Cancer and Cognitive Functioning

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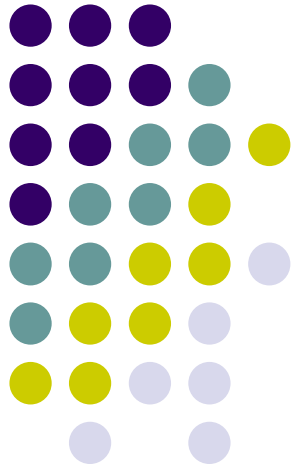
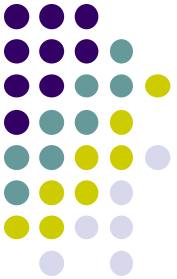


Cognitive Functioning after Cancer



- Location of cancer
  - Brain
  - Organ with effects on brain functioning
  - All others (e.g., breast)

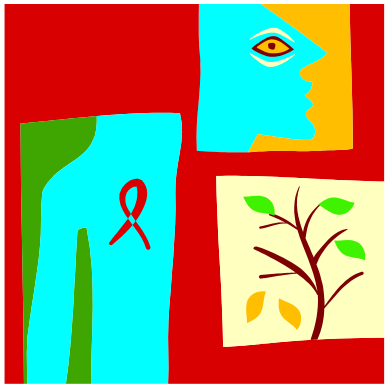
- Treatments
  - Surgery
  - Radiation Therapy
  - *Medication or Chemotherapy*

Medications in Cancer – Type of Agents

- Three general types
  - Chemotherapy – target cancer cells
  - Biological response modifiers (immunotherapies)
  - Hormone Tx
    - Common in breast and prostate cancer
- Not highly specific – can affect healthy tissues

Treatment Outcome in Cancer

- Focus on
  - Survival time
  - Time to disease progress
  - Remission
  - Cure



- Side effects – treatment toxicities

Cancer Treatment Side Effects

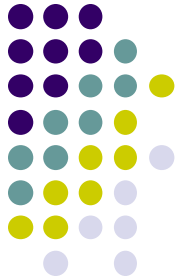
- Historically focused largely on physiological symptoms, like:
  - Nausea
  - Appetite loss
  - Fatigue
  - Vomiting
  - Decreased blood cell counts - anemia
  - Hair loss
  - Pain

- More recent focus on quality of life
  - Satisfaction
  - ***Neurocognitive functioning - "Cancer treatment-related cognitive impairment"***

“Chemobrain”

- Does it exist?
- If yes, what’s it etiology?
- What kinds of cognitive problems arise?
- How long does it last?
- What to do about it!

“Chemobrain”

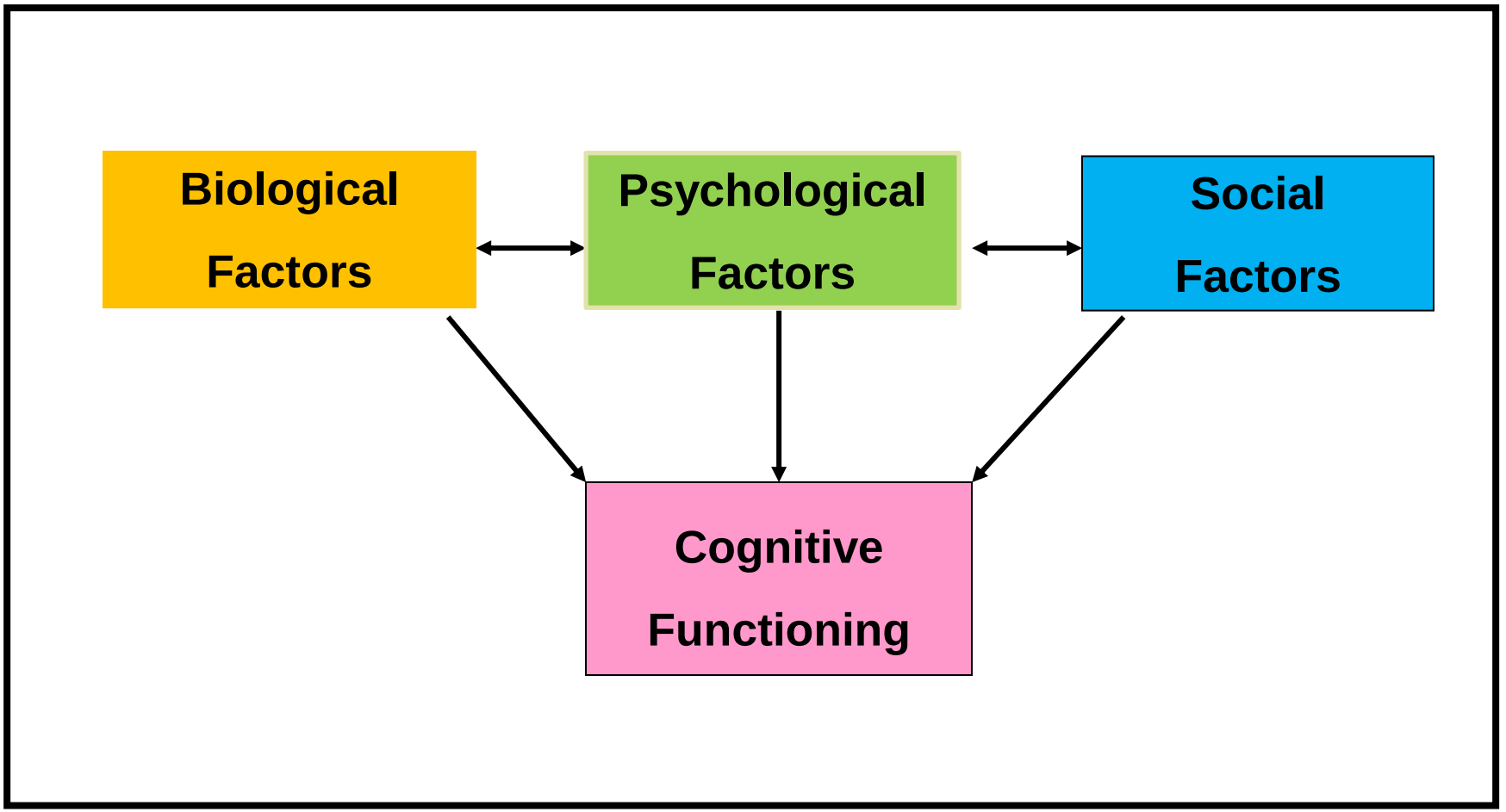


- Across studies:
  - 50%-98% of individuals with various forms of non-brain-related cancers (e.g., breast cancer) reported changes in cognitive functioning during and/or after cancer treatment
- Typical self-reported cognitive symptoms:
  - Short-term memory
  - Word finding/recall
  - Concentration – hard to maintain focus
  - Mental multitasking
  - Planning and organization
  - Speed of mental processing – things take longer
- Typically, symptoms are mild, but often severe enough to affect:
  - Everyday functioning (work, education, etc.)
  - Social interactions with others / relationships
- Duration of cognitive symptoms:
  - Varies across studies, with most reporting improvement / resolution, but a sizeable number reporting persistence over years.

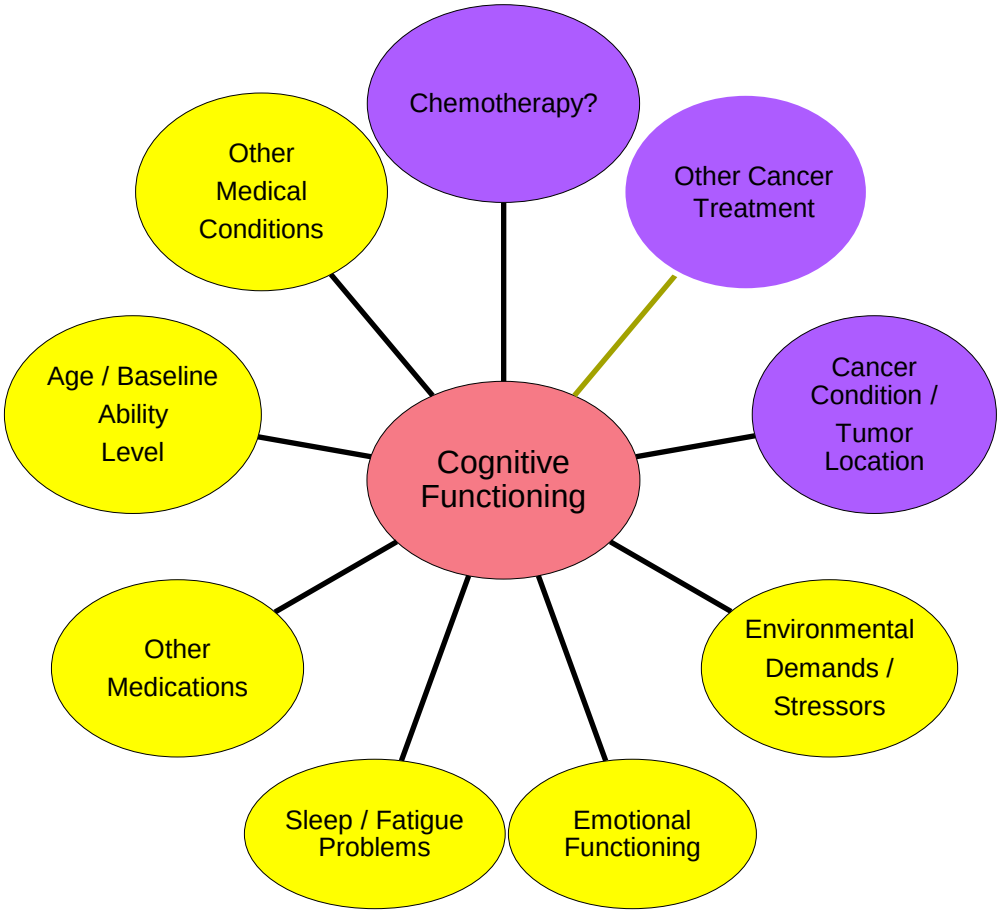
What Does the Research Say?

- Is it all just chemotherapy?
- Yes and no…….
- Its typically *multifactorial!*
  - Several factors can influence a persons cognitive functioning
  - *Biopsychosocial model*

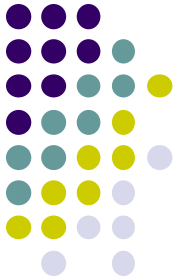
The Biopsychosocial Model



It's Not that Easy! Possible Contributing Factors to Cancer-Related Cognitive Dysfunction



The Complexity of It All – *Cancer Effects*



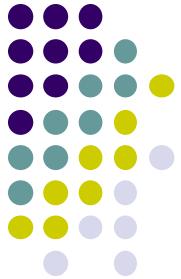
- Cognitive declines may be present:
  - At time of cancer diagnosis
  - Before start of chemotherapy
- Examples – cognitive testing before chemotherapy
  - Women with breast cancer: 11 to 35% found to have cognitive dysfunction
  - Pts with small cell lung cancer: 70-80% deficits in memory functioning (Meyers et al)
  - Acute myelogenous leukemia (AML): 41-44% deficits in memory functioning (Myers et al.)
- Possible Reasons:
  - Inflammation processes
  - Autoimmune mechanisms
  - Other medications
    - E.g., pain medications
  - Emotional functioning
  - Fatigue

The Complexity of It All – *Chemotherapy Effects*

- Best studies are those that:
  - Compare pre-chemotherapy and post-chemotherapy findings: longitudinal-prospective studies

  - Use objective measures of cognitive functioning – neuropsychological tests
  - Use good comparison groups

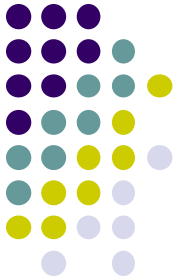
The Complexity of It All – *Chemotherapy Effects*



- **Wefel et al (2004) – one of the first prospective studies on chemotherapy**
  - Early stage breast cancer survivors
  - Measurement: pre; 3-weeks post; 1-year post
  - Findings:
    - Pre-chemo (baseline):
      - 33% showed impairment
    - 3-weeks post treatment:
      - 61% showed evidence of decline in one or more cognitive areas
    - 1-year post:
      - 50% with initial decline improved
      - Rest remained stable – i.e., ~ 30% showed continued declines
    - No relationship with depression or anxiety at either time point

- **Updated prospective study by Wefel et al (2010) on breast cancer survivors**
  - Pre-treatment:
    - 21% showed cognitive dysfunction in at least one cognitive domain (e.g., memory)
  - During or shortly after treatment
    - 65% showed decline from pre-treatment status
  - 1-year post baseline; nearly 8 months post chemo completion
    - 61% showed decline from their acute status
      - Of these individuals:
        - 29% demonstrated new onset decline – not present acutely
    - In the vast majority (94%), only one cognitive domain was affected
    - Improvement from acute to late testing was rare

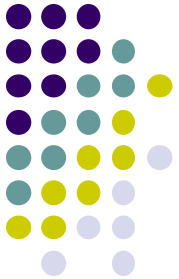
The Complexity of It All – *Chemotherapy Effects*



- **Other pre-to-post breast cancer treatment studies:**
  - Acute decline: 20% to 50% of patients
  - Long-term: 13% to 34% show long-term cognitive declines; though sometimes not greater than controls

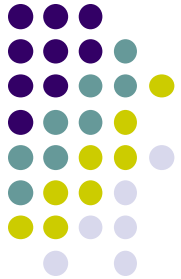
- **Across other forms of non-brain cancer results for relationship between chemotherapy and cognitive functioning have varied**
  - For example:
    - Small cell lung cancer study (Whitney et al)
      - 62% showed some form of cognitive decline 1 month after chemotherapy
      - At 7 months post chemotherapy nearly total resolution for most
    - Review of advance prostate cancer studies – hormone therapy (Nelson et al)
      - 9 studies: nearly all with small sample sizes
      - Compared pre-treatment to 6 to 12 months post-treatment
      - Conclusions:
        - 47% to 69% of men showed “subtle but significant declines” in one or two domains (e.g., memory), but not across all cognitive domains.

Chemotherapy Effects: Typical Cognitive Problems



- Most frequent areas of demonstrated decline
  - Learning and memory
  - Speed of mental processing
  - Executive functioning
    - Cognitive flexibility
    - Problem solving
    - Verbal fluency (response initiation and organization)
- Often the degree of decline is mild
  - But may not be proportional to effect on functional status – e.g., home or work setting demands

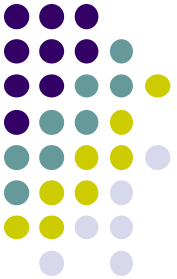
Chemotherapy Effects: Direct Mechanisms



Neural mechanisms underlying cognitive changes – poorly understood

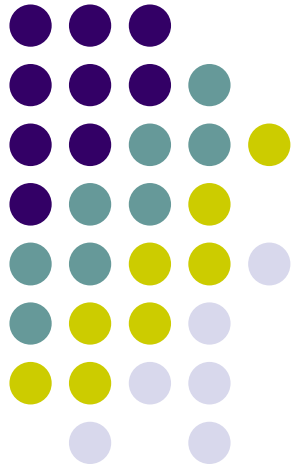
- **Oxidative stress**
  - Reaction to oxygen creates free radicals – lead to cell damage
  - Normal metabolism creates oxidative stress
  - Chemotherapy can induce further oxidative stress
- **Metabolic changes causing inflammatory reactions that injure nerve cells**
- **Microvascular injury in the brain**
  - White matter may be especially vulnerable
- **Anemia – decrease oxygen to the brain**
  - Occurs at a high rate in persons treated with chemotherapy
- **Effects on nerve cell generation and repair – e.g., suppression of neurogenesis in hippocampus**

Chemotherapy Effects: Indirect Mechanisms



- Effects on other organs that can affect brain functioning
  - E.g., liver or kidneys
- Psychiatric symptoms
  - E.g., increases in depression shown with interferon alpha for treatment of leukemia
- ***Fatigue***
  - Increased mental effort to sustain sufficient cognitive performance?
  - Price to pay…..

What Helps?



Steps to Improve Cancer-Related Cognitive Dysfunction

- Evaluate cognitive dysfunction risk factors
- Mindset - Lifestyle Changes
- Strategies to enhance cognitive functioning
  - Self-generated
  - Cognitive Rehabilitation

First Step:

Evaluate Cognitive Dysfunction Risk Factors

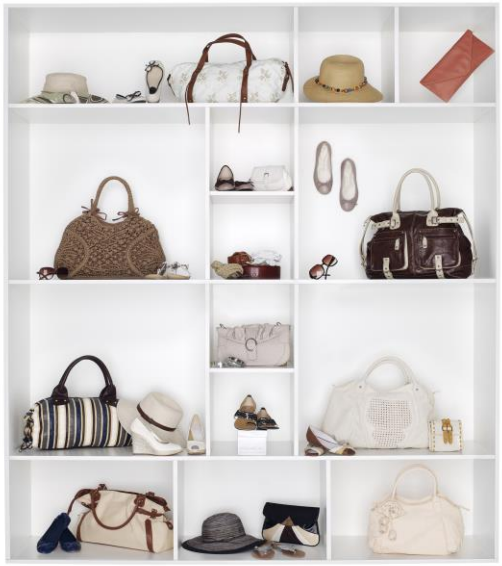
- Tell your health care provider
- There may be reversible causes – need to sort out the factors
- For example:
  - Medication changes to less cognitive interfering ones
  - Medication for sleep / sleep study?
  - Medication to improve energy level
  - Examination of blood counts – e.g., anemia, vitamin deficiencies
  - Treatment for pain
    - Medication /Physical Therapy / Cognitive-Behavioral Strategies
  - Treatment for depression / anxiety

What helps in day-to-day life?

- Mind set
  - Be mindful of difficulties – but try to “normalize” them
  - Its going to take more effort – may need to change routines!
  - Self-efficacy – I can make a difference (cognitive restructure)
- Key: focus on modifying factors that affect cognitive functioning in daily life
  - Overstimulation
  - Fatigue / sleep disturbance
  - Stress / mood problems

What helps in day-to-day life: Reducing stimulation

- Lifestyle changes
  - Get organized!
    - Establish consistent daily routines
      - Regular wake and sleep time
      - Mealtime
      - Routine activities
    - Have a central (or “hub”) place for essential, routinely used items (e.g., keys, wallet, purse, mobile/smart phone)



- Time management
  - Plan daily or weekly schedule ahead of time – write out a check list
  - Prioritize activities - what’s essential to get done
    - E.g., label 1,2,3
  - Estimate how long a given activity will take
  - Adjust schedule if unexpected problems arise – look at activity priorities
  - Check over list at the end of day – adjust next day schedule

Even More Lifestyle Changes - Dealing with Fatigue

- Cancer-related fatigue
  - One the most commonly reported and stressful symptoms in persons with cancer
    - Prevalence rates vary – 50% to 99% (higher with chemothrerapy)
    - May last for years posttreatment
- Trying to function at an acceptable level --
  - But at a greater cost
  - Mental – physical fatigue

Combating Fatigue

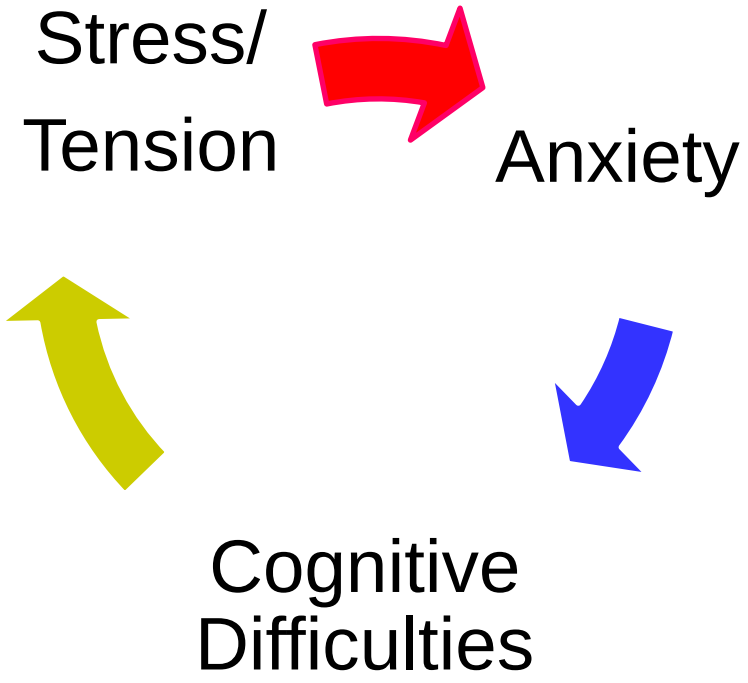
- Check with your physician
  - Any medical problems other than cancer / tx -- e.g., sleep disturbance, anemia
  - Medications to increase energy

- Nonpharmacological strategies
  - Exercise – if medically cleared
    - E.g., take short walks / light exercise
  - Pace yourself during the day
    - Take breaks when you can, even if not yet overly fatigued
  - Be flexible – task schedule, work schedule
  - Do important tasks when you have the most energy
  - Delegate – i.e., get help for tiring tasks
  - Nutrition
  - Manage sleep
    - To nap or not to nap? – that is the question!
      - Catnap versus long nap

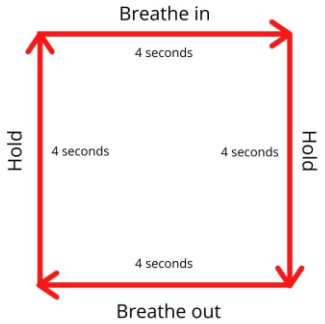
Sleep Hygiene Strategies

- Keep a consistent sleep schedule.
- Establish a relaxing bedtime routine.
- Avoid consuming caffeine in the afternoon or evening.
- Avoid consuming alcohol before bedtime.
- Reduce your fluid intake before bedtime.
- Don’t eat a large meal before bedtime.
- Turn off electronic devices at least 30 minutes before bedtime.
- Make your bedroom quiet and relaxing.
- If you don’t fall asleep after 20 minutes, get out of bed. Go do a quiet activity without a lot of light exposure. It is especially important to not get on electronics.

Stress Management: Nonpharmacological



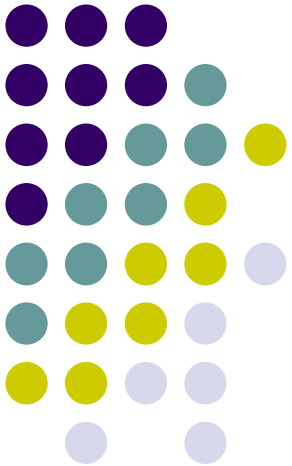
- Stress / tension reduction techniques break the cycle by decreasing stress/tension and anxiety
- Strategies
  - Relaxation exercises
    - “Box breathing”



    - Progressive muscle relaxation
  - Meditation
  - Yoga
  - Exercise

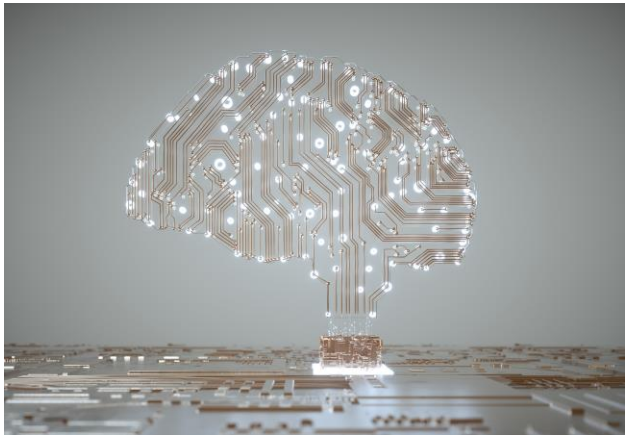
Treating the Symptoms

Cognitive Rehabilitation



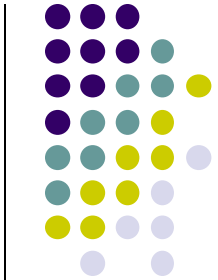
Improving Cognitive Functioning: Treatment – What Works?

- Restoration vs. compensation
- Restoration – make improvements in our natural cognitive abilities
  - Brain / mental exercising



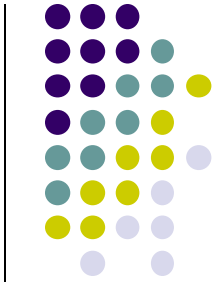
- Compensation
  - Focus is on lessoning the interference of cognitive problems in performing daily tasks
  - Develop internal and external strategies for enhancing cognitive abilities
  - Goal is to improve ability to perform given tasks, e.g.,
    - Sustain attentional focus on a task
    - Recall of important information
    - Recall of to-do list or appointments

Restoration Strategies



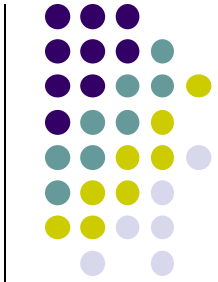
- Guided practice on a set of specific tasks designed to improve given cognitive abilities (e.g., attention, memory, executive functioning)
- Can be computer-based or delivered by a therapist (e.g., Speech Therapist)
  - Computer-based
    - Lumosity
    - CogniFit Personal Coach
- Maybe up to 50-60 sessions; 15-90 minutes per session
- Study by Kesler et al. (2013) at Stanford Univ. on women with breast cancer + chemotherapy
  - Lumosity
  - Target – executive functions (e.g., cognitive flexibility, processing speed, verbal fluency)
  - 12 weeks of training – 48 sessions
  - Pre-post testing showed significant improvements on several tests
  - Most participants felt improvement in their abilities

Restoration Strategies: Current Status



- Promising for some individuals
  - E.g., may raise confidence in abilities
- Often improvement occurs on pre-post treatment tests of cognitive abilities that have been targeted in treatment
- Questions remains about generalizability
  - Does functional status in daily life improve?
  - Are beneficial effects long-term?
- Monetary costs
- No comparison studies have been done with other cognitive treatment strategies (e.g., compensation) or life-change strategies

Compensation – What You Can Do on Your Own!



- Attention
- Memory
- Emotional Functioning

Managing Attention Problems

- Be more mindful - tell yourself to focus
  - Much easier said than done – takes effort!!
  - Being mindful
- Keep distractions to a minimum when doing complex tasks -- e.g.,
  - Quiet please!
  - Remove clutter from desk
  - Unplug the phone
  - Perform the task away from computer (if its not involved)
- Complete only one task at a time - avoid multitasking
- Divide complex tasks into small steps
- Control the pace of performance or the speed of incoming information – if possible
  - E.g., Take planned rest breaks

Compensating for Memory Problems

- Memory functioning -- stages
  - Acquisition
  - Storage
  - Retrieval
- Breakdown can occur at any of the stages
- Strategies can be applied for each stage

Compensating for Memory Problems: Strategies by Stages

- **Acquisition**
  - Focus attention – minimize distractions
  - Make sure you understand info
  - Ask for info to be given slower or repeated

- **Storage / Retrieval**
  - Mentally rehearse information
  - Organize information
    - Any underlying themes
    - Link to something meaningful – old information
    - Use mnemonic strategies
      - Acronyms
      - Easy to remember phrases (1st letter represents a word on the target list)

  - *** Written / Computerized Compensatory Strategies

Compensating for Memory Problems – The Memory Book!

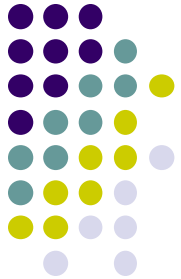
- Memory book = daily planner = daytimer
- Use one central memory book
  - ***Avoid the sticky approach***
  - Smart phone versus written daytimer
    - Smart phone → task initiation alarms!
- What to put in
  - Daily schedule – e.g., appts., to-do-list; alarms
    - Check off space
  - Summary of important conversations
    - E.g.., Family members, new medical info, care providers, co-workers
- ***<u>Remember to remember</u>*** to use your memory device!
- Other strategies:
  - Pill box for medications
  - Memory board in one location – e.g., kitchen

What Else To Do?

- Seek neuropsychological evaluation – if cognitive problems persist and especially if:
  - Day-to-day functional status is being affected (e.g., work performance)
  - Difficulties seem to be worsening over time
    - Of course - consult with your physician!

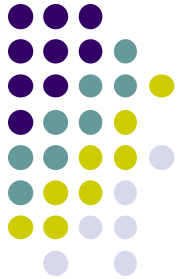
- Neuropsychological evaluations help to”
  - Determine the type and degree of problems
  - Disentangle factors affecting cognitive functioning
  - Can help to indicate your ability to engage in certain activities, like work
    - ****_**Provides info on both weaknesses and strengths**_**
  - Provides a road map for treatment

Neuropsychological Evaluation



- Objective measurement of cognitive capacities
  - Attention / Mental Processing Speed / Memory / Communication / Visuospatial Functioning / Executive Functions (Problem Solving, Reasoning, Thinking Flexibility)
- Emotional / Personality / Behavioral Factors
- Takes into account historical/other factors, e.g.,
  - Baseline cognitive capabilities
  - Possible learning deficiencies in past
  - Medications
- Outcome:
  - Gives you a good idea of your cognitive capacities and factors that might interfere with you applying your capacities to their full extent
  - Prescribe treatment options/program to improve functioning
  - What settings are best/worst suited for you
    - Helps determine your ability to return to productive activities, like work
    - Is there need for job accommodations/modifications

Formal Neuro-Rehabilitation Treatment



- Treatment program developed specifically for the given individual
- Can include some or all of the following:
  - Cognitive Rehabilitation
    - Often by Speech Therapy
    - Typically focuses on compensatory strategies but could combine restorative types of activities
  - Physical Therapy
    - E.g., for pain
  - Occupational Therapy
    - E.g., improvement in functional tasks at home
  - Psychotherapy
  - Vocational Rehabilitation
  - Rehabilitation Medicine Physician Consultation

Thanks!