



SPECIAL COMMUNICATION

Opening the Black Box: Lessons Learned From an Interdisciplinary Inquiry Into the Learning-Based Contents of Brain Injury Rehabilitation

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Abstract

This article describes challenges encountered and lessons learned in an effort to explore the black box of rehabilitation. A multidisciplinary team created detailed, mutually exclusive operational definitions for the contents of learning-based treatments administered in a brain injury unit. The function and activity levels of the *International Classification of Functioning, Disability and Health* were used to organize content definitions, which included examples of therapy activities and therapist behaviors, such as cues. Pairs of trained coders independently identified defined learning episodes within each minute of 128 videotaped physical, occupational, or speech therapy sessions. Interrater agreement was generally acceptable and did not vary by discipline of session, discipline of coder, or whether coders were clinically trained. Disagreements typically involved the threshold for determining that a learning episode had occurred, or deciding between function and activity codes where the surface content of the sessions were similar. The focus on individual therapy sessions allowed for rich qualitative detail, but a less granular analysis will be necessary for comprehensive efforts to characterize the contents of therapy.

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Rehabilitation has been called a black box because the precise ingredients, their mechanisms of action, and their efficacy and effectiveness remain largely unknown. We tend to define our interventions using discipline labels (eg, speech therapy [ST]) or names of treatments that essentially restate the problems being addressed, without indicating how they are being addressed (eg, gait training, memory retraining, vocational rehabilitation).¹ Such terminology may mask important differences among treatments with the same name, or similarities among interventions with different labels.² In addition, specifying treatments in this way reveals little about their known or hypothesized active ingredients, the aspects of intervention that are most powerful for inducing clinical change. However, we must specify active ingredients to advance our evidence base; we cannot determine whether, how, and for whom rehabilitation is effective without knowing what components of treatment are expected to exert the desired effects.

In this article we describe an effort to develop a circumscribed taxonomy of rehabilitation treatments that preceded and in many ways informed the broader, ongoing project summarized in the other articles in this supplement, that is, the rehabilitation treatment taxonomy (RTT).¹ The RTT is an example of a theory-driven or top-down approach to classification.³ In this framework, treatments are defined according to the hypothesized mechanisms of action by which active ingredients exert direct effects on specific aspects of functioning, called targets.⁴ In contrast, most previous attempts to specify the ingredients of rehabilitation have been inductive, or bottom-up, using practice-driven classifications. Inductive methods have been used to examine the contents, or specific therapist activities, within physical therapy (PT),^{5,6} occupational therapy (OT),⁷ and a comparison of the 2 therapies.⁸⁻¹⁰ Such studies have been used to illuminate the differences between home- and clinic-based treatment⁵ or to document that therapists spend less time than expected on certain activities, such as community integration⁷ or caregiver training.⁶ Some inductive classifications have been developed for specific kinds of interventions for specific populations—for example mobility and self-care in spinal cord injury.^{11,12} In a stroke unit, Bode et al¹³ recorded activities of occupational and physical therapists and speech-language pathologists. A longer hospital stay and more intensive focus on activity- versus

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function-level therapies were associated with greater gains, controlling for initial severity.¹⁴ Vocational interventions have been classified by the contents, settings, and/or recipients of contact in several observational studies.^{15,16}

The most extensive of the bottom-up approaches is represented by the observational studies known as practice-based evidence (PBE) research^{7,17-19} in which treatments are coded per session using lists developed by practitioners within each discipline working with specific populations (stroke, joint replacement, etc). These studies attempt to determine salient treatment variables by examining their relations to rehabilitation outcomes, adjusting for patient characteristics in very large samples. As with most inductive approaches, however, the PBE coding scheme mostly characterizes treatments by their intended outcomes (eg, bed mobility) rather than the processes or mechanisms used to achieve them.¹ In addition, the PBE coding scheme and most previous coding schemes rely on therapist self-report of therapy contents. This makes documentation easier but may be subject to memory distortion and other biases.^{10,20}

As an alternative approach, a few studies have examined reliability of classification systems by having independent observers identify the contents of videotaped rehabilitation sessions.^{10,12} For example, De Wit et al¹⁰ used independent raters to code the contents of videotaped OT and PT sessions at 20-second intervals and found, among other results, that the 2 disciplines offered considerable overlap of specific contents (eg, activities to challenge sitting balance were used about the same proportion of time in both therapies). The use of external observers may provide evidence of interrater reliability but is, of course, unfeasible for collecting ongoing data on specific kinds of treatments.

The purpose of this article is to present the methods, findings, and lessons learned from a study that sought to (1) define the contents of rehabilitation for a specific population, traumatic brain injury (TBI), at an early stage of recovery; and (2) validate these treatment definitions using ratings from external observers. To create definitions of treatment, we used primarily a bottom-up, inductive approach, but a top-down focus was provided by using learning concepts as a framework for the study. A main reason for this was the assumption that many of the active ingredients of rehabilitation are based in learning.²¹ We also wished to emphasize learning and teaching strategies because the impairments in learning and memory commonly encountered by specialists in TBI rehabilitation may ultimately be understood and treated effectively using a transdisciplinary consideration of learning principles. However, the purpose of this article is not to present a complete and validated treatment classification, but rather to discuss and illustrate the challenges encountered in developing such a classification.

Methods

Project team activities

The project was conducted by a core team of clinicians and clinician researchers recruited from a brain injury center within a rehabilitation hospital. The team was comprised of 2 physical therapists; 2 occupational therapists, 1 of whom was team coleader; 1 speech-language pathologist; 1 therapeutic recreation (TR) specialist; and 1 neuropsychologist, who was the other team coleader. A rehabilitation nurse also participated in the initial phases, and 2 physiatrists served as consultants who met with the team leaders. All team members were experienced in inpatient TBI rehabilitation, and several also had experience in outpatient and community-based treatment. Most had also served as trainers/supervisors of other TBI therapists.

After convening the project team, the coleaders outlined the scope of work and facilitated a participatory action process to plan specific activities aimed at the broad objective of enumerating and defining treatment contents of an inpatient and early-stage outpatient program for the treatment of TBI. The team was given several guidelines and constraints. First, the focus on learning meant an emphasis on defining the contents of rehabilitation as what patients are expected to learn and what therapists attempted to teach. This entailed omitting therapy activities done purely for evaluation purposes (eg, the administration of standard examination tools) and therapeutic activities of a passive nature (eg, casting and passive stretch). Mostly for logistic reasons, the emphasis of the current project was on inpatient and outpatient rehabilitation taking place in a public clinic environment, rather than, for example on a job site or other community settings, or during private conversational settings (eg, psychotherapy). Within those constraints, we started with the premise that rather than compiling contents per discipline, we wished to generate 1 list that cut across, while recognizing that disciplines would specialize in the delivery of certain contents over others. To avoid including activities that might be idiosyncratic to 1 or few patients, another guiding principle was to focus on treatments that clinicians consider to be both central (done with many patients) and important (expected to have an impact on outcomes). Finally, the team was informed that the ultimate goal was to develop therapy definitions that could be verified by outside observers using a coding system, which meant that the definitions needed to be quite detailed and mutually exclusive.

In regular meetings, the team began to brainstorm and make lists of tasks, materials, and activities used by clinicians to induce changes in behavior through learning, that is, through active experience or practice. The team used both existing and new sources of data to compile these lists and to draft definitions of treatments. In addition to reprints of previous studies on this topic and the treatment lists used in the PBE studies available at that time, existing sources included textbooks covering practice within a discipline^{22,23} and textbooks on TBI rehabilitation.²⁴ The practice framework in OT²⁵ and the *Guide to Physical Therapist Practice*²⁶ were examined for information on OT and PT practice, respectively. Local materials included the evaluation and progress forms used by individual team members' disciplines. We also stimulated our thinking by reading about different types of learning and the strategies associated with them, for example implicit/procedural and explicit/declarative learning, errorless learning, and chaining, and by discussing the various types of contents that patients are expected to learn or relearn (facts, attitudes, skills, strategies, fixed or variable sequences, techniques,

List of abbreviations:

ICF	International Classification of Functioning, Disability and Health
OT	occupational therapy
PBE	practice-based evidence
PT	physical therapy
RA	research assistant
RTT	rehabilitation treatment taxonomy
ST	speech therapy
TBI	traumatic brain injury
TR	therapeutic recreation

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