



TBI-BH ECHO

Traumatic Brain Injury – Behavioral Health ECHO

UW Medicine | Psychiatry and Behavioral Sciences

Depression after TBI

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Objectives

- Describe the prevalence of depression following TBI
- Determine risk factors for depression following TBI
- Discuss assessment and treatment strategies for depression following TBI
 - Pharmacological
 - Neuromodulation
 - Psychoeducational & Behavioral

TBI is a ...

- **Neurobiological Injury**
 - Consequences of direct injury to CNS
- **Traumatic Event**
 - e.g., Risk for Post-traumatic Stress Disorder, Depression, Anxiety
- **Chronic Medical Condition**
 - May lead to long-term symptoms & disability

Mental Health Disorders after TBI

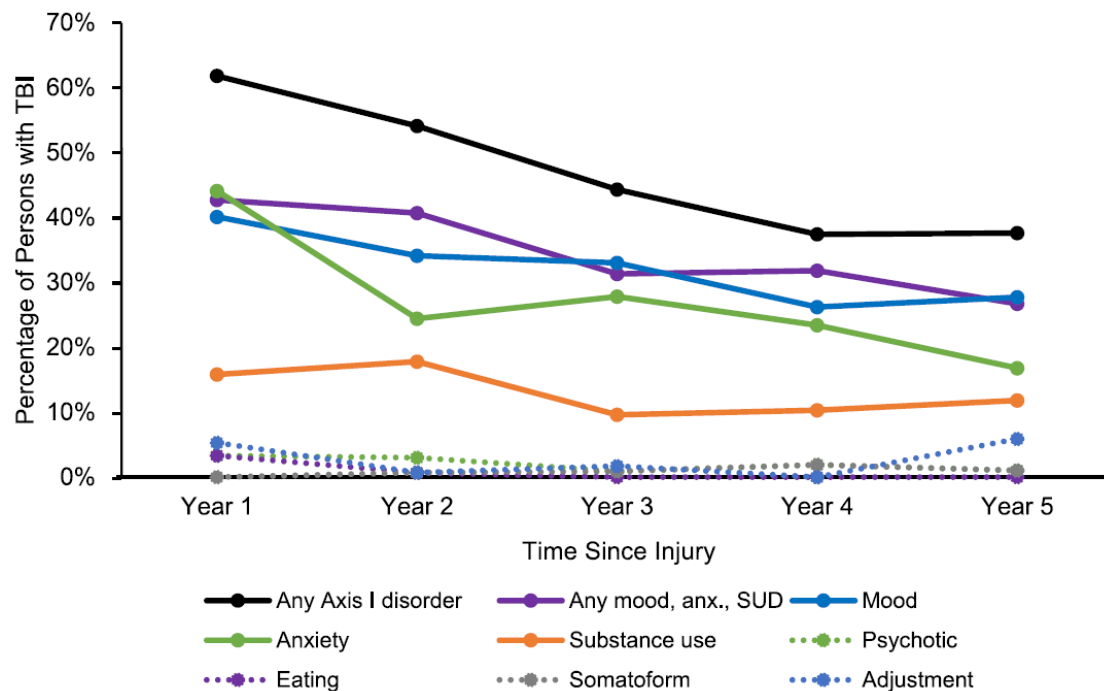
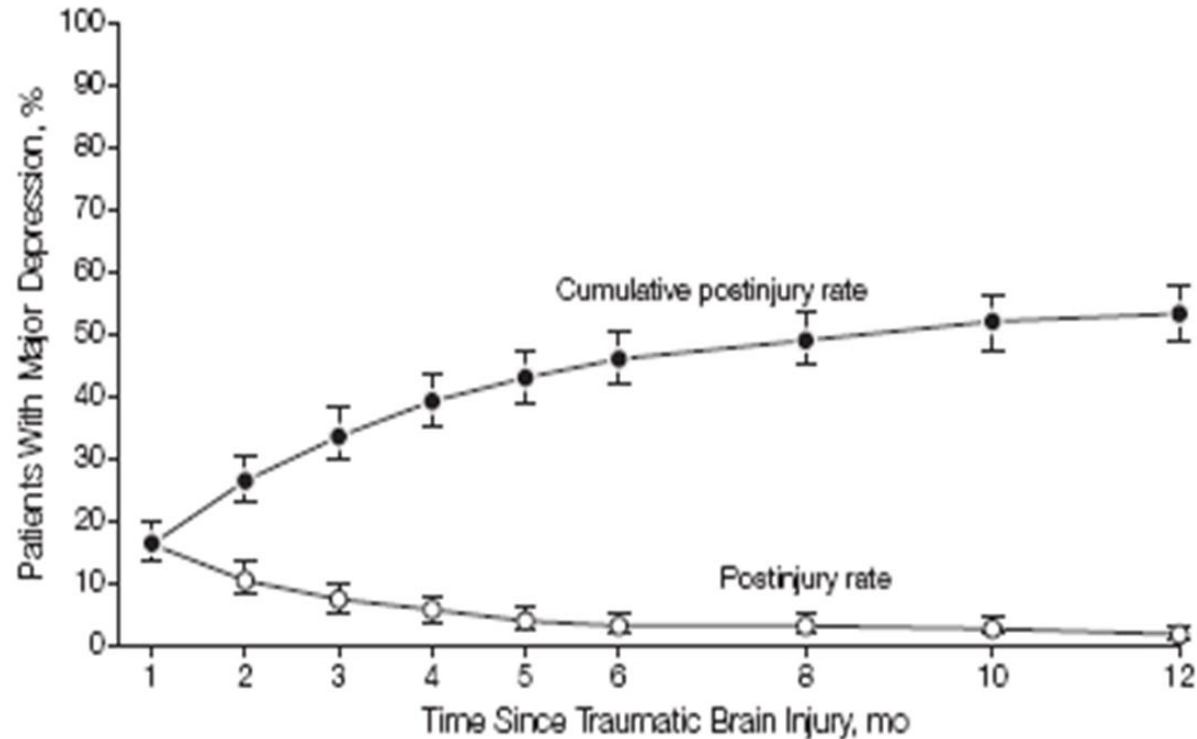


Figure 1. Annual prevalence of different classes of psychiatric disorder in the prospective study of moderate to severe traumatic brain injury (TBI) from Alway *et al.* (54). DSM-IV Axis I diagnoses were determined via Structured Clinical Interview. Mood, anxiety (anx.), and substance use disorders (SUD) were the most prevalent DSM-IV Axis I disorders across 5 years of follow-up after injury, with a steady decline in prevalence over time.

Howlett, Nelson, Stein. *Biol Psychiatry* 2022

Trauma Population County Hospital, N=559



Postinjury rate is the proportion of cases ascertained with major depressive disorder for the first time after traumatic brain injury at each assessment. The values underestimate the true rates because not all participants were assessed at each time. Error bars indicate 95% confidence intervals.

Bombardier, et al. JAMA 2010

Prevalence Meta-analysis

- 93 studies, 11,926 participants
- Overall point prevalence of MDD is 27%
- Mean prevalence of MDD appears to increase during first 5 years (21-43%) then declines to 22%
- MDD in mild TBI (16%) vs. mod-severe TBI (30%)
- Odds of developing MDD/dysthymia after TBI is 7.69 times greater than in non-injured community controls and 1.55 times greater than in medical controls

Osborn et al., Neuroscience and Biobehavioral Reviews 47 (2014) 1–15

Depression Risk Factors in TBI

- Age at injury (11-15, 30-44 vs. >60) *
- Repetitive TBI *
- Female Gender *
- Black race *
- < HS education *
- Violent etiology *
- Medicaid insurance
- Litigation involvement
- Lifetime alcohol dependence *
- Cocaine/Methamphetamine intoxication
- Prior psychiatric history, sleep disturbance (e.g., sleep apnea) *
- Unstable pre-injury work history *
- Injury severity, Lower motor & cognitive functioning (ISS, FIM scores) *
- Poor social & family support *
- Poor problem solving
- Fear of job loss

* Multivariate analysis

Bombardier et al., JAMA 2010; Dikmen et al., Arch PM&R 2002; Hart et al, Arch PM&R 2012; Hamm et al 2000; Hayes & Dixon 1994; Gomez-Hernandez et al 1997; Orlovskaya et al, Am J Psych 2014; Stein et al, JAMA Psychiatry 2019; Etemad et al, JAMA Netw Open 2023; Mikolic et al, BMJ Mental Hlth 2025

Incarcerated Populations with TBI

Large study in Wisconsin & New Mexico (Schneider et al, Brain Inj 2021)

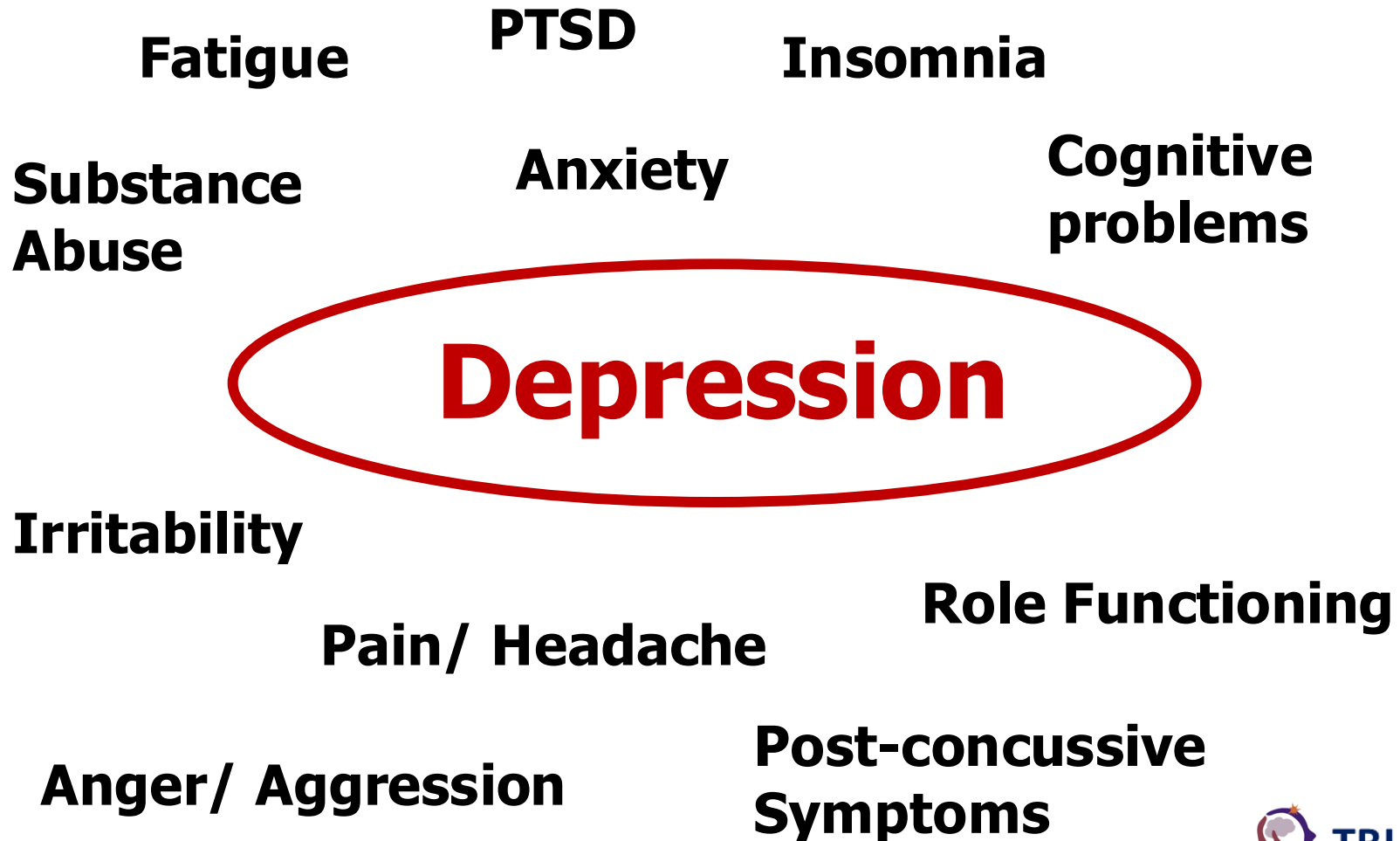
- **Rates of TBI** (80% mild) 5 times higher (men: 52-55%, women: 47-67%) than in general population
- 20-30% with **>1 TBIs**
- Higher rates of TBI caused by **assault** (>25% vs. 8%)
- High rates of **Depression** among men (12-36%) and women (46-55%) with TBI

Law-enforcement & Corrections officers also have high prevalence of TBI (64%) and depression (22%) & PTSD (17%) (Caccese et al, JHTR 2026)

Hypopituitarism

- Unrelated to TBI severity in most studies
- Growth hormone deficiency, hypogonadism
- Can be assoc. with anxiety, depression, fatigue, irritability, insomnia, sexual dysfunction, cognitive impairment
- Assess GH-IGF-1 (Growth Hormone-Insulin-like Growth Factor-1) axis
- Hormone replacement may help

Common Depression Comorbidities



Impact of Depression on Outcomes

Depression after TBI associated with:

- Poorer **cognitive functioning** (Rappoport et al., 2005)
- Lower **health status** and greater **functional disability** (Christensen et al., 1994; Levin et al 2001; Fann et al., 1995; Hibbard et al., 2004; Rapoport et al., 2003)
- More **post-concussive symptoms** (Fann et al., 1995; Rappoport et al., 2005)
- Increased **aggressive behavior** and **anxiety** (Tateno et al., 2003; Jorge et al., 2004; Fann et al., 1995)
- Poorer **recovery** and **return to work** (Mooney et al., 2005, Hoge et al, 2008)
- Higher rates (compared with non-TBI controls) of:
 - **suicidal plans** (Kishi et al., 2001)
 - **suicide attempts (8x)** (Silver et al., 2001)
 - **completed suicides (3-4x)** (Teasdale and Engberg, 2001)

Basic Treatment Principles

- Characterize & document diagnoses & symptoms as precisely as possible
 - Neuropsychiatric symptoms may not fit DSM criteria
- Assess pre-TBI personality, coping, psychiatric history
 - Prior patterns may be accentuated
 - What treatments have worked in the past?
- Define realistic treatment endpoints
 - Use validated instruments, when available
- Medications & Psychotherapy appear to have similar efficacy in meta-analyses

Fann JR, Kennedy R, Bombardier CH. Physical Medicine and Rehabilitation. In: Textbook of Psychosomatic Medicine, 2nd Ed. Levenson J (ed), American Psychiatric Publishing, Inc., Washington, D.C., 2018;

Fann JR, Quinn DK, Hart T. Treatment of Psychiatric Problems after Traumatic Brain Injury. Biol Psychiatry 2022

Peppel et al. Pharmacological and Non-pharmacological Interventions for Depression after Moderate to Severe TBI: A Systematic Review and Meta-Analysis. J Neurotrauma 2020

Transdiagnostic Depression Symptoms

	TBI
1. Depressed mood	
2. Anhedonia	
3. Weight loss/gain	
4. Insomnia/hypersomnia	X
5. Psychomotor changes	X
6. Fatigue	X
7. Worthlessness/guilt	
8. Poor concentration	X
9. Thoughts of death/suicide	

PHQ-9 has been validated in TBI

- Criterion of 5+ items present (at least one cardinal symptom) present at least several days over past 2 weeks provides best sensitivity and NPV

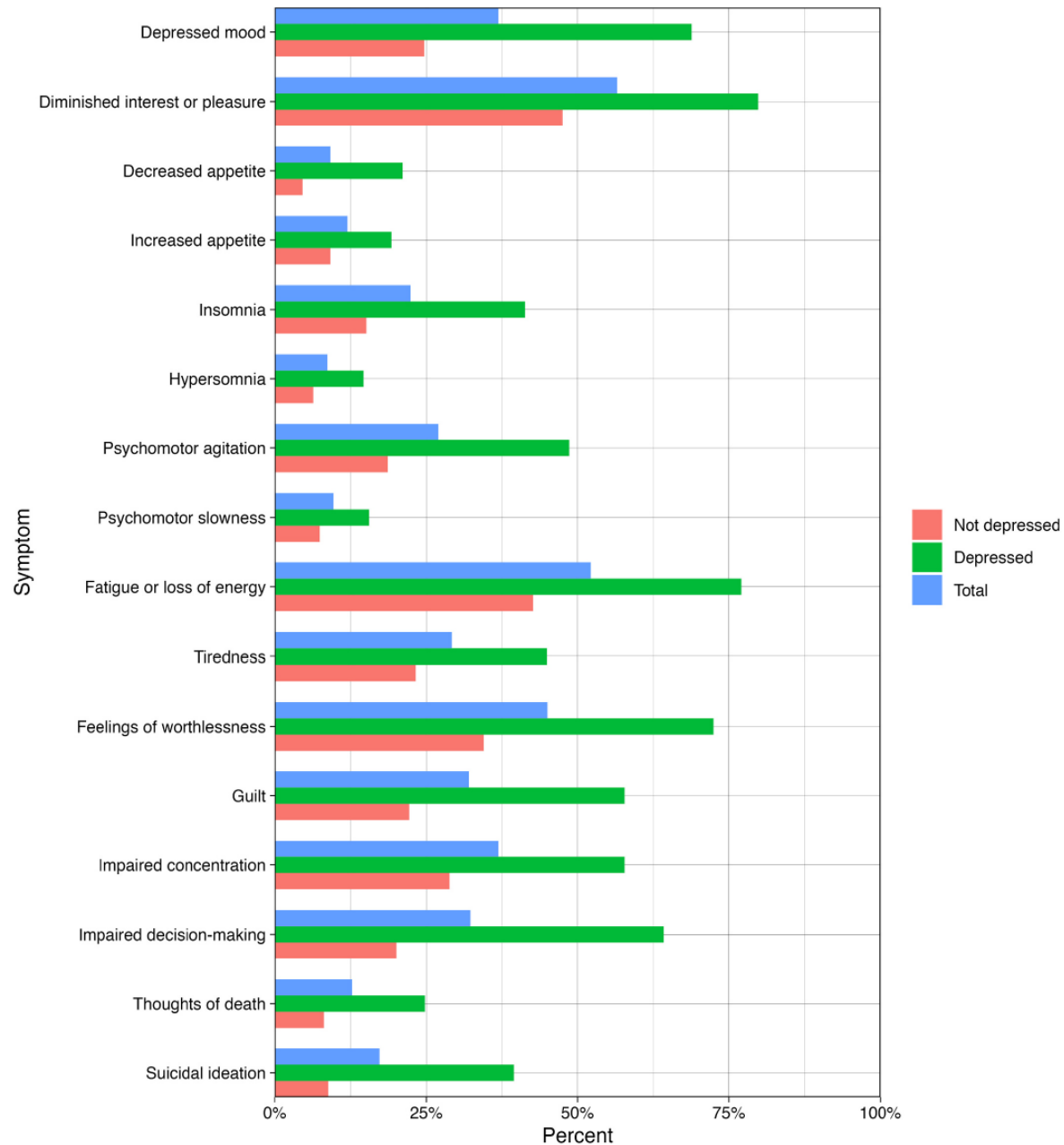


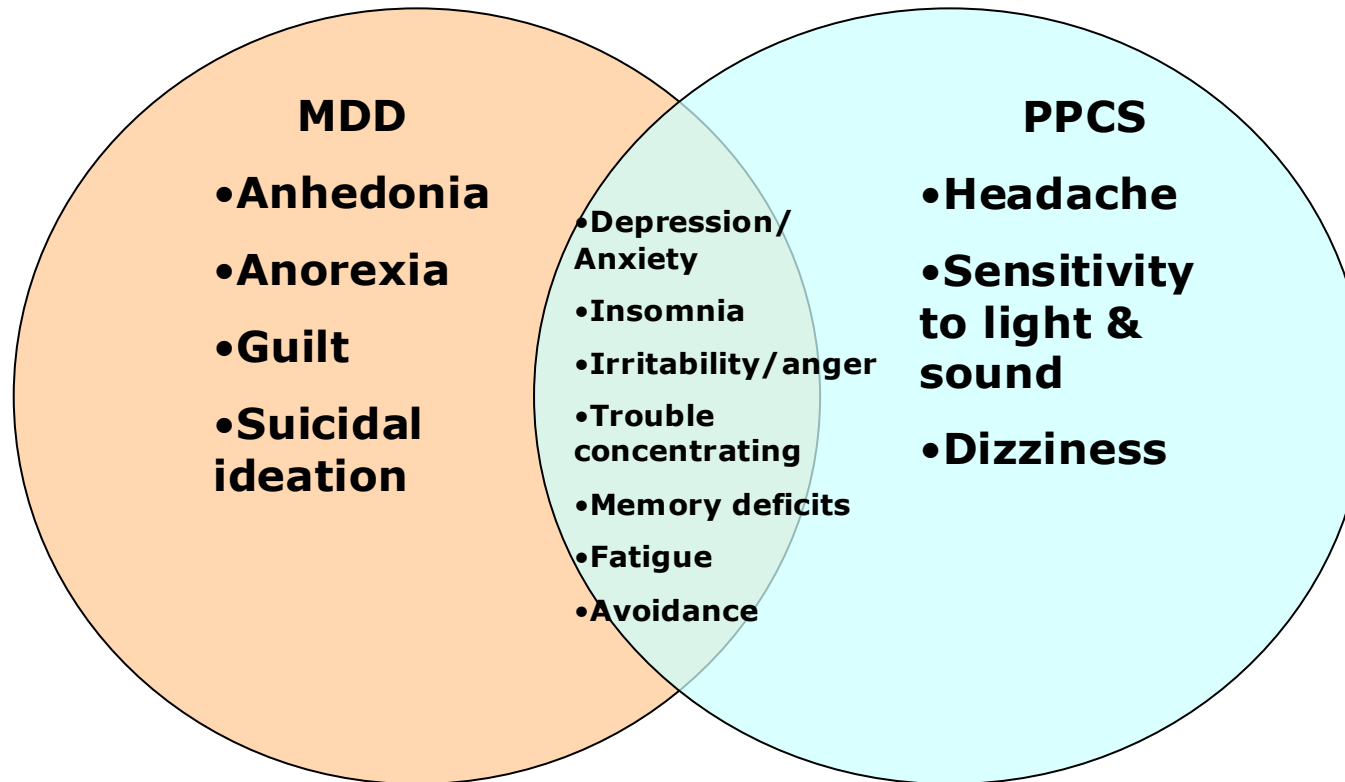
Fig. 1. Frequency of specific depressive symptoms in the total sample ($n = 393$; blue) as well as among participants who did self-report ($n = 109$; green) and did not self-report a current diagnosis of depression ($n = 284$; pink). Note. The items used to assess each symptom are listed in Table 1. A symptom was considered present in an individual based on a score of ≥ 3 on the relevant IDAS item/s (or ≥ 2 for suicidal ideation). Controlling for age, sex, and TBI severity, participants who self-reported a depression diagnosis had significantly greater odds of endorsing each symptom. The statistical outputs can be found in Supplemental Table S1. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

**Carmichael et al, J
Affect Dis 2024**

Depression & Apathy

- Assess pre-injury depression and alcohol use
- Use 'inclusive' diagnostic technique
- Older adults (≥ 65) less likely to have MDD
- Addressing Post-concussive Symptoms (e.g., sleep, pain) may decrease risk of depression
- **Apathy** alone - prevalence 10%
 - disinterest, disengagement, inertia, lack of motivation, lack of emotional responsivity

Interface of MDD & Persistent PCS



TBI Depression Treatment Modality Preferences

Subjects Likely To Participate In Treatment

Treatment Modality	Depressed n=37		Non-Depressed N=108		Total Sample N=145	
Physical Exercise	33	(89.2%) ^a	88	(82.2%) ^c	121	(84.0%) ^c
Counseling/Psychotherapy	29	(78.4%) ^a	69	(63.9%) ^{a,b}	98	(67.6%) ^b
Antidepressants	27	(73.0%)	42	(38.9%)	69	(47.6%)
Alternative or Herbal	25	(67.6%)	66	(61.1%) ^b	91	(62.8%) ^a
Self-Help Materials	23	(62.2%)	68	(63.0%) ^{a,b}	91	(62.8%) ^a
Group Therapy	16	(43.2%)	47	(43.5%)	63	(43.4%)

Note: Differences reported are among treatment modalities within each column.

a: Favored over Group Therapy

b: Favored over Antidepressants

c: Favored over all modalities

Fann et al, JHTR 2009

Inadequate TBI Depression Treatment

Among our 53% with TBI and MDD:

- 44% received any depression treatment
 - 41% received any antidepressant
 - 20% received any psychotherapy

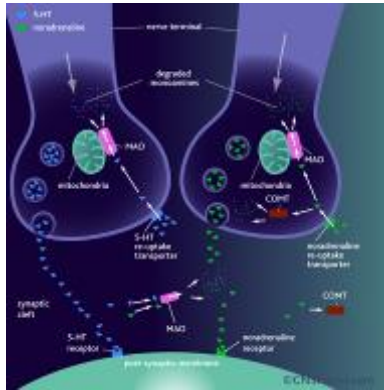
In **primary care**, 1/3 of depressed Pts receive any mental health treatment. Of these, ~50% receive 'minimally adequate treatment'

Wang et al, Arch Gen Psychiatry 2010; Bombardier, et al. JAMA 2010;
Rockhill et al, J Neurotrauma 2012

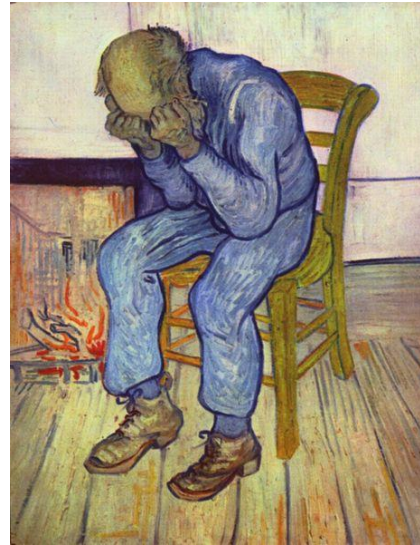
Modifiable Risk Factors

Depression

Neurobiological Factors



No Pleasant Activities



Psychosocial Adversity



Cognitive Impairment, Bias, Distortions



Sedentary Lifestyle, Alcohol abuse

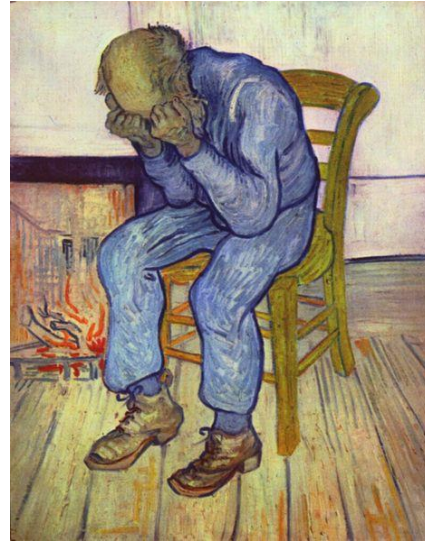


Possible Interventions

**Pharmacotherapy, Light,
Neuromodulation**



Depression



**Cognitive Behavioral Tx,
Mindfulness, Environmental**



**Behavioral
Activation**



**Case Mgt, Social Support,
Problem Solving Tx**



**Exercise,
Motivational
Interviewing**



Pharmacological Interventions

Basic Medication Treatment Principles

- Focus on maximizing functioning
- Treat maximum Sxs with fewest possible medications
 - TBI patients more sensitive to side effects

START LOW, GO SLOW, ...BUT GO

- Start at 25-50% usual dose, but may still need maximum doses
- Therapeutic onset may be delayed
- Medications may lower seizure threshold
- Medications may slow cognitive recovery
- When adjusting meds, make one change at a time

Depression, Apathy, Pseudobulbar Affect (PBA)

- Meta-analyses: ADs reduce depression, not significantly different from placebo, **SSRIs/SNRIs** best tolerated
- **Two Class I RCTs of sertraline:**
 - N=62: complicated mild-sev TBI, post-acute phase (mean 5 months post-TBI), high psych comorbidity
 - N=52: 36% mTBI, chronic phase (mean 18 years post-TBI)
 - showed trends toward superiority of sertraline over placebo in chronic, but not post-acute phase
 - May improve information processing speed post-acutely

Depression, Apathy, Pseudobulbar Affect (PBA)

- TCAs, moclobemide (reversible MAOI, not in US): efficacy in small studies
- Methylphenidate: AD effect in small studies; decreases mental fatigue, apathy; improve arousal, cognitive processing speed, anger, participation
- Selegiline (MAO-B inhibitor): may decrease apathy
- Dextromethorphan/quinidine: decreased PBA in uncontrolled studies (SSRIs & TCAs may also help)
- (Blue) Light therapy: preliminary evidence for positive effects on depression, fatigue/daytime sleepiness, sleep disturbance (Srisurapanont et al, PLoS One 2021)

Not formally tested in TBI:

- Bupropion: may help with fatigue, apathy
- Mirtazapine: may decrease anxiety, increase sleep, appetite
- Newer ADs, e.g., vilazodone, vortioxetine, levomilnacipran, esketamine: not yet systematically studied

Pharmacologic Options

- Selective serotonin re-uptake inhibitors (SSRIs)
 - **sertraline** - paroxetine - fluoxetine
 - **citalopram** - **escitalopram**
 - Can help with anxiety, pain, anger – possibly decrease inflammation & organ damage?
- SNRIs - **venlafaxine**/desvenlafaxine, **duloxetine**, levomilnacipran (help with pain, esp. neuropathic; can cause HTN rarely)
- bupropion (may decrease seizure threshold), activating
- mirtazapine (may be too sedating), increase appetite/weight
- Tricyclics: **nortriptyline**, desipramine (blood levels available)
- **methylphenidate**, dextroamphetamine – decreases fatigue, improves cognition
- Newer ADs not yet studied in TBI

- **Apathy**: Dopaminergic agents - methylphenidate, pemoline, bupropion, amantadine, bromocriptine, selegiline, modafinil, armodafinil (no RCTs in TBI)

Common Polypharmacy Pitfalls

- **Depression**
 - Antidepressants
- **Anxiety / Worry / Panic**
 - Benzodiazepines, antihistamines
- **Insomnia**
 - Sedative-hypnotics
- **Headache / Pain**
 - Opioids, gabapentin
- **Irritability / Anger**
 - Beta-blockers, antipsychotics, anticonvulsants
- **Fatigue / Cognitive Impairment**
 - Psychostimulant, amantadine, AChE inhibitors



Potential Consequences of Polypharmacy

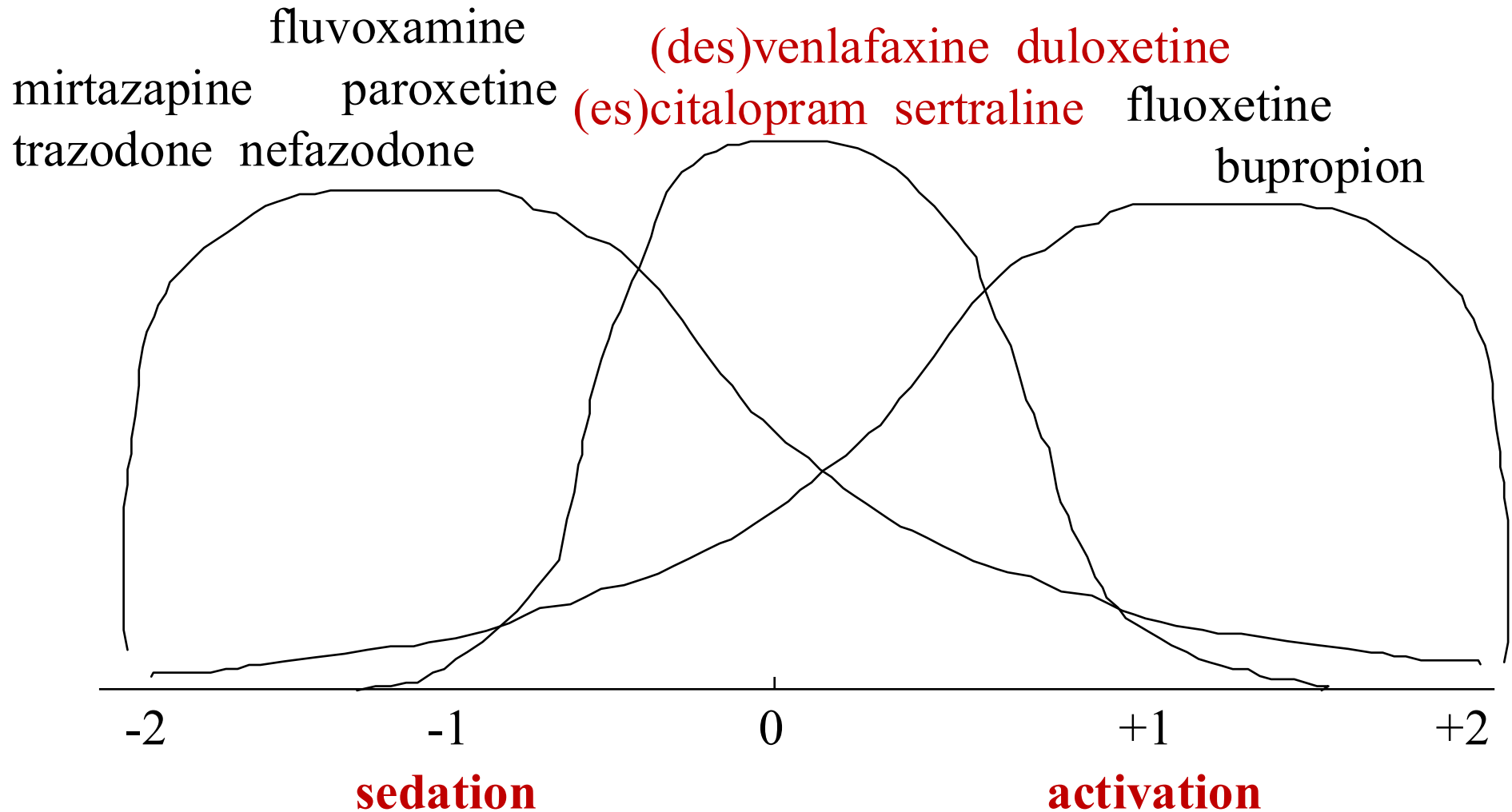
- Drug-drug interactions
- Accidental or volitional overdose
- Non-adherence
- Cumulative adverse effects
 - E.g., sedation, lightheadedness, cognitive impairment, fatigue
- Delirium
- Accidents (falls, MVAs)
- Unnecessary health care utilization & costs

Table 2. Potential Pharmacological Strategies Across Neuropsychiatric Syndromes

Drug Mechanism (Examples)	Depression	Apathy	Anxiety	PTSD	Agitation, Anger, Irritability	Mania	Psychosis	Insomnia
5-HT ₂ Reuptake Inhibition (Sertraline, Citalopram)	x		x	x	x			
5-HT ₂ /NE Reuptake Inhibition (Venlafaxine, Duloxetine, TCAs)	x		x	x	x			
5-HT ₂ /α ₂ Antagonism (Mirtazapine)	x		x	x				x
5-HT ₂ Antagonism/Reuptake Inhibition (Trazodone)	x		x	x	x			x
5-HT ₁ Agonism (Buspirone)			x		X			
DA/NE Reuptake Inhibition/Release (Bupropion, Methylphenidate, Dextroamphetamine)	x	x			x			
GABA Agonism (Lorazepam, Clonazepam)			x		x	x		x
Sodium Channel Inhibition (Valproate, Carbamazepine, Lamotrigine)			x	x	x	x		
Calcium Channel Inhibition (Gabapentin, Pregabalin)			x		x	x		x
Glutamate Modulation (Lithium)		x			x	x		
DA Agonism (Amantadine, Bromocriptine, Pramipexole)		x			x			
DA/5-HT ₂ Antagonism (Quetiapine, Olanzapine)	x		x	x	x	x	x	x
Alpha-Adrenergic Modulation (Prazosin, Clonidine)				x	x			
Beta-Adrenergic Modulation (Propranolol, Nadolol)			x	x	x			
Histamine Antagonism (Hydroxyzine)			x	x				x

5-HT, serotonin; DA, dopamine; GABA, gamma-aminobutyric acid; NE, norepinephrine; PTSD, posttraumatic stress disorder; TCA, tricyclic antidepressant.

Sedation and activation profiles



Neuromodulation Interventions

- Transcranial Magnetic Stimulation (TMS)
 - Promise for individualized precision targeting using MRI
- Transcranial Direct Current Stimulation (tDCS)
- Photobiomodulation (PBM)
- Electroconvulsive Therapy (ECT)
- Trigeminal Nerve Stimulation (TNS)
- Vagus Nerve Stimulation (VNS)
- Deep Brain Stimulation (DBS)

All have some evidence for decreasing depression in TBI

Other target outcomes in TBI: arousal, cognition, anxiety, PTSD, impulsivity, pain, headache, functioning, QOL

Long-term efficacy needs to be established (Chang et al, J Clin Med 2023)

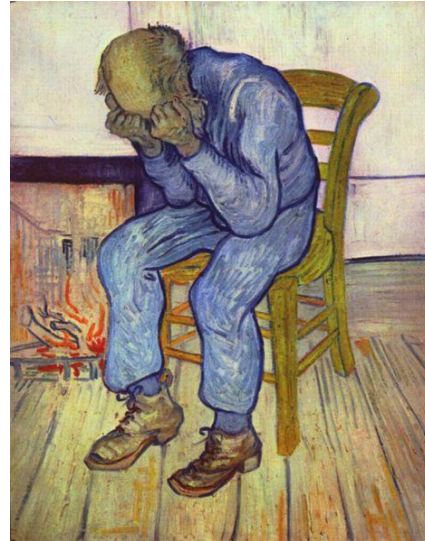
Psychological & Behavioral Interventions

Possible Interventions

**Pharmacotherapy, Light,
Neuromodulation**



Depression



**Cognitive Behavioral Tx,
Mindfulness, Environmental**



**Behavioral
Activation**



**Case Mgt, Social Support,
Problem Solving Tx**



**Exercise,
Motivational
Interviewing**



Effect of psychological treatments on depression after TBI

Carrier et al Neuropsychol Rehab 2026

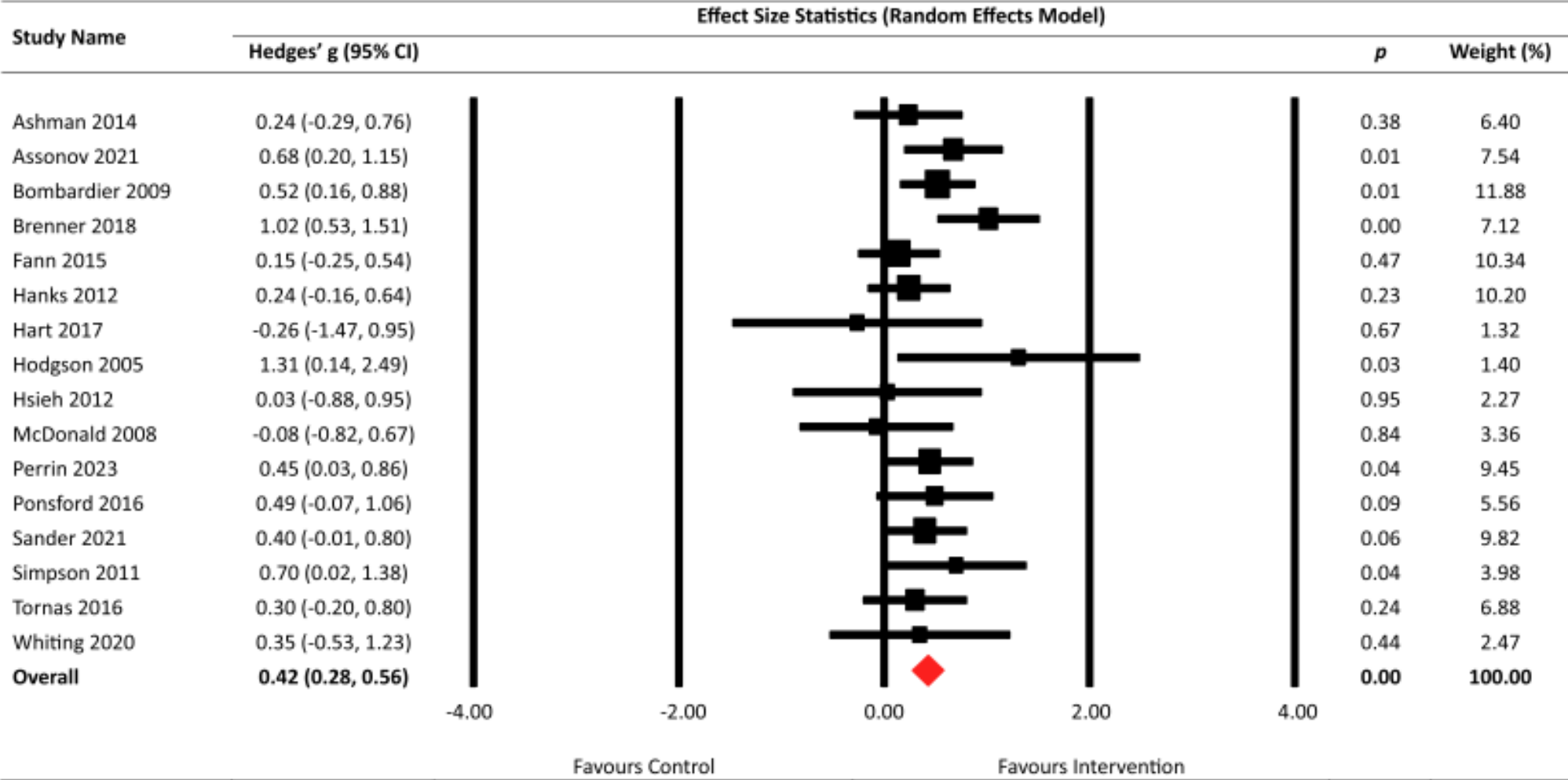
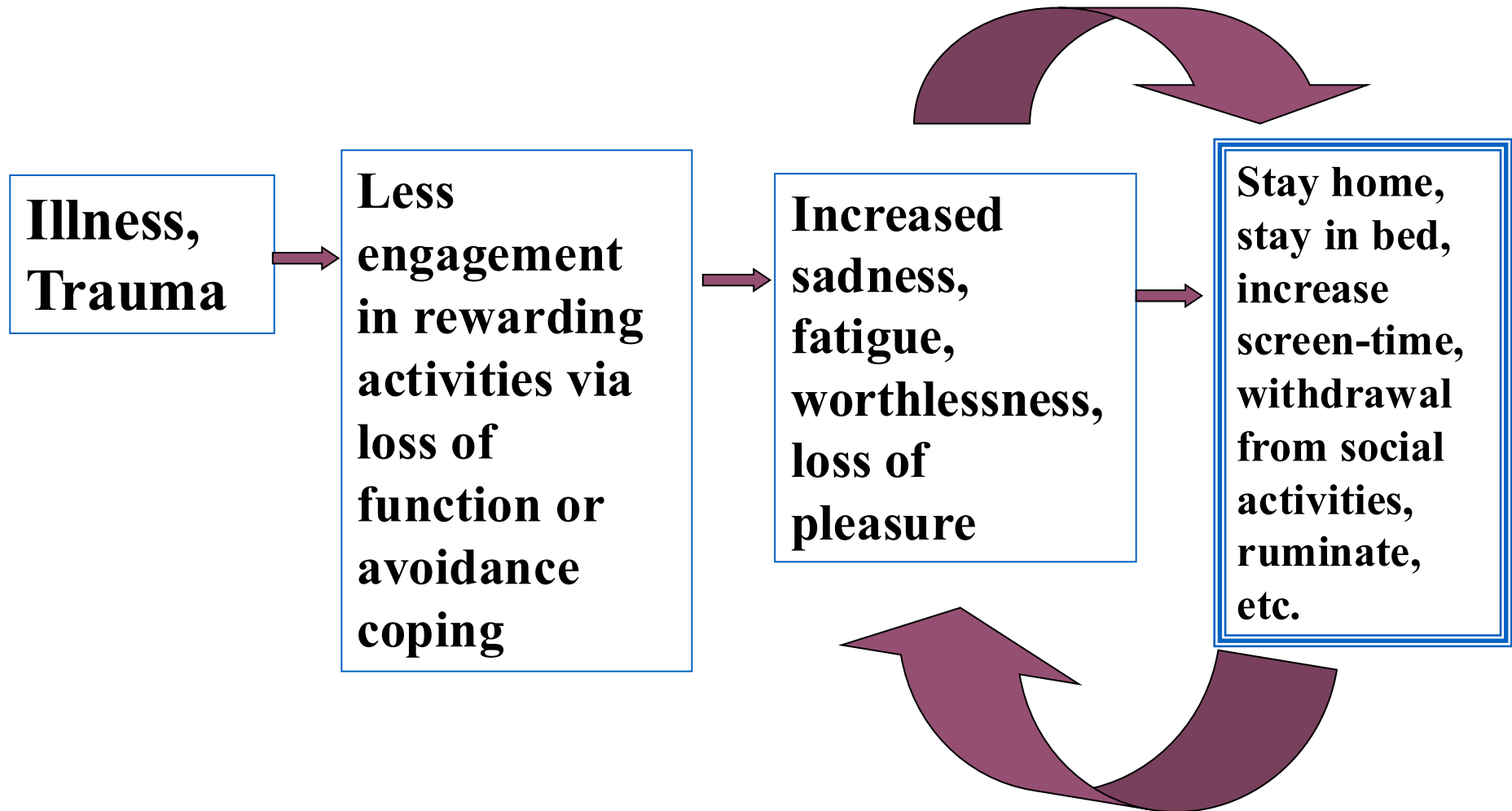


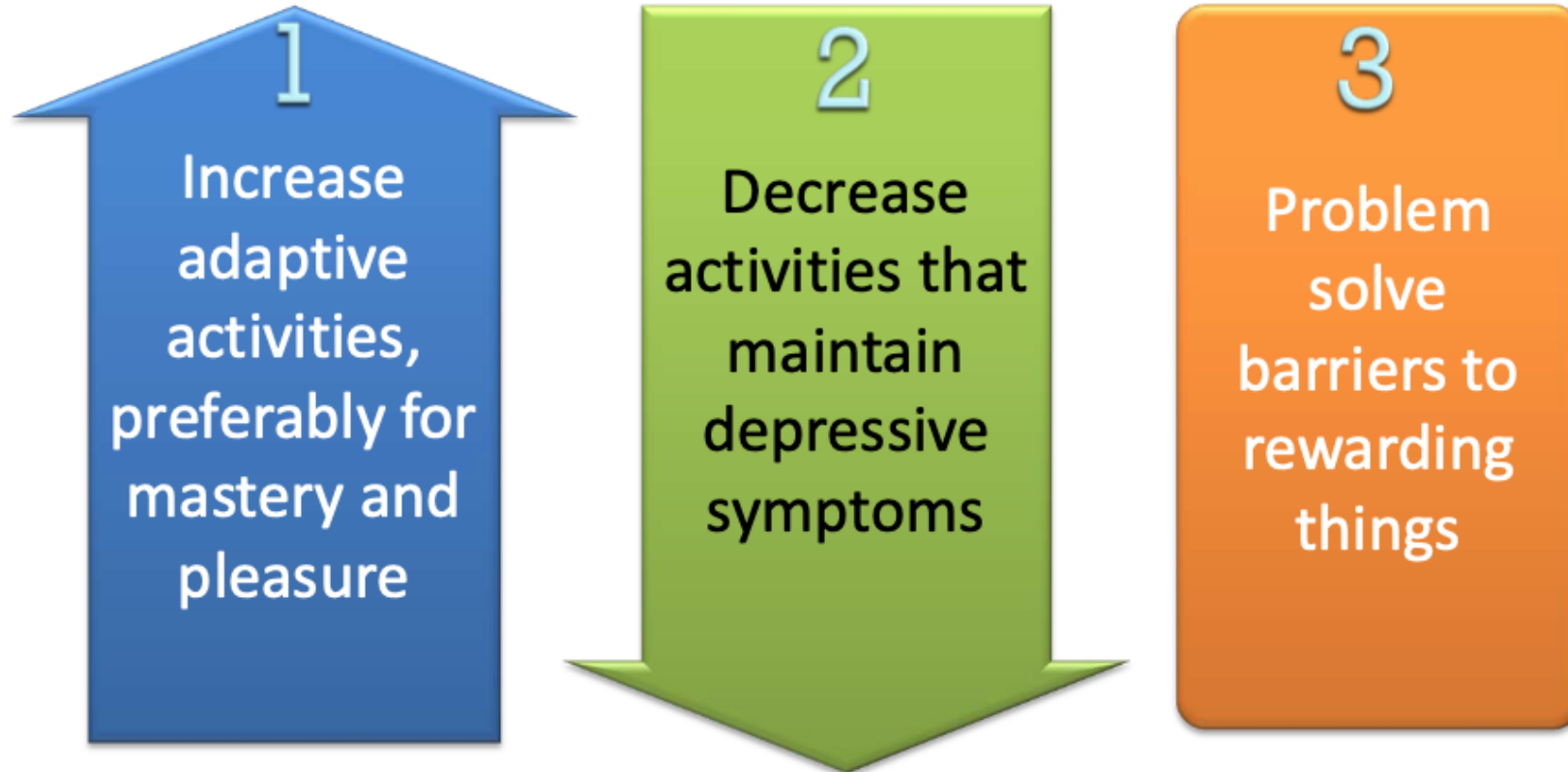
Figure 6. Overall effects of all interventions (RCTs) for depression on primary outcomes combined across timepoints.

Behavioral Conceptualization of Depression



Adapted from Chris Martell, PhD

3 GOALS OF BA



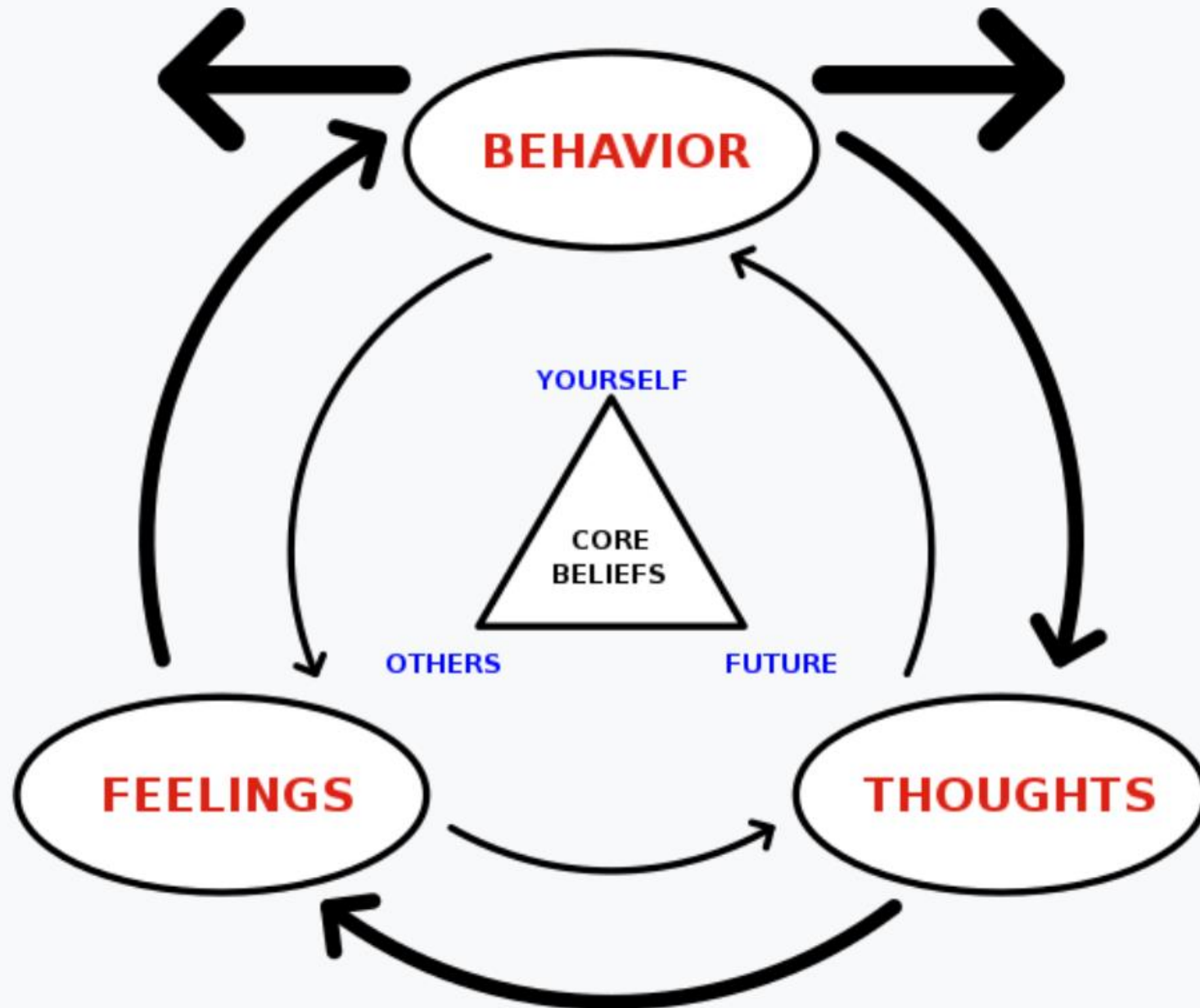
Behavioral Activation (BA)

- RCT of single session of BA plus 8 weeks of daily text-messaging to implement activities vs. attention control session plus motivational messages, N=59
 - Both groups had improved mood
 - BA group reported more environmental reward, decreased avoidance
- RCT of 8 sessions of BA (6 FTF + 2 phone, plus EMA + text reminders) to increase activity) vs. 1 FTF + 8 weeks of BA text reminders to increase activity, N=60
 - Among those with higher distress, the first group had significantly greater improvement in distress post-treatment

Adaptations for Behavioral Activation

Key Components	Adaptations to Improve Treatment Receipt/Treatment Enactment in TBI
Explicit self-monitoring of activities and associated moods; recognition of behavioral avoidance	Provision of simple written or electronic aids for monitoring behaviors and concurrent moods and for creating activity schedules
Identification of personal values and activities consonant with values; gradually increasing scheduling of pleasant (reinforcing) and value-based activities	Visual aids for understanding theoretical rationale for behavioral activation and relationship of values to reinforcing activities and behaviors
May also include skills training (e.g., social skills) as needed to initiate activities	Assistance in selecting and scheduling activities; prompts to complete planned activities at designated time

Cognitive behavioral therapy



Cognitive Behavioral Therapy (CBT)

- High structure & self-monitoring advantageous after TBI
- Three RCTs after mod-sev TBI
 - 2 for depression: no signif improvement compared to UC/supportive Tx
 - Worked equally in severe vs. moderate TBI
 - Phone CBT as effective as in-person
 - Behavioral activation may be more effective than cognitive restructuring
 - 1 for depression &/or anxiety
 - Anxiety improved quickly, depression improved after boosters. MI offered no additional benefit to CBT.

Ashman et al, JHTR 2014; Fann et al, J Neurotrauma 2015;
Ponsford et al, Psychol Med 2016

Symptom Cluster Trajectories with CBT

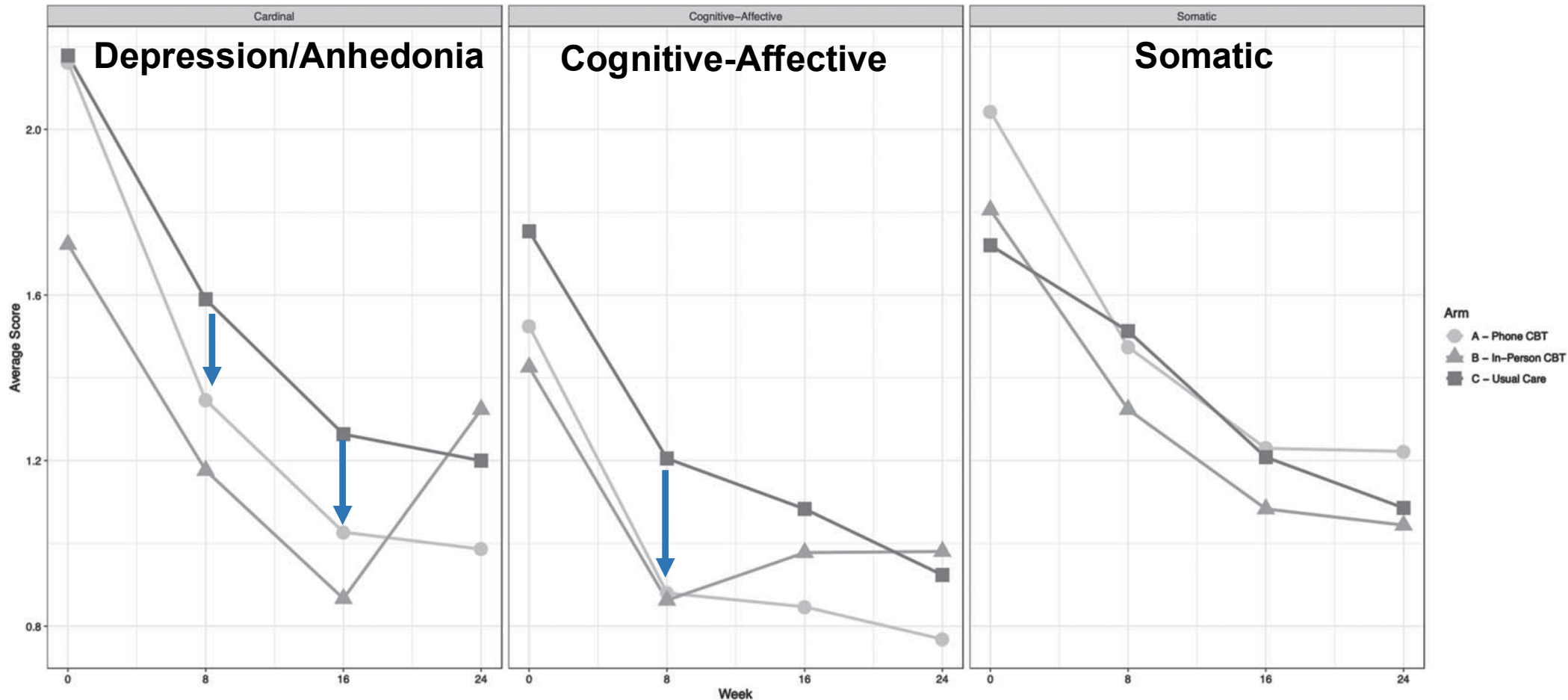


Fig. 1b. Graphic display of symptom cluster trajectories.

Erickson et al, NeuroRehabilitation 2024; Fann et al, J Neurotrauma 2015

Adaptations for CBT

Key Components	Adaptations to Improve Treatment Receipt/Treatment Enactment in TBI
Cognitive restructuring: challenge automatic negative thoughts and replace them with more realistic ones, often using evidence from in vivo behavioral experiments	Changes to treatment sessions: shorter sessions/slower pace, repetition and review within and across sessions, avoidance of multitasking (e.g., no note-taking while listening)
Schedule pleasant events and plan behaviors that reduce fear-based avoidance and improve self-esteem	Strategies to support memory: written handouts summarizing session content; written or electronic schedules completed with help from therapist or support person at home; assistance in planning when/how to complete homework, with prompts at designated time
May also include skills training, e.g., muscle relaxation, coping, problem-solving, assertiveness	Practice of new skills/behavioral experiments within session, with therapist feedback Frequent checks for understanding of material

The 'ABC's' of Problem Solving Therapy

- **A**ssess the problem; achievable aims
- **B**rainstorm possible solutions
- **C**onsider & **C**hoose the best solution
- **D**evelop a plan and **D**o it
- **E**valuate your progress
- **F**lex and **F**ight on!

Problem Solving Therapy (PST)

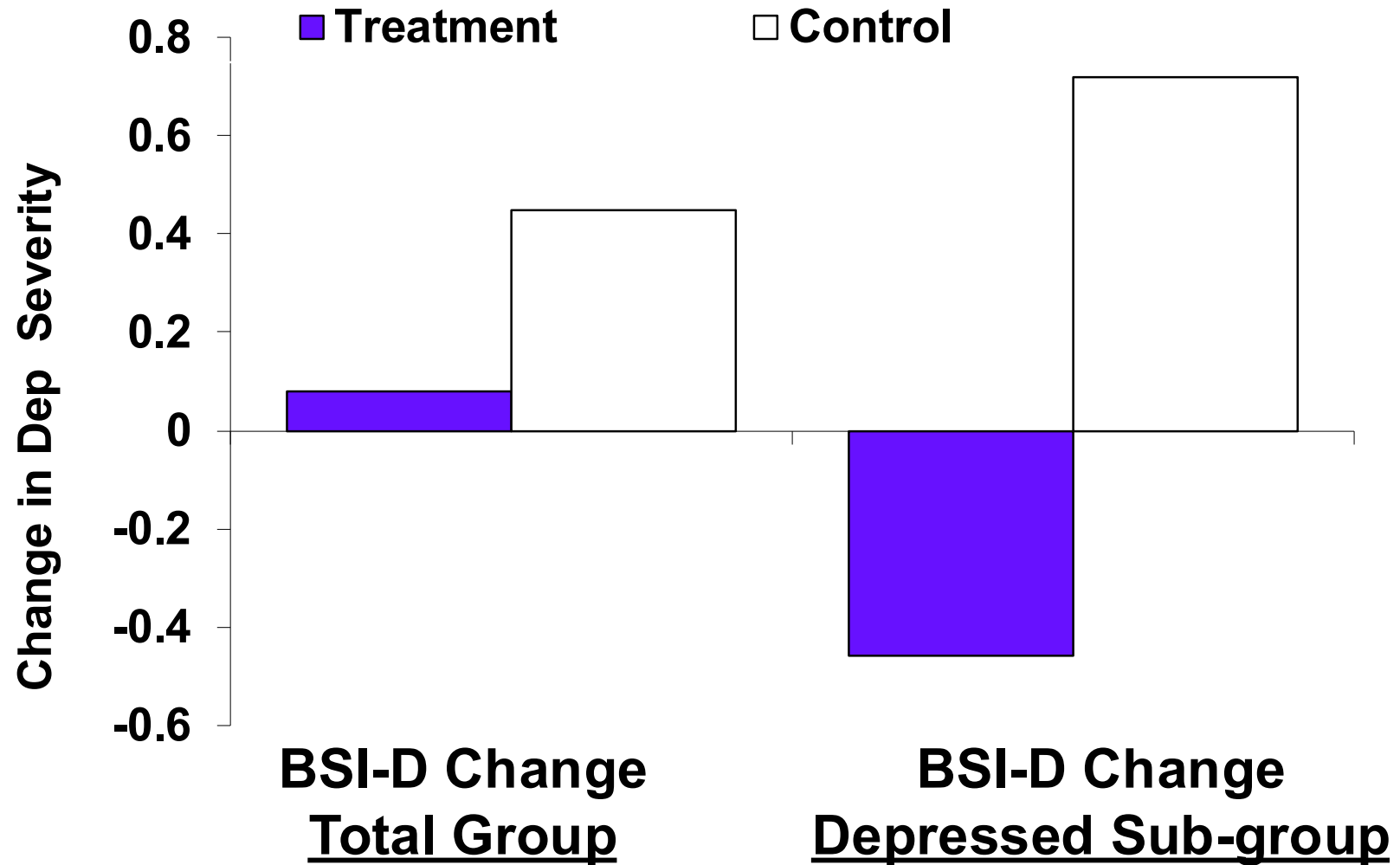
- Stepwise algorithm to identify & solve problems
- Similar strategies used for:
 - Remediation of executive dysfunction after TBI
 - Depression in elderly
- RCT of 12-session phone-delivered PST vs. Education in active duty Service Members with mTBI
 - Significant improvement in emotional status, depression, PTSD, sleep, physical function
 - Gains at 6-mos. not sustained at 12-mos.
- MBSR + CBT vs. Waitlist improved depression
- ACT appears to be mediated by psychological flexibility

Telephone Counseling to Improve TBI Recovery: Effect on Depression

- Reanalysis of Bell et al., Arch PM&R, 2005
- At discharge from inpatient rehabilitation 171 persons randomly assigned 1:1 to telephone counseling or usual care
- Intervention consisted of 30-45 min calls at about 2, 4, 8, 12, 20, 35 and 45 weeks after discharge
- Counselor used motivational interviewing techniques to elicit concerns, provide information and facilitate problem-solving to help with overall recovery/functioning after TBI
- Outcomes collected at one year by examiner unaware of group assignment

Bombardier et al JHTR 2009;24(4):230-238

Change in Depression Severity: 0-12 Months



BSI-D, Brief Symptom Inventory-Depression; $p=.02$, $p=.004$, respectively

Adaptations for Problem Solving Therapy

Key Components

Application of a step-by-step algorithm to:

- Identify, characterize, and prioritize problems; choose one to work on
- Brainstorm possible solutions
- Evaluate solutions as to feasibility and potential effects, and choose one to try
- Make and carry out a specific plan to apply the chosen solution
- Evaluate the success of the solution
- Modify the plan as needed or, if successful, continue with solution

Adaptations to Improve Treatment Receipt/Treatment Enactment in TBI

Begin with relatively simple problem to illustrate method and ensure success

Therapist prompts and assistance in defining problems and brainstorming solutions

Visual aids to illustrate cyclic nature of problem-solving process and remind patient of steps

Worksheets to help accomplish each step and record progress toward solutions

Caregiver involvement to assist with formulating and/or carrying out plans

Environmental Modification

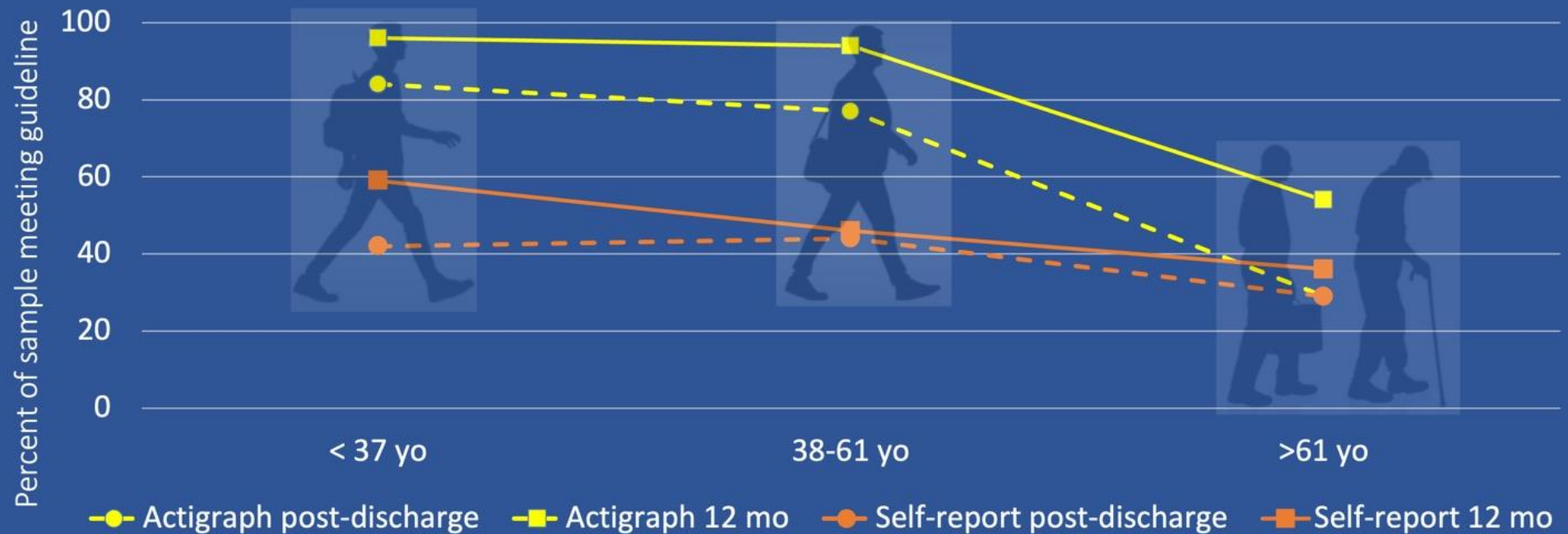
- Important for those unable to engage in talk therapy
- Consists of contingencies to alter frequency of targeted behaviors
- **Positive Behavior Support**
 - Emphasizes evaluation & prevention of **antecedents (triggers)** vs. consequences
 - Teaches prosocial skills
 - Provides patients choice of behaviors
 - Caregiver training enables long-term changes

Many People With TBI Are Physically Inactive

- People with TBI are more deconditioned than controls
- Report average of only 46 minutes of MVPA per week
- During IPR the longest period of MVPA was 2 minutes
- Physical activity is lower than needed to maintain health
- 58% of 18-44 year-olds but only 38% of those 45 or older met aerobic exercise guidelines
- *Being sedentary puts people in the general population at 18-25% greater risk of becoming depressed in the future relative to those who meet 50% or 100% of recommended activity levels*

(Mossberg et al., APM&R 2007; Driver et al., Disabil Health, 2012; Driver et al., Brain Imp, 2015; Driver et al., APM&R 2016; Hassett et al., JHTR, 2015; Hamilton et al., Brain Inj, 2016; Pham et al., PM&R, 2023; Pearce JAMA NW Open 2022)

Older adults are at greater risk of becoming physically inactive after TBI



METHOD: Investigators used wrist-worn activity monitors (actigraph) and self-report questions to estimate the percent of people (n = 180) who meet physical activity guidelines (at least 150 minutes per week of moderate to vigorous physical activity) after discharge from inpatient rehabilitation for TBI and at one-year post-TBI.

CONCLUSION: People older than 61 are at significantly increased risk of not meeting physical activity guidelines.

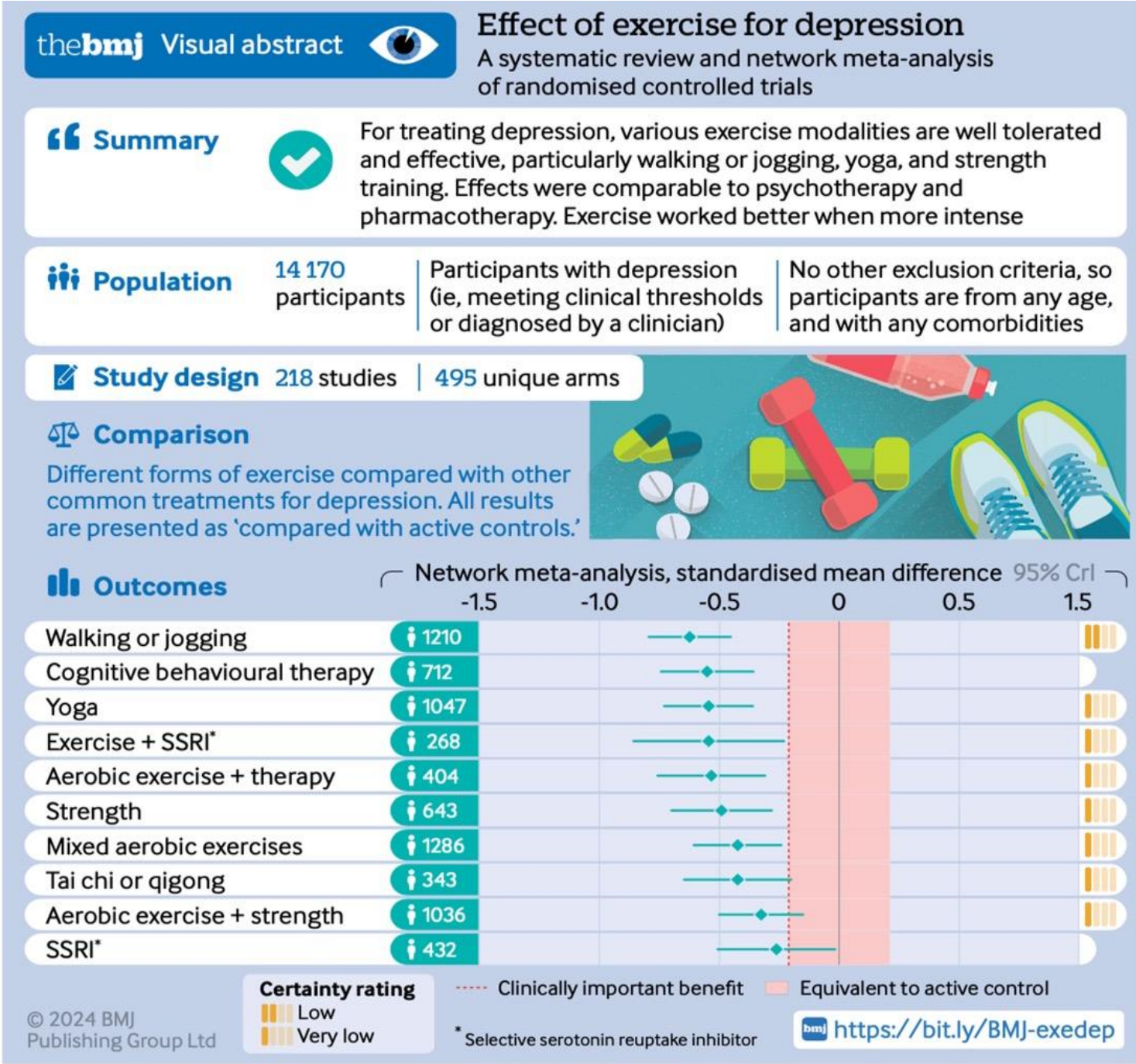
IMPLICATION: Older adults may benefit from early interventions to prevent prolonged physical inactivity following TBI.

Authors: S. Pradhan, D. Esterov, S. Driver, J. Whyte, K. Bell, J. Barber, N. Temkin, and C. Bombardier, *in press JHTR*

Project supported by the UW TBI Model Systems grant # 90DPTB0008, 90DPTB0024

Aerobic Exercise, Strength Training, and Mind-Body Exercise Are Effective Treatments for Major Depression in non-TBI Samples

Noetel et al., BMJ 2024



Exercise for Depression in TBI

- RCT (n=16) demonstrated improved mood after 8-week aquatic aerobics class vs. vocational rehabilitation class
- RCT (n=157) demonstrated no differences in depression between 12 weeks of cycle aerobics vs. relaxation classes
- RCT (n=84) demonstrated no differences in depression after 10 week supervised + home exercise program, but those who exercised > 90 min/week had lower depression scores
- Randomized crossover study of walking program vs. nutrition class (n=123 enrolled; 69 completers) showed walkers had improved depression compared to nutrition class

Driver S, Ede A. Brain Injury March 2009;23:203–212

Bateman A, Arch Phys Med Rehab 2001; 82:174–182

Hoffman J, PM&R 2010;2:911–919

Bellon, K. Brain Injury 2015;29:3, 313-319

inMotion Study design

- Participants: 80 under-active adults (18-64) with TBI and MDD
- Design: Participants will be randomized (1:1) to community/home based physical activity program versus wait-list control
- Intervention: 8 telehealth counseling sessions over 12 weeks; goal is to achieve *150 minutes of moderate to vigorous physical activity/week*; Smartwatch used to calibrate exercise intensity and for goals setting
- Outcomes: Depression severity (primary), pain, fatigue, anxiety, quality of life, and cognition at 12 and 24 weeks assessed by blinded interviewer
- Potential moderators: (e.g., race, sex, TBI severity)
- Potential mediators: (e.g., minutes of MVPA/week)

inMotion Study Treatment Manual*

Session 1: Overview of InMotion Program & Benefits of Moderate/Vigorous Physical Activity (MVPA)

Session 2: Goal Setting & Action Planning

Session 3: Injury Prevention and Safety

Session 4: Barriers, problem solving, coming up with solutions

Session 5: Prompts, cues, reminders

Session 6: Skills Review: Problem solving, goals setting, barriers, self-monitoring, cues

Session 7: Unhelpful/Negative Thinking

Session 8: Relapse prevention/slips, Action Plan & Keys to Success

***Physical activity intervention adapted from Diabetes Prevention Program, Lifestyle Balance Treatment Manual**

Screen for Physical Inactivity

Physical Activity Vital Sign

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1. On average, how many days per week do you engage in moderate to vigorous physical activity (like a brisk walk)? _____ days
 2. On average, how many minutes do you engage in physical activity at this level? _____ minutes
- Total minutes per week of physical activity (multiply #1 by #2) _____ minutes per week**

U.S. guidelines recommend 150 minutes per week of moderate intensity physical activity. In place of moderate intensity activity, you can complete 75 minutes of vigorous intensity activity, or an equivalent combination of moderate and vigorous intensity physical activity.

- **1 minute of vigorous activity is equal to 2 minutes of moderate activity.**
- **You can perform activity in multiple “bouts” of any length throughout the day to add up to the 150 minutes/week.**

Opportunities

- With some adaptations, many interventions are promising for those with significant cognitive impairment after TBI
- A team-based collaborative care approach was shown to decrease pain, depression, & anxiety (Hoffman et al, JAMA Netw Open 2024)
- Treatment based on skills training (e.g., CBT, PST) likely need booster sessions
- Need to better define interventions, identify & measure active ingredients
- Need to test theoretically based interventions that align with causative factors (e.g., BA or ACT to counteract loss of meaningful activity, associated with post-TBI depression)
- Remote technologies have great potential to enhance & facilitate delivery of interventions

Questions?

