

**DEFINING REHABILITATION  
TREATMENTS:  
DO WE KNOW WHAT WE'RE DOING AND CAN WE  
TELL OTHERS?**

**John Whyte MD, PhD**

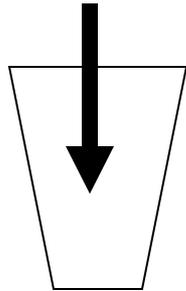
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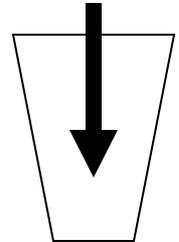
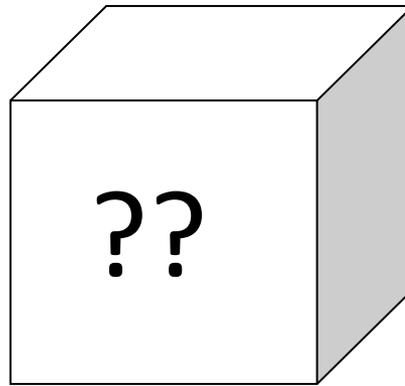
**MRRI**  
MOSS REHABILITATION  
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Impairments

Activity limitations

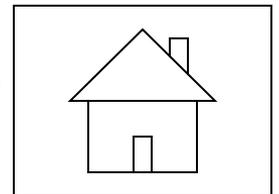


# The Black Box of Rehabilitation



Improved  
functioning?

Better quality of life?



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## Collaborators:

Christine Chen, ScD, OTR/L, FAOTA

Marcel Dijkers, PhD

Mary Ferraro, PhD, OTR/L

Tessa Hart, PhD

Andrew Packel, PT, NCS

Lyn Turkstra, PhD, CCC-SLP, BC-ANCDS

Jarrad VanStan, MA, CCC-SLP, BCS-S

Jeanne Zanca PhD, MPT

# An Example of our Problem: synthesizing research for evidence based practice

- The Department of Defense wanted to know whether “Cognitive Rehabilitation” is an effective treatment after TBI
- DoD commissioned an evidence-based review of “Cognitive Rehabilitation”
- The reviewing contractor assessed the effectiveness of, among other things, “Memory Remediation”

# Memory Remediation Included:

- Training in mnemonic strategies for remembering therapists' names
- Using a memory notebook to keep track of job-related directions
- A digital paging system that provided reminders of key appointments
- Is there reason to think:
  - That all of these or none of these is effective?
  - That they are all effective in improving the same thing (“memory”)?

# Current Status of Treatment Specification

- Treatments defined by discipline (2 hours/wk of PT) or facility (6 weeks in an IRF)
- Treatments defined by the problem addressed (gait training, memory remediation)
- Neither supports:
  - Research on effectiveness, including systematic reviews and meta-analyses
  - Dissemination of effective treatments
  - Clinical education and supervision

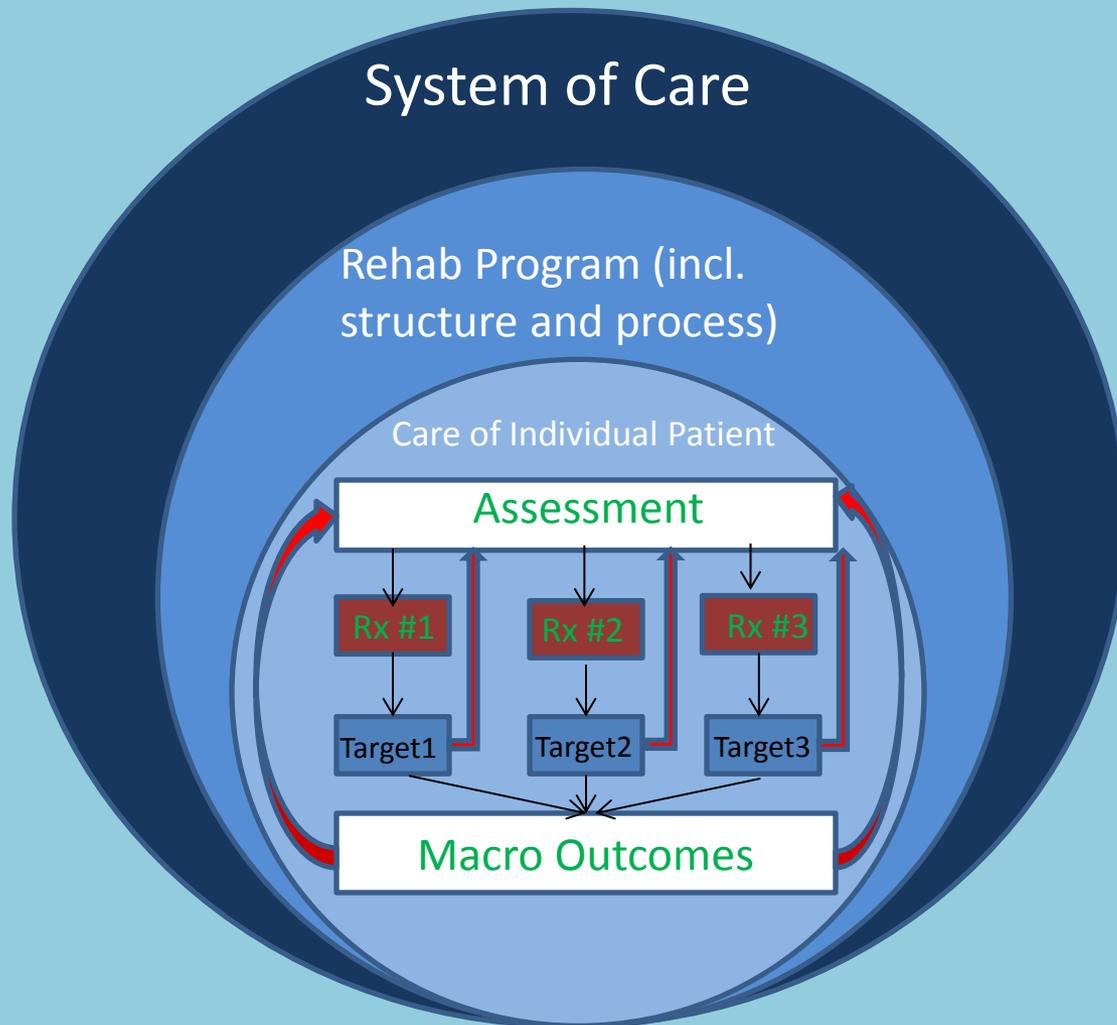
# The Alternative

- *An ingredients-based* definition of treatment:
  - What does the clinician do with the patient?
- But there is an infinite number of potential “ingredients” (color of treatment room, name of clinician, day of the week of treatment)....
- *Which* ingredients should define the treatment?

# Before we go there...

- What part of the rehabilitation process are we trying to define?

# The Rehabilitation Process



# The Proposed Treatment Definition Scheme Relies on Treatment Theory

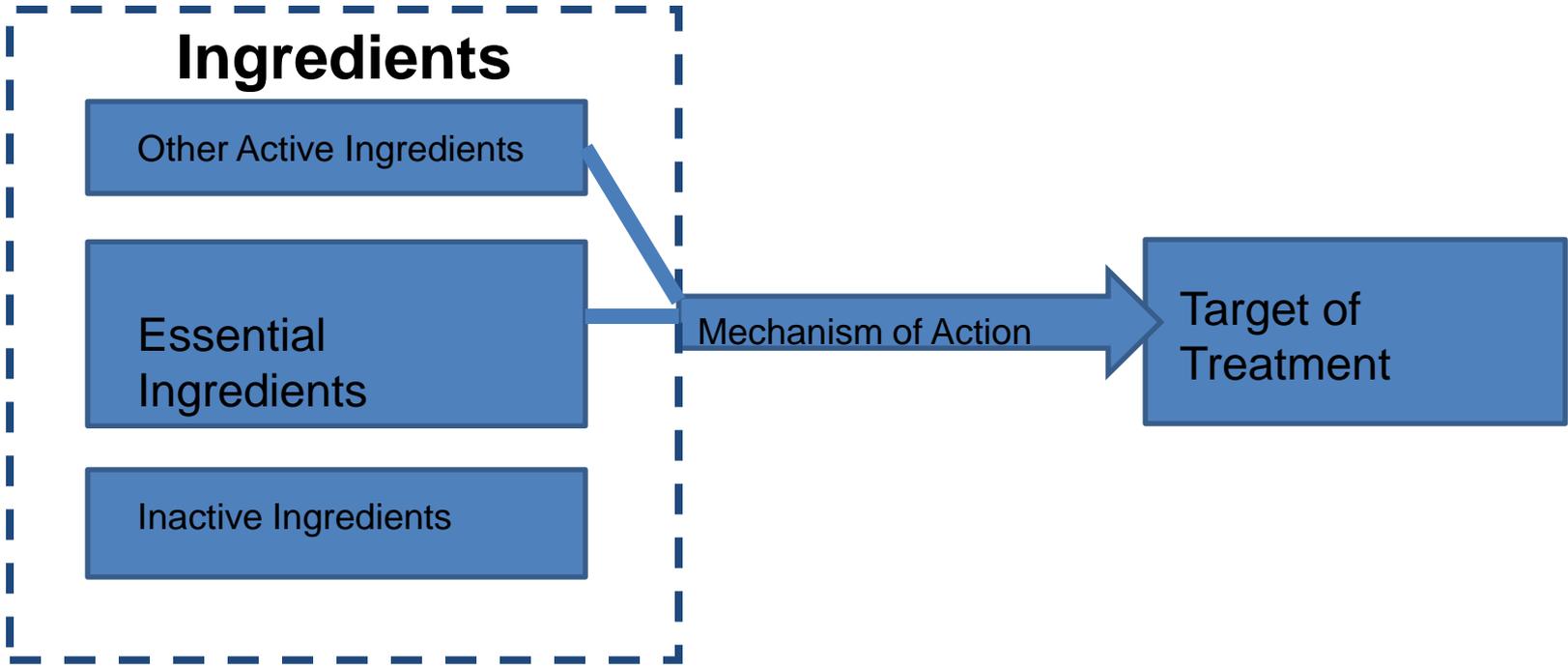
- What Is a Treatment Theory?“
  - ...some set of propositions that describe what goes on during the transformation of input into output, that is, the actual nature of the process that transforms received therapy into improved health.”

--Keith & Lipsey, 1993
  - That is, a statement of *how* and *why* a particular treatment works.

# Treatment Theory

- Specifies the mechanism by which a proposed treatment *directly* changes some aspect of functioning
- Directly changed entity = “target” of treatment
- In doing so, the treatment theory defines the “essential ingredients” of the treatment that produce the desired change
- There may be additional “active ingredients” that moderate the treatment’s effect, but the “essential ingredients” are defining
- In rehabilitation, treatment theories come from many different domains of science

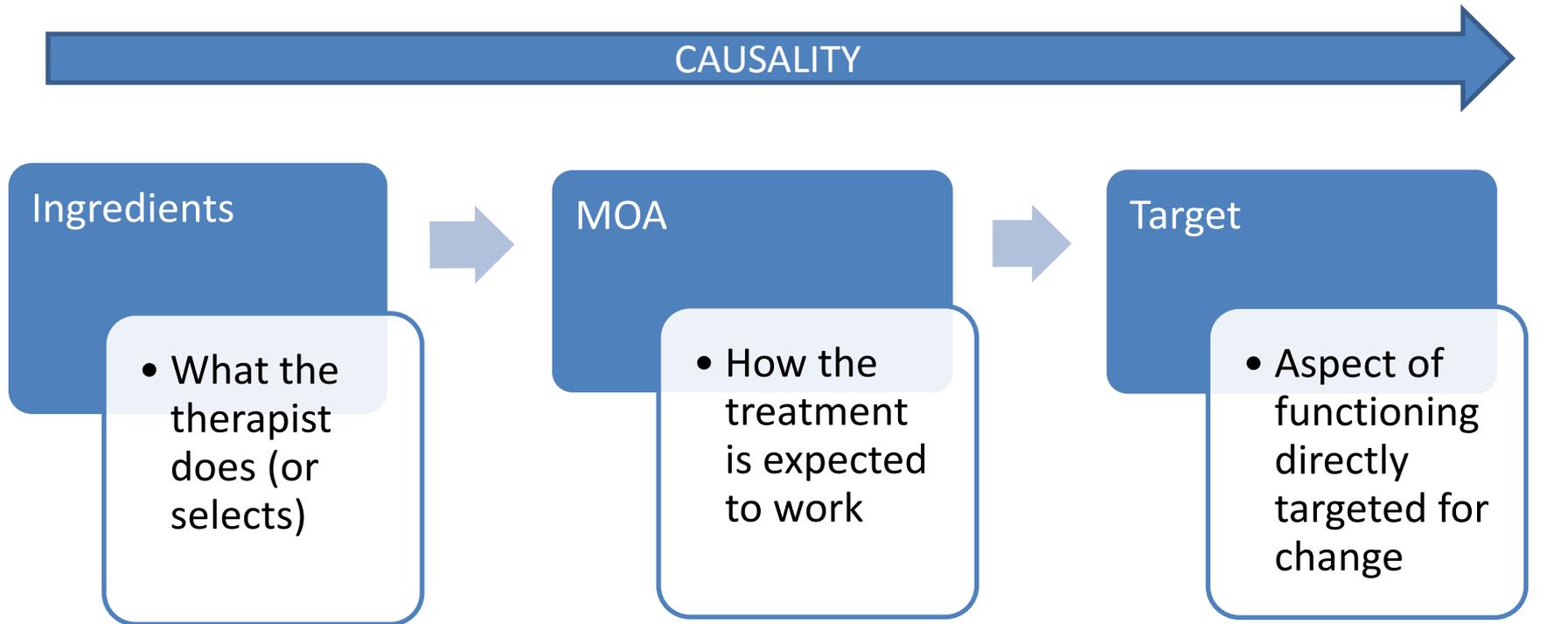
[.....Treatment.....]



# Treatment Theories Can Be Developed at Any ICF Level from Body Function to Participation

Treatment	Target	Essential Ingredients
Palatal lift	Reduced nasality of speech	Physical elevation and posterior displacement of soft palate
Progressive resistance exercises	Increased torque of the muscles around a joint	Repetitive contraction against increasing resistance
Social communication training	Improved social competence in conversation	Conversation practice in group setting (?) with self-assessment (?) and peer-assessment (?)

# Treatment Theory's Tripartite Structure

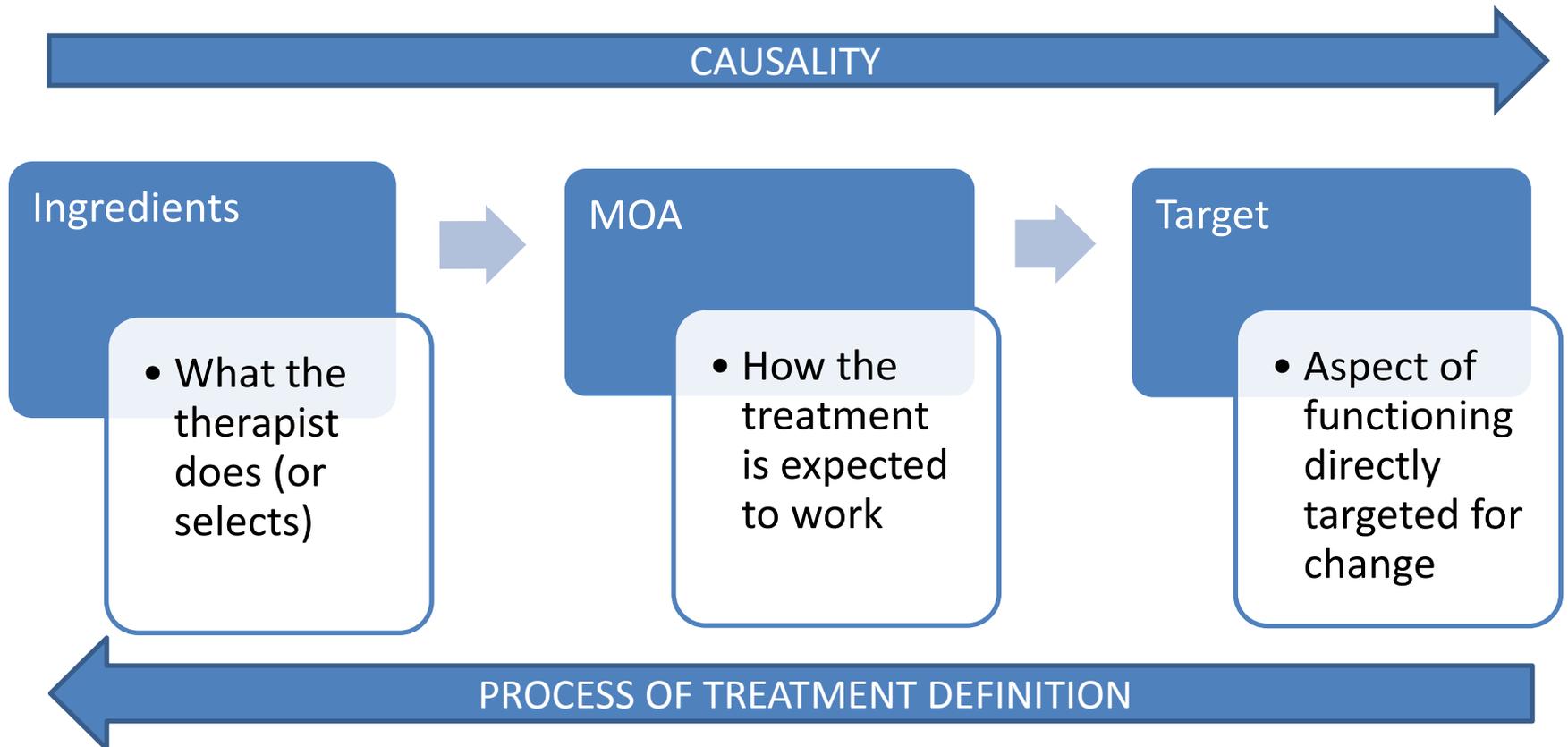


*...effects of treatment beyond the Target are for enablement theory to explain*

# Relation to clinical practice

- In planning a treatment, one does not follow the causal chain, ingredients → MOA → target, but rather its reverse:

# Clinical Chain of Treatment Theory

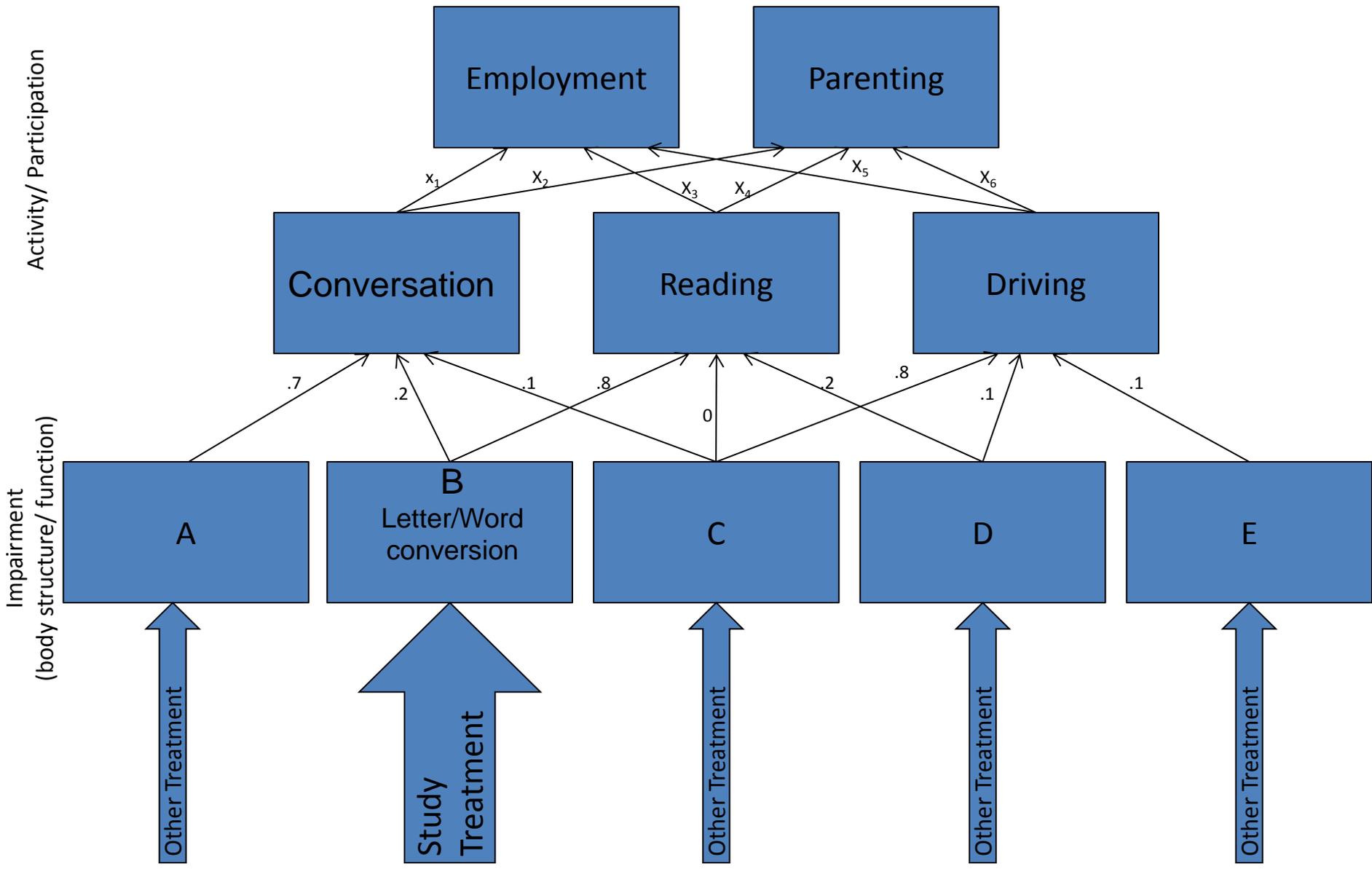


# The Essential Problem in Neurologic Rehabilitation

- A stroke or brain injury typically produces multiple physical and cognitive impairments
- The clinical concern is to restore real-world functioning in activities of importance
- Many activity limitations and participation restrictions are produced by a complex combination of multiple impairments
- The link between impairment treatment and activity success is tenuous

# Enablement Theory...

- Addresses the causal interrelationships among variables at different levels within the ICF
- *If* we improve a particular impairment, *what effects* do we expect *elsewhere* in the ICF system?
- Doesn't tell us *how* to make a change in a target.
- *Aim* of treatment (the clinically important desired outcome) is often distal to *target* of treatment, so enablement theory is relevant (e.g., strengthening to enhance ambulation).



# Contributions of Treatment & Enablement Theories

- Treatment theory
  - Defines a treatment
  - Tells us whether a given bundle of ingredients are “treatment A” or “treatment B”
  - Predicts a target that should change in response to treatment
- Enablement theory
  - Determines the broader impact of a treatment on distal aims
  - Helps determine what set of outcome measures should respond to treatment in which patients

# Using Broad Treatment Theories to Define Broad Groupings of Similar Treatments

- In trying to compose groupings (classes) of treatments that are mutually exclusive with respect to targets- MoA- essential ingredients,
- We have started with types or domains of targets that are commonly addressed in rehabilitation →
- 3 treatment groupings\*

\* In our original publications there were 4 treatment groupings but 2 have since been combined

# The 3 groupings: Treatments that alter...

- Organ and organ system functions and substitutions – “O” group
- Skilled performances and habits – “S” group
- Cognitive/ affective representations and volition – “R” group

# Organ functions

- Typical targets: Output/ efficiency/ response dynamics of organ or organ system; desired changes may be temporary or longer lasting
- MoAs: Up- / down-regulation; classical conditioning/ habituation; substitution of organ function
- Essential ingredient: Organ-specific stimuli that change the relationship between inputs and organ system outputs
- Examples of active ingredients: Forms of energy, patterns of stimulus exposure, prosthetic organs
- Typical dosing parameters: Progression in demand on organ system
- Clinical examples:
  - Prolonged stretch to increase joint ROM
  - Deep brain stimulation, tDCS, tilt table, “attention capture” treatments for pain, prosthetic limbs
  - Cardiovascular exercise, muscle strengthening exercise (volitional – more later!)

# How can one group cover so much different territory?

- Commonality is that the functional output of the organ (system) is changed:
  - Dynamics between inputs and outputs are changed (decreased heart rate with exercise in cardio, attenuated startle response with habituation)
  - Something substitutes for the output (prosthetic limb, cochlear implant, brain stimulation)

# S and R – “Active Learning Groups”

- All treatments in these 2 depend on learning mechanisms for MoAs
- All treatments included in these 2 groups are volitional
  - Require effort, engagement on part of recipient
  - *Does not necessarily mean that the recipient is aware of learning. Recipient may be “task aware” without being “learning aware”*
- Large groups (contain majority of rehabilitation treatments)

# Skilled Performances & Habits

- Typical targets: Speed, efficiency, quality, automaticity of performance
- MoAs: Implicit & explicit learning mechanisms
- Essential ingredient: Facilitation of performance--“learning by doing”
- Examples of additional active ingredients: Instructional/ motivational aids; provision of strategies; “coaching” guidance & feedback
- Typical dosing parameters: Schedules of practice; progression of performance demands (“zone of proximal development,” shaping)
- Clinical examples: Training in any kind of performance (you name it); “functions” and “activities”; both mental & physical skills; use of compensatory strategies; repeated practice to improve balance, dexterity; etc., etc.
- Targets can be subdivided into “function-like” (e.g., “balance”, “manual dexterity”, “working memory”) and “activity/skill-like” (e.g., “dressing”, “preparing a cold meal”, “playing the piano”)

# Cognitive & Affective Representations & Volition

- Typical targets: Internal representations: Amount & accuracy of knowledge; changes in emotional reactions, attitudes, & beliefs, propensity to act or perform
- MoAs: Information processing mechanisms
- Essential ingredient: Facilitation of the acquisition of (salient) information (this can include novel interpretations of “old” information)
- Examples of active ingredients: Attributes of information, emotional valence; means of facilitating acquisition & retention; Socratic methods
- Typical dosing parameters: Amount, spacing of information; repetition & rehearsal; *no true progression as in other groupings*
- Clinical examples: “Talk therapies,” patient education, adjustment counseling, information on “how to” or “what to do” (w/o practice)

# The Role of Volition

- Many treatments in Group O can be delivered “passively” to patients (e.g., serial casting, electrical stimulation) as long as they don’t resist, but others (e.g., exercise) require volitional effort.
- All treatments in Groups S and R require the patient to engage in some form of effortful performance in order to be effective.
- Even many of the “passive” treatments in Group O may sometimes be “self-administered”, in which case they can be thought of as “activities” (albeit activities with their own therapeutic effects) that must be learned and executed.

# Two Targets for Volitional Treatments?

- Volitional treatments in Groups O and all treatments in Group S require 2 treatment components and 2 targets:
  - An R group target of *performing the therapeutic activity as directed* (with corresponding informational and motivational ingredients); and
  - An O or S group target reflecting the change in organ function or skill that will result from performing the therapeutic activity
  - Treatments with R targets don't need a second R target *unless* the activity will be performed without supervision

# Treatment with/without supervision

- Resistance training to increase muscle torque
  - It's an “activity” that must be learned
  - When it's performed correctly it has effects on muscle torque
- The clinician selects
  - Ingredients for the exercises themselves (e.g., the amount of weight, number of reps, rules of progression)
  - Ingredients to transmit knowledge of how and when, motivation to actually perform
  - If supervised, the latter set of ingredients may be “improvised”; if unsupervised, they should be carefully planned

# Benefits of an Ingredients-based Treatment Specification System

- Focuses a clinician's attention on the target vs. the aims, and invites consideration of the range of relevant targets
- Focuses research on the impact of classes or dimensions of ingredients rather than separate instances of their use, i.e.,
  - Effects of different schedules of practice across many different activities that must be learned, vs.
  - Effectiveness of gait practice; effectiveness of meal preparation practice, etc.

# Targets Must Be Measurable (in principle)

	Target Content	Measurable Aspect
O Group	Biceps torque; Bladder storage capacity	Increase, decrease, altered variability
S Group	Dynamic balance; Shirt-donning	Increased resistance to balance challenges; faster, reduced assistance
R Group	Names and purposes of medications; Willingness to speak in public	More accurate knowledge, reduced speaking anxiety

# Treatments & Treatment Components

- Many “treatments” (in clinical parlance) have multiple “treatment components” with different targets, e.g.,
- Treatment: Self-Medication
  - Ability to name and describe purpose of each medication (R)
  - Ability to organize pill box with needed meds (S)
  - Reliably taking medications as instructed (R)

# Back to Where We Started

- Mnemonic strategy to remember therapists' names: Target = improved ability to name therapists
- Digital paging system: Target = increased reliability of keeping appointments
  - In neither case is the target “memory”
  - In both cases there are at least 2 treatment components, one (R) focused on the rationale and technique, and one (S) focused on skillful application
  - The ingredients are largely different

# Next Steps

- Using treatment experts in different areas to generate a finite list of targets for O and “function-like” S treatments
- Developing guidelines for writing the infinite number of targets that could be pursued in “skill-like” S treatments and R treatments
- Developing lists of the commonly used ingredients in each of these treatment groupings
- Finalizing the Manual for Rehabilitation Treatment Specification

# The Vision

- Clinicians use enablement theory to select the priority targets for treatment
- Clinicians use treatment theory to select the active ingredients that can address the target
- Supervisors look for the proposed active ingredients being delivered
- Authors and journal editors use this scheme for defining the treatments that they report
- Short-hand names are applied to groups of treatments that share the same basic ingredients
- Studies of effectiveness group treatments by their active ingredients

# Conclusions

- Current methods of defining/specifying rehabilitation treatments don't support evidence synthesis, training, supervision, or interdisciplinary communication.
- An ingredients-based treatment specification system will promote important research and invite clinicians to be more analytical about their treatment choices.