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Clinical Focus

Knowing What We're Doing: Why Specification of Treatment Methods Is Critical for Evidence-Based Practice in Speech-Language Pathology

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Purpose: The purpose of this clinical focus article is to describe the conceptual framework of the multidisciplinary rehabilitation treatment taxonomy (RTT) and illustrate its potential use in speech-language pathology (SLP) clinical practice and research.
Method: The method used was a critical discussion.
Results: Current methods of defining and classifying SLP and other rehabilitation interventions maintain the "black box" of rehabilitation by referring to hours or days of therapy or using problem-oriented labels (e.g., *naming treatment*) to describe treatments, none of which reveal what is actually done to effect desired changes in patient functioning. The RTT framework uses treatment targets, ingredients, and mechanisms of action defined by treatment theory to specify SLP and other rehabilitation interventions with greater precision than current methods of treatment labeling and classification. It also makes a distinction between the target of treatment at which ingredients are directed and broader aims of treatment, which may be downstream effects explained instead by enablement/disablement theory.
Conclusion: Future application of the RTT conceptual scheme to SLP intervention may enhance clinical practice, research, and knowledge translation as well as training and program evaluation efforts.

Speech-language pathology (SLP), along with other disciplines within the interdisciplinary team, is under increasing pressure to improve the evidence base of rehabilitation. Research on the effects of rehabilitation has been advanced by greater precision in the measurement of case mix factors (e.g., patient and family characteristics, the type and severity of dysfunction) and rehabilitation outcomes at all levels of the International Classification of Functioning, Disability and Health (World Health Organization, 2001): impairments, activity limitations, and participation restrictions. What has been relatively neglected is the measurement of the treatment that stands in the middle of the "equation" from the onset of disability to the end of rehabilitation treatment. The current state of the science is that we measure rehabilitation interventions by days in treatment (length of stay) or perhaps hours provided within various disciplines, but such measures tell us little about what has been done during the specified time. Treatment labels that aim to specify the contents of intervention tend to be generic (e.g., *patient education*) or problem focused in a tautological manner (e.g., *stuttering therapy* is that intended to improve stuttering). None of these treatment specification schemes provides the most important information: how the treatment was administered and why that mode of administration was assumed to be effective.

In this clinical focus article, we describe a framework called the *rehabilitation treatment taxonomy* (RTT), which uses theory, rather than surface characteristics, as a basis for specifying the details of rehabilitation treatments. We discuss how the RTT, which is being developed by an interdisciplinary group (Dijkers, 2014; Dijkers, Hart, Tsaousides, Whyte, & Zanca, 2014; Dijkers, Hart, Whyte, Zanca, Packel, & Tsaousides, 2014; Hart et al., 2014; Whyte et al., 2014), stands to improve research and practice in SLP.

Treatment Theory: The Core of the RTT

In the words of Keith and Lipsey (1993), *treatment theory*[1] explains "the actual nature of the process that transforms received therapy into improved health" (p. 51), that is, how and why a treatment works. With its emphasis on

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[1]Italicized terms are defined in the appendix.

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theory to organize treatments, the top-down approach of the RTT differs from other schemes that provide inductive, or bottom-up, definitions of treatment activities. A theory-driven system is important because without at least some hypothesis about how a treatment is supposed to work, we cannot identify the key components of treatment that underlie efficacy or isolate the critical details to convey for a given treatment to be replicated.

We propose that rehabilitation treatments may be specified using three elements of treatment theory: *targets*, which are the specific aspects of functioning intended to change as a result of treatment; *ingredients*, which are the specific actions taken by the clinician to effect changes in the target; and *mechanisms of action*, which are the known or hypothesized means by which ingredients exert their effects (Hart et al., 2014). These elements together define *treatment components*, which are portions of clinical treatments with a single target. The treatment *recipient* is anyone in whom the therapist is attempting to effect change. This usually is a patient or client but also can be a caregiver or someone else who plays a role in the patient's communication environment, such as an employer.

As the clinician actions are administered to bring about the desired change (Hart et al., 2014), treatment ingredients are highly varied and include environmental modifications, devices and strategies, and many types of guidance. In the SLP literature, familiar ingredients may include instructional methods (i.e., how we teach or reteach knowledge and skills; Sohlberg & Turkstra, 2011), such as providing opportunities for high-frequency practice or using elaborative encoding to help a patient learn new information. Ingredients may also be directed to make changes in physical tissues or organs, such as application of transcranial direct current stimulation for treatment of aphasia, a palatal lift for treatment of dysarthria, or manipulation of the larynx for treatment of swallowing or voice. Ingredients of behavioral treatments include cues, prompts, and feedback; modeling; prompting of rehearsal; and explanations and discussions used in patient education. Any time a therapist explains a task, praises a client's performance, or engages the client in goal setting that therapist is administering ingredients, just as a physician administers medications. Ingredients are always measurable, at least in principle; if they are not, they cannot be replicated or varied systematically to observe the effects of different ingredient dosages or combinations.

The target of treatment also is measurable in principle; otherwise, we would have no way of evaluating whether the ingredients are effective (i.e., active) for a particular type of change. The target is the aspect of the recipient's functioning that is selected for change and that the treatment theory holds can be changed directly by the ingredients administered via their mechanism(s) of action (Hart et al., 2014). For example, asking the patient wh-questions about verbs (the ingredient) is theorized to improve verb retrieval (the target; Edmonds, Mammino, & Ojeda, 2014). Changing that aspect of functioning (verb retrieval), however, does not necessarily lead to improved everyday conversation. In RTT terminology, we distinguish the target from aims that might ultimately ensue from work toward one or more relevant targets. In this example, improved everyday conversation is the aim and is likely to require addressing additional targets such as the ability of family members to prompt the patient's word retrieval, ability of the patient to construct sentences in addition to retrieving specific word classes, and the patient's comfort in requesting conversational assistance at home. As another example, a patient's aim might be to use his or her cell phone as a memory support in everyday activities, which could be addressed with several treatment components, each with its own target and specific ingredients. There might be error-minimization techniques to teach a key sequence and practice entering and retrieving information from the phone in varied environments to promote generalization. An aim may or may not change as a result of achieving change on a single target, depending on the strength of the causal relationship between the two and on other factors affecting the aim. For example, if successful use of a cell phone to record appointments is the only barrier to a patient's maintaining his or her employment, then success on that target may serve to fulfill the aim. But if other factors impinge on his or her success at work, such as the quality of his or her interactions with coworkers, then additional target(s) may need to be identified and addressed in treatment to accomplish the employment aim. We distinguish targets from aims to help remind clinicians and researchers alike that a focus on a specific, measurable aspect of functioning—which is necessary to determine the effectiveness of the treatment—may not necessarily lead to more "macro" effects unless additional targets and ingredients are used to bring about further change.

Active ingredients administered by the therapist affect the target via some mechanism of action (Hart et al., 2014). In contrast to ingredients and targets, mechanisms of action may be unknown (thus not measurable) and may need to be inferred from ingredients' effects on the target, as is also the case for many medical interventions. Mechanisms of action related to learning and information processing are particularly difficult to characterize precisely. For example, semantic feature analysis (SFA) is hypothesized to strengthen semantic representations (Boyle & Coelho, 1995), but we can only infer the strength of these representations from the patient's responses. Likewise, we can say that repeated practice of looking things up in a memory notebook creates a procedural memory, but the neural processes involved in memory consolidation are invisible to us. Nonetheless, theories that explain changes in behavior or cognition at a psychological level of analysis are fruitful sources of treatment theory for targets involving changes (improvements) in knowledge, attitudes, and skilled performances.

Treatment theory can be contrasted with *enablement/disablement theory*, which seeks to establish links among International Classification of Functioning, Disability and Health elements (impairments, activities, participation, personal factors, and environmental factors; Whyte & Barrett,

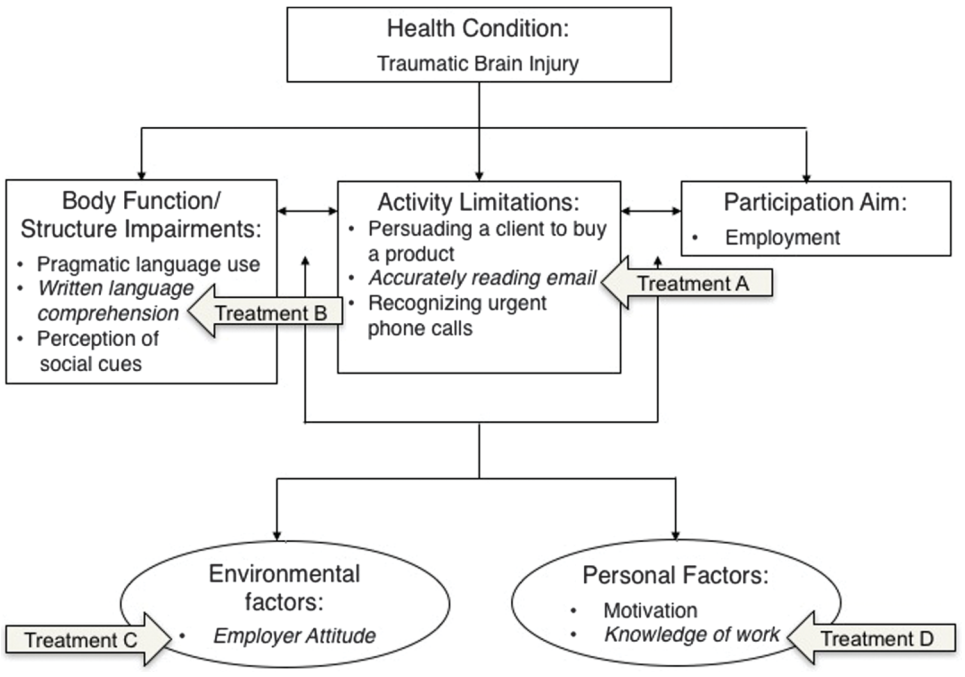
2012). Enablement theory is critical to rehabilitation research and clinical practice in a manner complementary to treatment theory. Enablement theory affords predictions about how impairments affect activities, for example, and how activity limitations may combine to contribute to participation restrictions (Whyte et al., 2014). However, enablement theory says nothing about how any impairment, activity limitation, or participation restriction might be changed—explaining change is the province of treatment theory. In practice, we need both of these bodies of theory: treatment theory for specifying ingredients with which to change human function and enablement theory to understand the multiple factors that influence the patient's achievement of his or her broader aims.

The relationship between treatment theory and enablement theory is illustrated in Figure 1, which is based on data from a qualitative study of workplace communication demands (Meulenbroek, Turkstra, & Bowers, 2016). The lines denote relations among International Classification of Functioning, Disability and Health elements, which are the focus of enablement theory. Block arrows labeled *Treatment (n)* refer to ingredients applied to targets (italicized in the figure) that can be at any level of the International Classification of Functioning, Disability and Health and are the focus of treatment theory. As an example, enablement theory might predict that the patient would have a high likelihood of successfully returning to work if he or she had a mild receptive language impairment, strong motivation to improve, and a supportive employer. Enablement theory is silent on the mechanisms that influence any of these factors (e.g., how language or employer attitude or motivation can be changed). By contrast, treatment theory directly specifies the mechanism by which a proposed treatment ingredient changes a target (e.g., didactic instruction to change employers' perceptions about communication problems in the workplace, employee training to improve comprehension of e-mails and other written materials, or persuasion to improve the patient's motivation).

Current Status of the RTT

We use the word *taxonomy* in the label of this framework in progress, but it is not a taxonomy in the sense of a hierarchical, Linnaean-type structure. Nor do we envision that the final form will resemble Linnaeus's taxonomy of living things, given the difficulties in establishing firm and useful boundaries among rehabilitation treatments (see Dijkers, Hart, Tsaousides, et al., 2014; Hart et al., 2014). Rather, we envision rules or guidelines for a process by which a rehabilitation practitioner may identify the types of targets present in a given intervention and map likely active ingredients onto each. We have identified four broad groups of treatment components that we believe encompass all interventions in rehabilitation and that are mutually exclusive with respect to the types of targets addressed and ingredients that are necessary to change them. In brief, the

Figure 1. Enablement theory is concerned with relations among elements of the International Classification of Functioning, Disability and Health framework, shown by thin arrows among boxes in the figure. Treatment theory is concerned with the ingredients and mechanisms of specific treatment components, represented by open block arrows, that the clinician uses to achieve treatment targets, represented by italicized terms.



four groups include ingredients and targets involving (a) changing the size and shape of tissues (e.g., using voice rest to reduce vocal fold edema); (b) changing the output of organ systems (e.g., methods to increase respiratory muscle strength to support speech production); (c) improving the quality, speed, efficiency, or automatization of skilled performances at either a function or activity level (e.g., by training a word-retrieval strategy); and (d) changing cognitive or affective representations, that is, increasing the amount and accuracy of knowledge or changing attitudes and beliefs (e.g., by counseling and education).

Although it is obvious that these four groups each contain a large number of varied treatment components, we still consider them to be useful even at this initial stage of development. First, thinking about how a clinical treatment may be subdivided into treatment components from the different groups may be helpful for systematizing treatment planning. For example, training on an augmentative communication device may entail several components, each with its own target and different active ingredients. There is customizing of the device, which involves ingredients related to achieving a careful match between device features and patient characteristics and needs. There is training to use the device, which like other skilled performances requires engaging the patient in active practice and the administration of ingredients such as corrective cues, feedback, and training in multiple practical situations. There may also be targets related to educating or motivating the patient to accept the device and perhaps caregiver training and education to create support for future performance. The second advantage of distinguishing the four groups is that they highlight treatments that share the same active ingredients but otherwise appear to be dissimilar, or invite us to test empirically whether similarities exist. For instance, does skill in augmentative communication device use respond to massed versus distributed practice in the same way other skilled performances do? Are there special ingredients that must be included in education about augmentative communication, or does it respond like other educational interventions to different modalities, amounts of information, or rehearsal strategies?

Comparison to Other SLP Treatment Frameworks

We acknowledge previous efforts to parse the contents of SLP and rehabilitation interventions. For example, Hatfield et al. (2005) developed an SLP stroke rehabilitation treatment taxonomy in which treatments were categorized by (a) broad target area (e.g., written expression, auditory comprehension, swallowing) and (b) type of intervention (e.g., compensatory strategy training, use of devices, education). Clinicians also recorded details such as treatment duration, level of cueing provided, and modalities used. All of these factors were evaluated in relation to FIM (http://www.udsmr.org/WebModules/FIM/Fim_About.aspx) comprehension and expression scores. Gordan et al. (2009) developed a taxonomy based on the work of Hatfield et al. (2005) and applied it to SLP treatments for patients with high spinal cord injury, again focusing on identifying interventions associated with positive outcomes. These investigators divided intervention into seven treatment categories, including intervention related to education, tracheostomy/ventilator support, motor speech or voice, swallowing for feeding, swallowing exercises, cognitive-communication functions, and communication functions. A recent practice-based evidence study (Beaulieu et al., 2015) dealt with traumatic brain injury interventions, and again, the Hatfield et al. (2005) classification was considered in developing a taxonomy of treatments for this patient group. Note that the three taxonomies just discussed all suffer to some degree from the "classifying by naming the problem" tautology.

Recently, Van Stan, Roy, Awan, Stemple, and Hillman (2015) published a taxonomy of voice therapy. The authors stated that a taxonomy should be rooted in theoretical foundations that elucidate the specific aspects of treatment that contribute to improvement and also should include terminology that can be accessed across disciplines. The voice taxonomy group used a bottom-up process to develop the taxonomy: reviewing chart notes and session descriptions to identify candidate therapy tasks (referred to in the taxonomy as *tools*), reviewing the literature for existing taxonomies that might be informative, then attempting to identify orthogonal dimensions along which therapy tasks varied. The authors classified tools by whether the clinician aimed to directly treat the vocal mechanism (direct interventions) or "modify the cognitive, behavioral, psychological, and physical environment in which voicing occurs" (p. 102; indirect interventions). A third category related to service delivery (clinician applied vs. client applied) and specified methods that would apply to the direct interventions. The authors subdivided therapy tools by factors such as the anatomical system exploited in treatment (e.g., respiratory vs. vocal) and then subcategorized tools according to "where the patient's attention is focused during the therapy activity" (p. 105; e.g., within the vocal category: glottal contact, pitch modification, or vegetative vocalization). The authors classified established voice therapy programs according to the tools used in each. For example, resonant voice therapy might use pitch modification (vocal function), discrimination (somatosensory function), and loudness modification (respiratory function).

Like the RTT, the voice taxonomy was theoretically based and broadly organized treatments by their targets, but because the focus was on tasks rather than treatment methods, the distinction between ingredients and targets was not always clear. For example, both "digital manipulation" of the neck and "voice rest" were listed as tools (i.e., activities), but the former might be an ingredient, whereas the latter (voice rest) is a behavioral target to be achieved with ingredients such as explaining the importance of voice rest and consequences of not resting. Also, some treatment methods were underspecified (e.g., the clinician's actions for tools such as "pitch monitoring" or "dynamic positions for

lengthening muscle" are not stated), and the three categories appear to represent only two different constructs (target and treatment method). Mechanisms of action are not addressed. Thus, although the voice taxonomy was an important first step in developing a conceptual voice therapy framework, the RTT has advantages for specifying how treatment is delivered and why a particular mode of administration is effective.

An Example: Applying the RTT to Social Skills Therapy

SLPs use social skills therapy with a wide variety of clinical populations and for people of all ages and ability levels. The overarching goal of therapy is to maximize the patient's participation in personally relevant social contexts. The methods by which we attempt to reach that broad aim, however, are many and varied. As there are few diagnostic groups for which there is sufficient evidence to support specific treatment methods, it could be helpful to look across populations for findings that can inform practice. Using the RTT approach, it is possible to see themes across studies, not only in ingredients (e.g., use of didactic instruction vs. intensive practice) but also in hypothesized mechanisms of action (e.g., improvements in knowledge vs. better skilled performance). These themes can guide us in selecting treatment ingredients and targets and are evident when we consider examples of treatment methods included under the umbrella of social skills training: using a video game to improve knowledge about social communication problems after traumatic brain injury (Llorens, Noe, Ferri, & Alcaniz, 2015), training peers of children with autism to identify socially isolated children and engage them in playground activities (Kasari, Rotheram-Fuller, Locke, & Gulsrud, 2012), group-based role-playing to improve specific social communication behaviors in adults with schizophrenia (Granholm, Holden, Link, & McQuaid, 2014), and emotion recognition training combined with didactic instruction on social skills and social coping to improve perceived social competence in deaf young women (Soleimanieh Naeini, Keshavarzi Arshadi, Hatamizadeh, & Bakhshi, 2013). Although they appear to be quite different, all of these treatments include some combination of skilled performance targets and knowledge targets, and ingredients that are effective for each of these categories of targets may be similar across populations (e.g., providing the opportunity for practice could help any patient learn a skill, and carefully organizing information might help any patient learn it). By grouping ingredients by target domains such as skills versus knowledge, it may be possible to identify ingredients that are effective across studies and populations. This will also help us identify ingredients that are ineffective (*inactive*), so we can focus our limited resources where they are likely to do the most good.

As an example, consider a young adult client with high-functioning autism. He has had problems interacting with his employer that threaten his continued employment, but his parents want him to keep his job (an aim). One major factor contributing to his problems at work is his inability to read his employer's intentions, so this is selected as a specific target for treatment. There is little evidence that social cognition training generalizes beyond treated stimuli in adults with autism (Fletcher-Watson, McConnell, Manola, & McConachie, 2014), but there is evidence supporting training of specific social scripts (Wong et al., 2015). Thus, to help the client keep his job, the clinician, parents, and client decide that the client will learn to ask his employer for clarification when he does not understand a spoken direction, which is a pragmatic language function that the client does not currently have. The active ingredients in this training will be clinician behaviors that facilitate the client's accurate performance of clarification requests. These active ingredients may include the therapist acting the part of an employer in role-play situations, modeling, fading cues, incorporating variable stimuli to promote generalization, and providing opportunities for high-frequency practice. The clinician also might include inactive ingredients such as greeting the client when he arrives at the session, which is a typical social behavior that is not expected to change the target. Note that the same type of treatment may be effective for an adult with traumatic brain injury, who might have arrived at his or her impairment via a different route but nonetheless also does not demonstrate the pragmatic function of asking for clarification. Note also that the RTT does not address assessment, which would be critical in identifying cognitive strengths and impairments that might differentiate these two clients and influence the selection of ingredients.

Implications for Clinical Practice

There are compelling reasons to think more systematically about the treatment methods we use as clinicians and report targets and ingredients more thoroughly in our clinical documents. First, our theories about mechanisms of action and ingredients influence our selection of targets. For example, there is debate about whether SFA is restorative (i.e., repairs semantic networks) or compensatory (i.e., trains the patient to use a feature-description strategy; Wambaugh, Mauszycki, Cameron, Wright, & Nessler, 2013). The clinician's theory about mechanism of action will directly influence not only his or her choice of targets (e.g., percentage accuracy vs. automaticity of strategy use) and ingredients (e.g., high-frequency practice alone vs. feedback to improve awareness of opportunities for strategy use) but also critical factors such as dose and how progress is measured. Notions about mechanism of action also can influence selection of treatment strategies for specific patients (e.g., if the clinician believes SFA is a strategy-development intervention, he or she might not recommend it for a patient with poor metacognitive skills). Second, we need a detailed understanding of active ingredients of treatments if we are to replicate our own and others' results. If hands-on practice is critical for teaching a patient to use an external memory aid, we might not have the same results for patient A if he was simply told how to use the aid as for patient B, who practiced it extensively during the session. Task performance

and practice within and outside the treatment session may be crucial to the success of most SLP treatments, but *how* we elicit and intensify that practice may be as important as *what* the patient practices—and the former typically goes missing in treatment descriptions. Third, thinking about the active ingredients of our treatments and the strength of their association with the target(s) helps us maximize time spent on those aspects of treatment that benefit our patients most. Last, knowledge of active ingredients allows us to use the best treatment methods for a given target. For example, if high-intensity practice is required for improving the patient's use of a memory strategy, treatment focused on expanding the client's knowledge of strategies might not be the best use of session time.

Implications for Research

Our goal as researchers is to design studies that identify active ingredients for specific treatment targets. Grouping or classifying treatments according to their hypothesized effects will allow us to aggregate evidence across treatment approaches that go by different names in different disciplines but might have the same targets and ingredients. For example, *errorless learning* (a term used in rehabilitation), *direct instruction* (which comes from the field of education), and *vanishing cues* (a method with roots in cognitive psychology) all involve providing opportunities for repeated practice of correct responses. Rather than studying the efficacy of each of these as discrete methods, and separately for each activity to which they are applied, we could investigate how ingredients such as schedules of practice, handling of errors, or other ingredients that are common to error-control approaches affect target attainment more generally. Another example is the social skills intervention described earlier. If the active ingredients in social skills therapy prove to be methods that promote self-awareness of impairments and encourage use of metacognitive strategies, then study design can focus on specific targets such as improved accuracy of self-knowledge or using strategies automatically. The use of well-defined treatment packages, such as constraint-induced aphasia therapy (Johnson et al., 2014) or SFA (Wambaugh et al., 2013), might obviate the need to enumerate separate treatment components, but the RTT framework might still be useful in helping us understand the contribution of various ingredients and provide hypotheses as to how they might be varied for different patients. In short, use of the RTT framework in research will allow us to build our body of evidence for specific treatment methods and help us to focus our research efforts on methods that are most likely to advance rehabilitation science and improve patient outcomes.

Summary

We propose that use of the RTT framework can improve clinical practice and research and also translation of information between these two settings. In the clinic, this conceptual framework can help us identify the best treatment methods for our clients. Thinking about causal relations among ingredients, mechanisms of action, and targets can help us choose ingredients (therapy methods) that best fit treatment targets. The RTT framework also can help us find themes across treatments that share ingredients, even if those treatments have names that do not suggest similarity of their active ingredients.

Use of the RTT framework in research will support the comparison of findings across clinical research centers and help us focus research on cross-cutting themes in the rehabilitation of individuals with communication disorders. Better specification of treatment ingredients in journal articles and research presentations also will help make research findings more accessible to clinical care providers.

We hope that future efforts to apply the RTT to SLP intervention will allow our practice to be more fully informed by published evidence and our own rich clinical experience. We invite commentary from interested readers in all areas of SLP research and practice.

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Appendix

Glossary of Terms (Adapted from Whyte et al., 2014)

Active ingredients: Attributes of a treatment, selected or delivered by the clinician, that play a role in the treatment's effects on the target of treatment.
Aim(s) (of treatment): Aspect(s) of the patient's or other recipient's functioning or personal factors that is predicted to change indirectly (via mechanisms specified in enablement/disablement theory) as a result of the treatment-induced change in the treatment target. A single treatment may have multiple aims, and there may be a chain of treatment aims (e.g., increased verbal fluency leading to improved conversations leading to greater community participation). Although highly relevant to the ultimate clinical value of a treatment, these distal treatment aims are not relevant to the definition or classification of the treatment.
Enablement/disablement theory: A theory that specifies how change in one aspect of a patient's functioning (e.g., at the level of an International Classification of Functioning, Disability and Health component: body structure, body functioning, activity/activity limitation, participation/participation restriction, personal factor, or environment) will translate into changes in another aspect, specifically a characteristic classified elsewhere in the framework being used.
Ingredients: Observable (and, therefore, in principle, measurable) actions, chemicals, devices, or forms of energy that are selected or delivered by the clinician.
Inactive ingredients: Attributes of a treatment that do not define or moderate the impact of the treatment on the target. Ingredients may be presumed to be inactive because they are not addressed by a treatment theory or have been empirically determined to be inactive.
Mechanism of action: Process by which the treatment's active ingredients induce change in the target of treatment.
Recipient (of treatment): Individual whose function/behavior is intended to be changed directly as a result of treatment. In most cases, this is the person with a disability (patient, client, or recipient), but in some instances, a caregiver or employer may be the recipient who is changed by the intervention (e.g., to provide care or intervention to the patient or client or to create a more supportive environment for the patient or client). Enablement theory may be used to postulate effects that improve the patient's/client's functioning.
Target of treatment/treatment target: Aspect of the recipient's functioning that is predicted to be directly changed by the treatment's mechanism of action.
Taxonomy: System of classification or categorization based on characteristics that have important pragmatic or theoretical implications.
Treatment component: Portion of a clinical treatment that includes one target, its known or hypothesized active ingredients, and associated mechanism(s) of action.
Treatment theory: Conceptual system that predicts the effects of specific forms of treatment on their targets, specifying the law(s) of the relationships between active ingredients and treatment target changes.