Enhancing the Precision and Effectiveness of Cognitive Rehabilitation by Applying the RTSS Framework

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Talk Objectives

- If treating people recovering from brain injury…
  - your treatment will be tied to a functional goal for your client
  - your client could describe the purpose of, and ingredients involved in your treatment
  - a colleague covering for you could implement your treatment
- If conducting clinical efficacy/effectiveness research..
  - practitioners reading your methods would be able to try out the treatment
  - other researchers could replicate your treatment

Disclosures

- Financial Disclosures:
  - Received honorarium and travel support for this talk
  - Receive royalties for textbooks and clinical programs that this talk references
- NonFinancial Disclosure
  - Member, ANCDS Research Writing Committee
  - Author and reviewer of numerous peer-reviewed publications regarding cognitive rehabilitation

The Field of CR has Evolved

Advancements

- Influence of technology
- Emphasis on instruction
- Emphasis on interprofessional collaboration and communication
- Emphasis on function
- Emphasis on empowerment and self efficacy as integral to cognitive rehabilitation (psychological mindedness)
- Adoption of implementation science research practices in the development and evaluation of clinical treatments
- Expanded understanding of neuroplasticity
- Increased focus on culturally informed practice

A Major Challenge

- Lack of specificity
  - Diverse set of practices
  - Delivered by multiple professions
  - Focus on function rather than cognitive impairment

The Solution: Rehabilitation Treatment Specification System (Hart et al., 2019)

The Goal of Cognitive Rehabilitation

To encourage functional change in clients and an increased sense of wellbeing in every client who seeks our expertise.

(Sohlberg, Turkstra & Hamilton, 2023)

Cognitive Rehabilitation Framework

- **International Classification of Functioning, Disability, and Health (ICF;** WHO, 2001) classifies impact of a medical diagnosis as it intersects with environmental and personal factors.
- **The Rehabilitation Treatment Specification System (RTSS;** Hart et al., 2019) classifying the specific components of rehabilitation treatments

ICF Model

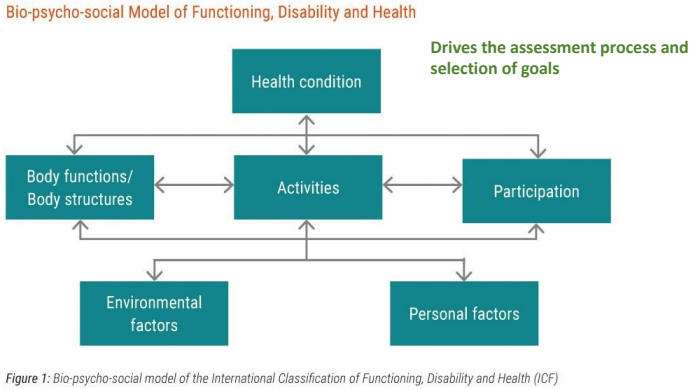
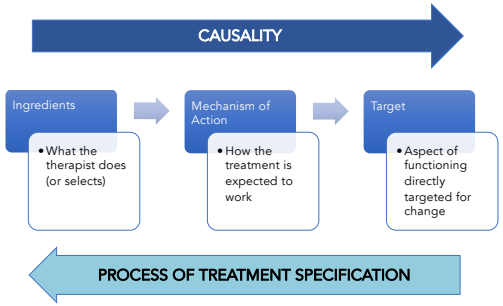


Figure 1: Bio-psycho-social model of the International Classification of Functioning, Disability and Health (ICF)

RTSS Model (Hart et al., 2019)

https://acrm.org/acrm-communities/rehabilitation-treatment-specification/manual-for-rehabilitation-treatment-specification/



Note: A group of targets often make up an AIM. You can think of targets as STO and Aims as LTG. We need to differentiate between learning a strategy or external aid from the IMPACT of using that tool.



RTSS in a nutshell

- Targets—what you hope client will gain during session
- Aims—meaningful impact of working on the targets
- Ingredients—What clinician will do to achieve targets
- Measurements that guide treatment and objectively describe outcome

Targets

- Targets are the direct, specific outcomes of treatment
- Not names of problems ("speech", "gait," "executive functions", "anxiety")
- Measurable
  - Increased volume of voicing?
  - Increased walking speed?
  - Increased accuracy of using planning app?
- ALWAYS observable and measurable (in principle)
  - Otherwise, there is no way of knowing if the selected ingredients are working

Two Categories of Targets

S Targets: Skills

- Common S targets in CR:
  - Metacognitive strategies
  - External aids
  - Functional tasks

R Targets: Knowledge or Affective States (representation)

Common knowledge targets in CR

- Brain injury recovery facts
- The effect of sleep on attention
- When and why to use a target strategy

Common affective targets

- Completing home program
- Attendance in treatment
- Expressing optimism for improvement

AIMS

A functional outcome representing a meaningful change for client by meeting targets.

- Examples:
  - Target: Increased volume of voicing
    - AIM: Spouse reports improved conversational ease
  - Target: Increased walking speed
    - AIM: Client able to complete morning neighborhood walk
  - Target: Increased accuracy in using planning app?
    - AIM: Decreased number of missed appointments

AIMS might be a group of targets or occasionally might be the same as a target if the target is a functional change.

Treatment Ingredients

- Specify what the clinician does to deliver treatment that is hypothesized to play a role on reaching the target
- Observable and Measurable
- Example: Training use of an app designed to increase focus
  - Possible ingredients
    - Systematic instruction (teach steps to use app; errorless learning; distributed practice)
    - Teach-back method (demonstrate, observe, correct, elicit reflection and repeat

Mechanism of Action

Category of Mechanism of Change	Description	Treatment Examples
Behavioral	**Improving skilled performance through learning which is usually a mix of declarative & nondeclarative learning**	**-Strategy training**
Cognitive	**Improving skilled performance though changes in processing ability.**	**-Attention training**
Psychological	**Improving performance through an alteration in beliefs, attitudes, mood etc. Holds that psychological states determine behavior**	**-Motivational Interviewing -Psychoeducation -Grief/Acceptance counseling**
Physiological	**Change in a structure will lead to desired performance**	**Oral Motor Exercises Palatal lift**

Target Groups and Corresponding Ingredients and MOA using RTSS

Target Type	Definition	Typical Ingredients	Mechanisms of Action	Examples of NeuroRehab Targets
Organ Functions	Change or replace organ functions	-Electrical stimulation -Exercise schedules for strengthening or endurance training -Devices for limb or organ replacement	Depends on the organ, e.g., changes in electrical signaling, tissue stretching, increased cardiac efficiency, artificial organ features	-Increased accuracy of recall on a list-learning task via transcranial direct current stimulation
Representations	Enhance knowledge, or modify attitudes or emotional responses	Didactic instruction Providing information in multiple modalities Linking to previous knowledge Prompts to evaluate task importance or self-efficacy	Cognitive or affective information processing	-Increased knowledge of facts about brain injury -Increased awareness of strengths and challenges -Increased self-rated motivation to complete a task
Skills & Habits	Improve ability to perform a mental or physical activity	-Opportunities for repeated practice -Instructions -Modeling -Cues -Feedback	Learning by doing	-Increased accuracy in following steps in a task (use of an app; dressing sequence; breathing technique; use of walker) -Increased frequency of entering to-do items in a digital reminder -

Example ingredients for Skill and Habit targets: (S Targets)

- Providing opportunities for practice
- Instructional techniques
  - Error minimization
  - Chaining steps
  - Anticipating difficult steps
  - Use verbal mediation
  - Discovery learning techniques
- Providing aids (e.g., calendar planner, app)

Example ingredients for R targets

- Knowledge/performance-enhancing methods
  - E.g., teaching information using visual aids, linking prior knowledge, verbal repetition. Making a video of key information
- Affective/ attitudinal change methods
  - E.g., motivational interviewing techniques with change talk; success imagery; CBT techniques
- Engagement/motivational methods
  - E.g., self reflection, self-directed goal setting

Sample Ingredients for R Targets Addressing Affective States (motivation, engagement, self efficacy)

Adapted from Michie, van Stralen, and West (2011).

- Identify the discrepancy between their current behavior and self stated desired goal
- Choose their own goals (aims and targets)
- Choose their own practice schedule (for home practice)
- List pros and cons
- Imagine future outcomes
- Identify themselves as role model
- Consider an identity associated with changed behavior
- Reframe problems, e.g., as "typical" or "challenges"
- Mentally rehearse successful performance
- Use positive self-talk
- Focus on past successes
- Agree to a behavioral contract
- Identify barriers to task completion and strategies to overcome those barriers

Alliance Enhancing Treatment Ingredients Can Improve Performance
Rothbart et al., 2025

Alliance Enhancing Treatment Ingredients	
Ingredients to Solicit Patient Input	(a) Task Rationale: Review task rationale (e.g., "Just a reminder that this drill [smartphone app] will help with your attention [or skill], which you mentioned would be useful.")
	(b) Task Choices: Provide choices regarding task execution (e.g., "Would you prefer to take a break now or after the next task?")
	(c) Task Prediction: Provide an opportunity to predict performance or required effort (e.g., "On a scale of 1-5, how challenging do you think this task will be?")
	(d) Task Reflection: Provide opportunity to reflect on task performance (e.g., "How did that feel?"; "Is there anything you want to do differently?")
	(e) Performance Affirmation: Provide specific and encouraging feedback pertinent to task completion (e.g., "You look like you are really concentrating."; "That was a high score on that drill."
Ingredients to Promote Positive Affective States	(a) Bonding Statement: Inquire about personal status (e.g., "How was your morning?"; "Tell me about your week?")
	(b) Active Listening Statement: Ask about a topic or event mentioned in previous session (e.g., "How did your visit with your daughter go?"; "I remember you preferred to have the screen dimmed a bit…is this ok?")
	(c) Positive Regard Statement: Express authentic positive regard about an observation (e.g., "I'm impressed with your resilience when faced with challenges from your injury.")

Most Rehabilitation Targets Involve both R and S Targets

TEACHING A CALENDAR APP

Sample R TARGETS:
Increase knowledge about different technology options and features
Increase confidence that client can use the technology

SAMPLE S TARGETS:
Increase skill in using the app
Increase skill in using the app for specific functions
Increase skill in using the app in specific contexts

Process for the Selection of Targets

Clinical process

- Personalized
- Collaboratively selected and developed

Ingredients

- Present options for aids or strategy
- For higher level clients have them try and rate options
- Some clients benefit from demonstration
- Clinician must be familiar w/options: apps, aids; strategy categories

Distinguishing Activities, Targets, Ingredients, & Aims

Example: Therapy session focused on learning names of members in support group

Activity: (format)

-Photo memory matching game

Target (Desired client behavior/action)

-Client correctly names four photos with no cues within 2 seconds

Ingredient (What the clinician does-replicable/specific)

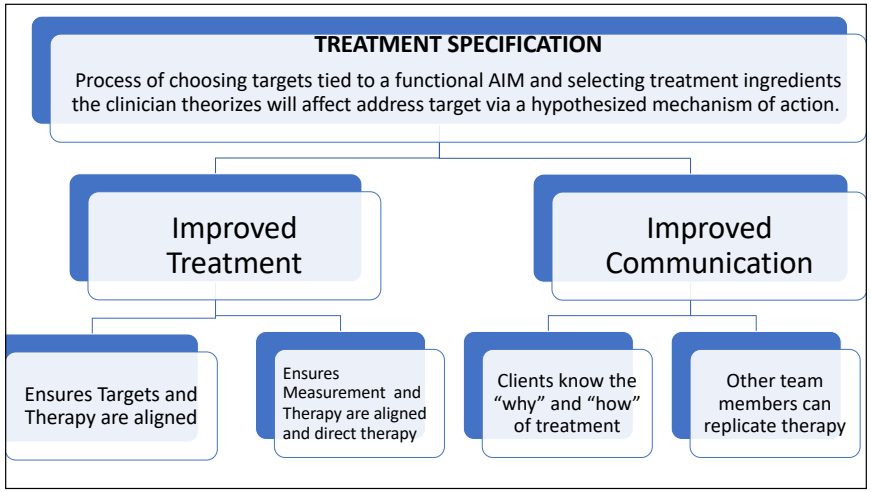
-Error controlled spaced retrieval (show photo card, client repeat name and characteristic, turn over card wait 10 secs and repeat doubling interval if correct. At 1 minute add new photo)

-Encouraging phrases: "We'll practice till you get this" "It's name by name"

Aim (Overarching meaningful, functional goal)

-Client greets two members by name

-Client reports feeling more comfortable with remembering names



Applying RTSS When Treating Client with Unawareness

- Client profile:
  - Psychiatrist sustained severe TBI from falling off ladder
  - Chief complaint: "My partners are making me do cognitive rehabilitation before I can go back to work
  - Knows about cognitive functions and the brain, and can explain in detail why he has recovered
  - Clinician chooses target of "increased awareness of memory strengths and weaknesses"

Target	Target Group	Ingredients	Outcome
Increased awareness of memory strengths and challenges	**R**	• **Asking the client to describe memory subtypes** • **Phrasing as "getting a sense of what you are capable of" rather than "showing impairments"** • **Collaboration to identify practice scenarios** • **Use of scenarios from a familiar, professional source (DSM-5th edition)** • **Videorecording role-playing** • **Data-sheet for client to record recall errors** • **Prompts to self-evaluate** • **Prompt to create his own memory profile**	• **Accurate verbal description of his own memory strengths and challenges (Target)** • **Agreement to modified work plan (Aim)**

What is Goal Attainment Scaling?

- A method of measuring outcomes that are specific, sensitive and meaningful to clients
- Uses a collaborative interview process to generate functional goal domains that would be expected to change with therapy
- Delineates different objective levels of possible progress
- Becoming increasing more common as there is a call for **patient-centered outcomes**

Advantages of GAS

- Captures individual variability
  - Can be used to measure intervention effects on heterogenous populations with different comorbidities
- Shows high sensitivity to change in the areas that individuals have deemed as most important to them.
- **There is therapeutic value from the GAS process specific to brain injury rehabilitation.** (Aligns the therapist and patient)
- Can delineate the degree of change

SAMPLE GAS

Functional Domain: School Performance/Assignment Management
Cognitive Domain: Executive Functions
Intervention Approach: Use of homework agenda
Measurement: Missing/late assignments reported on school website; self report

2 Most favorable outcome likely	No missing/late assignment	I follow my homework checklist 4 days in a week
1 Greater than expected outcome	1 missing/late assignment,	I follow my homework agenda 3 days in a week
0 Expected level of outcome	2 missing/late assignments	I follow my homework schedule 2 days in a week
-1 Less than expected outcome	3 late/ missing assignment'	I don't follow my homework agenda
-2 Most unfavorable outcome	More than 3 late assignments	I decide not to use a homework agenda

Application of RTSS and GAS to Inpatient Setting

Client Profile

- 19 y/o male who sustained an anoxic brain injury from a near drowning incident
- Admitted to IPR for comprehensive rehabilitation ~6 weeks post-injury following complicated acute hospital stay
- Prior level of functioning: College student, athletic (skier)
- Supports: Involved mother, currently local

Primary Concerns

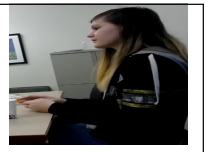
- High levels of distractibility by internal and external stimuli
- Safety judgement: 1:1 sitter, impulsive, high fall risk with profoundly impaired memory to recall why safety precautions are in place
- Problem solving: unable to recognize a problem with absent awareness of current circumstances or deficits. Profoundly impaired.
- Constantly wants to get out of bed and is in restraints

Aim, Target, Ingredients, Goal Attainment Scale

- ***Aim:*** *Improve personal safety*
- ***Target: Use Call Button to contact nurse before getting out of bed***
- ***Ingredients:*** *A visual reminder posted in his line of sight; periodic massed practice feedback and when call bell not used, rapid response and praise when call bell used, daily feedback about progress toward target*
- ***Measurement Plan:*** *GAS Nursing staff will document all occurrences of use and non use*
  - ***Timeframe:*** *Level 0 to be demonstrated across 3 consecutive days by one week from now*

-2	-1	0	+1	+2
Much less than expected	Less than expected	Expected outcome	Better than expected	Much better than expected
Diego rings the call bell for help less than 20% of the time.	Diego rings the call bell for help 20-39% of the time.	Diego rings the call bell for help 40-60% of the time.	Diego rings the call bell for help 61-80% of the time.	Diego rings the call bell for help more than 80% of the time.

Case Example: Training Use of a Cognitive Strategy



15 y/o female 1 year post moderate TBI

- Bike accident; no helmet; no initial loss of consciousness.
- Surgery for removal of rt frontal epidural hematoma
- Seen at our clinic 1 year post

Persistent symptoms:

- Executive function, attention, social communication challenges (learning & memory within expected levels)
- Headache
- Anxiety

School

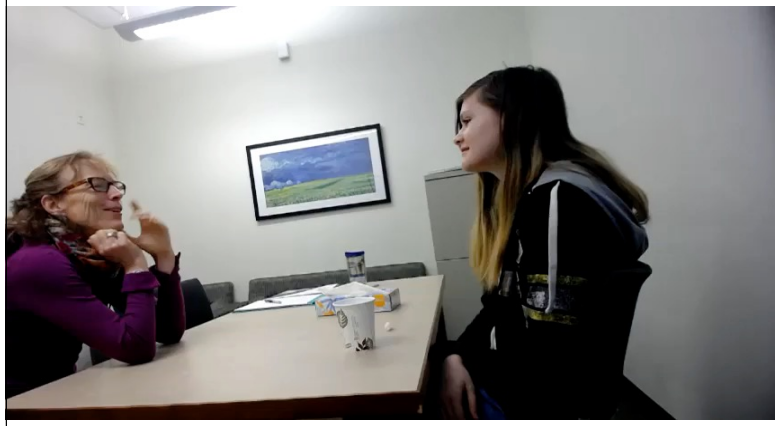
- IEP
- limited day; supported study hall, modified assign

Collaboratively Identified Goals

- Increase successful social communication
- Increase assignment management

Overall AIM: Improve social communication

Allie: "I want to have more friends and feel good at school."
Mom: "I want her to have more successful interactions with peers and less conflict with her brother"



Video Example of Collaborative Selection of Cognitive Strategy

What do you like to do?
I want to be a theoretical physicist.
Oh you like hypothesis testing.
Yes, I like theories.
You have described some issues with social interaction where you are unsure of what people mean—can you tell me more about that?
….Leads to suggestion for strategy

Allie's "Social Theory" Theory Strategy

STRATEGY STEPS

1. **Pause when I get "weird vibes"**
2. **Come up with at least two theories**
3. **Test them out by thinking about it or by asking the person**

Cognitive Strategy Training

Collaborative **selection** of strategy

TREATMENT

KNOWLEDGE (R target): Why, how and when to use strategy

APPLICATION (S target): Demonstrating the strategy

MEASUREMENT: (a) Knowledge-R target, (b) Strategy Use-S target' (c)Impact-GAS

Allie's Treatment

- Ingredients for R Target Teaching Strategy Knowledge:
  - Verbal knowledge questions (100%-1 session)
  - (1) Name situations you want to use your strategy; (2) Describe the three steps of your strategy
- Ingredients for S Target Teaching Strategy Use
  - Role play practice with real life scenarios brought in by Mom
  - Cyclical process: prediction, reflection, modification (Criteria Met in 3 sessions)
- S-Target Measurement (Ability to Use Cognitive Strategy): Electronic check-in and log by Allie and her mom (4 sessions)
- AIM Measurement (Impact of Strategy): Goal Attainment Scale

GAS
+1 (more than expected improvement; 1-2 instances in a one week period)

OUTCOME (Impact)

Best outcome	Zero instances of social disappointments per week
Better than expected level	1-2 instances of social disappointments per week
Expected level (after working on it for about one term)	3-4 instances of social disappointments per week
Where you are now	5-6 instances of social disappointments per week
Worse than now	7-8 instances of social disappointments per week

Qualitative notes:

"I can see her at the dinner table thinking when someone says something like her wheels are spinning. Then I ask her and she can give hypotheses. Conflict has way reduced"

Bottom Line: Specification Matters

Targets—what client will do during session

Aims—impact of working on all the targets that is meaningful to client

Ingredients—What clinician will do to achieve targets

Measurements that guide treatment and objectively describe outcome



Thank you!
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