reported limits to function/participation

Summary

- COVID-19 can cause neurological symptoms from a variety of pathways
- Common neurological symptoms include: headache, memory loss, decreased attention/concentration, impaired executive functioning, and mood disorders
- Neurological symptoms can be brief or long-lasting; if symptoms persist >12 weeks and can not be explained by another diagnosis, a diagnosis of Post-COVID Syndrome (Long COVID) is made
- Treatment is multidisciplinary and individualized to each patient

  Physical therapy – fatigue, weakness, decreased endurance, joint and muscle pain

  Speech Language/CR – attention/concentration, memory, executive functions

  Counseling – pain, anxiety/depression, poor sleep patterns, PTSD (post intensive care)

  Occupational therapy – establishment of positive daily routine, dietary considerations

  Nursing – medication management; other symptom management

- Patients should continue practicing strategies in the home and community settings

Resources – *Read More About It*

- Fiani B, Covarrubius C, Desai A, et al. (2020). A contemporary review of neurological sequelae of COVID-19. *Frontiers in Neurology*. https://doi.org/10.3389/fneur.2020.00640
- Sykes DL, Holdsworth L, Jawad N, et al. (2021). Post COVID-19 symptom burden: what is long-COVID and how should we manage it? *Lung; 199*: 113-119.
- Mazza MD, DeLorenzo R, Conte C, et al. (2020). Anxiety and Depression in COVID-19 survivors: role of inflammatory and clinical predictors. *Brain, Behavior & Immunity; 1*: 594-600.
- Guo P, Ballesteros AB, Yeung SP, et al. (2022). COVCOG2: Cognitive and memory deficits in long-COVID: A second publication from the COVID and cognition study. *Frontiers in Aging and Neuroscience*. https://doi.org/10.3389/fnagi.2022.804937
- Storz MA. (2021). Lifestyle adjustments in long-COVID management: Potential benefits of plant-based diets. *Current Nutrition Reports. 10*: 352-363

Questions?

(hopefully, some answers)

THANK YOU

Austin
Bakersfield
Dallas
Fort Worth
Houston
Los Angeles
San Francisco

CONTACT US

Gary S. Seale, PhD, LPA, LCDC
Regional Director of Clinical Services

409.789.4667

gseale@neuroskills.com

neuroskills.com