CLASSIFICATION OF SCI REHABILITATION TREATMENTS

SCIRehab Project Series: The Occupational Therapy Taxonomy

Rebecca Ozelle, OTR/L, BCPR¹; Catherine Sipple, MS, OTR²; Teresa Foy, OTR/L³; Kara Cantoni, OTR/L⁴; Katherine Kellogg, OTR/L⁵; Jennifer Lookingbill, MS, OTR/L⁶; Deborah Backus, PhD, PT³; Julie Gassaway, MS, RN⁷

¹Rehabilitation Institute of Chicago, Chicago, Illinois; ²Craig Hospital, Englewood, Colorado; ³Shepherd Center, Atlanta, Georgia; ⁴Carolinas Rehabilitation, Charlotte, North Carolina; ⁵Mt. Sinai Medical Center, New York, New York; ⁶National Rehabilitation Hospital, Washington, DC; ⁷Institute for Clinical Outcomes Research, Salt Lake City, Utah

Received November 17, 2008; accepted January 11, 2009

Abstract

Background/Objective: Lack of a classification system for occupational therapy (OT) rehabilitation interventions for traumatic spinal cord injury (SCI) rehabilitation in the United States makes conducting outcomes research difficult. This article describes an OT SCI rehabilitation taxonomy (system to categorize and classify treatments).

Methods: OT clinicians and researchers from 6 SCI rehabilitation centers developed a taxonomy to describe details of each OT session. This effort is part of the SCIRehab study, which uses the practice-based evidence, observational research methodology to examine current treatment processes without changing existing practice.

Results: The OT taxonomy consists of 26 OT activities (eg, training on activities of daily living, communication, home management skills, wheelchair mobility, bed mobility, transfers, balance, strengthening, stretching, equipment evaluation, and community reintegration). Time spent on each activity is documented along with therapeutic interventions used to facilitate the activity. Treatment descriptions are enhanced further with identification of assistance needs, patient direction of care, and family involvement, which help to describe and guide OT activity selection. The OT taxonomy documentation process includes all OT rehabilitation interventions for patients with SCI while maintaining efficiency in data collection.

Conclusion: The electronic documentation system is being used at 6 centers for all OT sessions with 1,500 patients with acute traumatic SCI. It is the largest known attempt to document details of the comprehensive OT rehabilitation process for patients with SCI in the United States.

J Spinal Cord Med. June 2009;32(3):283–297

Key Words: Spinal cord injuries; Rehabilitation, physical; Occupational therapy; Taxonomy; Evidence-based practice

Please address correspondence to Julie Gassaway, MS, RN, Institute for Clinical Outcomes Research, 699 E. South Temple, Salt Lake City, UT 84102; p: 410 315 8091; f: 801 466 6685 (e-mail: jgassaway@isisicor.com).

The contents of this article were developed under grants from the Department of Education and NIDRR Grants H133A060103 and H133N060005 to Craig Hospital, H133N060028 to National Rehabilitation Hospital, H133A21943–16 to Carolinas Rehabilitation, H133N060009 to Shepherd Center, H133N060027 to Mount Sinai School of Medicine, and H133N060014 to Rehabilitation Institute of Chicago. However, these contents do not necessarily represent the policy of the Department of Education, and you should not assume endorsement by the federal government.

This is the 4th in a series of 9 articles describing The SCIRehab Project: Classification of SCI Rehabilitation Treatments.

INTRODUCTION

Occupational therapists (OTs), much like other health-care professionals, are challenged to advance clinical practice based on sound evidence (1). This evidence should include parameters of treatment that are deemed important within OT: impairment, activity limitations, and the amount of therapy provided to achieve a given goal with a specific patient group. Similar to other areas of rehabilitation, treatment interventions and patient characteristics often are not defined in research reports evaluating OT interventions for spinal cord injury (SCI) (2). Although the Occupational Therapy Practice Framework: Domain and Process (3) defines OT approaches and interventions, it does not provide evidence for each intervention (or a combination of interventions) that

would be most beneficial to reduce a given impairment or dysfunction. Furthermore, this document does not address SCI rehabilitation specifically. To advance research on OT clinical practice in SCI rehabilitation, OT providers and researchers first must have standard classifications for OT interventions.

The idea of defining and quantifying OT treatments used during the rehabilitation process is not novel. Keith (4) described the necessary components that need to be included when evaluating the rehabilitation process. Keith makes 4 recommendations to assist in determining what variables of the rehabilitation program lead to the best outcomes: (a) report hours of service/treatment, (b) define treatment strength (how well the plan was executed, specificity of the plan, dosage, timing), (c) analyze naturally occurring variations in processes and care, and (d) develop a taxonomy.

DeJong et al (5) suggested criteria to evaluate the usefulness of taxonomy efforts and subsequently describe how a group of researchers and clinicians came to a consensus and established a taxonomy for characterizing the rehabilitation process after stroke (6). Richards et al (7) described the OT component of this taxonomy for post-stroke rehabilitation, which also addresses most of the areas put forth by Keith (4). The OT stroke rehabilitation taxonomy included the treatment activity (bed mobility, transfers, wheelchair [WC] mobility and management, activities of daily living, home management, community integration, and leisure activities) and the duration of each activity. It also included whether a session was conducted individually or in a group and the amount of time spent in evaluation/planning and team conferences. Through development of this taxonomy, Richards et al (7) were able to describe the focus of OT interventions for stroke rehabilitation. The multidisciplinary stroke rehabilitation taxonomy of DeJong et al (6) allowed researchers to determine the effect of rehabilitation treatment variables on outcomes after stroke. For example, they evaluated the effect of timing of the start of stroke rehabilitation on outcomes (8), the timing and types of interventions that led to the best speech outcomes (9), and the effects of gait training on walking outcomes (10). The authors' suggest that the taxonomy provided a tool to describe the stroke rehabilitation process, and therefore, may be useful for operationalizing rehabilitation standards of practice and for rehabilitation research.

Recently, van Langeveld et al (11,12) used the International Classification of Functioning (ICF) to develop a classification system to categorize occupational, physical, and sports therapy treatment interventions for mobility and self-care in SCI rehabilitation; it was tested for feasibility and validity in the SCI population in The Netherlands. To develop the classification, the authors solicited expert opinion on level of agreement regarding (a) definitions, (b) terminology, (c) relevance, and (d) completeness of the classification. The experts rated the system as useful and found it easy to use. Thirty-six therapists (14 of whom were

OTs) were able to classify 86.3% of treatment sessions using the 3 defined levels and reported that they were able to record codes designating the nature of sessions within 3 minutes. The classification system of van Langeveld et al only includes individual treatment sessions that focus on mobility and self-care domains. It is an important step toward classifying OT treatments for rehabilitation after SCI and showed that a group of individuals can come together to reach consensus on at least a subset of OT activities deemed important in SCI.

Thus, although the literature has begun to include taxonomies related to OT treatments, including a recent classification specifically for SCI, they are not comprehensive to describe the full spectrum of OT treatments used in SCI rehabilitation. A comprehensive taxonomy will provide the foundation to determine the effect of rehabilitation components, individually and in combination, on outcomes while controlling for patient differences.

SCIReHAB PROJECT

The SCIRehab Project is a 5-year research effort designed to determine which SCI rehabilitation activities and interventions are associated most strongly with positive outcomes at 1 year after injury, after controlling for underlying patient characteristics including diagnosed level/severity of injury. To describe and quantify specific interventions used by each clinical specialty involved in SCI rehabilitation, a comprehensive taxonomy for each discipline needed to be developed, because current chart documentation at the 6 SCIRehab centers does not include consistent detailed descriptions of each therapy session. The OT taxonomy was produced as part of the first phase of this project, which will enroll 1,500 consecutive initial rehabilitation admissions of patients with traumatic SCI consenting to participate at 6 centers over 2.5 years.

The first article in this *Journal of Spinal Cord Medicine* SCIRehab series by Whiteneck et al (13) describes the SCIRehab project in detail, including how it uses the practice-based evidence (PBE) methodology that thrives on center-to-center and patient-to-patient practice differences while not specifying or requiring specific therapeutic interventions. It also presents the SCIRehab hypotheses and research questions.

The second article in the series by Gassaway et al (14) describes the iterative process used to develop discipline-specific taxonomies (eg, OT, physical therapy, therapeutic recreation, psychology) and details those elements that are supplemental to the taxonomies but common across disciplines in the SCIRehab project, such as use of group therapy, co-treatment, patient assistance needs, patient/family involvement, and factors impacting a given treatment session.

This article describes the OT taxonomy developed by a group of SCIRehab OTs and explains the elements that were included. The taxonomy is comprehensive of OT activities and interventions used at each of the 6 centers. Center-by-center practice differences are reflected in the

array of OT activities in which patients participate and interventions used to facilitate their participation.

OT TAXONOMY

The OT documentation system that includes the taxonomy described here is comparable to the format used by all SCIRehab disciplines (14). As shown in Table 1, the OT first describes each therapy session in terms of type (individual or group), co-treatment with other disciplines (if applicable), the extent of the patient directing care, and patient and family involvement. Factors that may limit the session (eg, orthostasis or behavioral issues) are identified. The OT then identifies time spent on assessment and 1 or more of the identified 26 OT-specific activities in which the patient participated during the session. Patient assistance needs (Table 2) may contribute to activity selection; Tables 3 to 21 contain the assessment and treatment “taxonomy” portions of the documentation and show the intervention details associated with each activity individually. Intensity is measured by the amount of time spent per activity.

Many of the 26 OT activity categories are supplemented by information about the assistance a patient requires to perform the activity. Table 2 lists the adapted Functional Independence Measure (FIM) (15) options for level of assistance (LOA) used in the OT activity descriptions. The use of adapted FIM descriptors to rate assistance needs consistently by all disciplines is described in the article by Gassaway et al (14). In the SCIRehab OT documentation, a finer delineation of assistance needs is obtained than would be captured with standard FIM application. Assistance needs are associated with specific OT activity components in the OT taxonomy rather than FIM items defined per the FIM manual (16). For example, a person with tetraplegia may improve significantly in a component of lower body dressing, such as donning pants. This improvement in donning pants is noted in the OT taxonomy but may not be reflected in the single FIM score for the lower body dressing item, which also includes assistance needed for donning shoes and socks. If functional work (eg, transfers, activity of daily living [ADL] training) is reviewed with the patient and/or family without the patient actually performing or practicing the task, there is no assistance needed. Thus, Table 2 also contains “education only” options.

Assessment and each of the 26 activities included in the OT taxonomy are contained in Tables 3 to 21 and described below. Although much treatment work is discipline specific (eg, OT activity of daily living training and physical therapy [PT] gait training), other treatments are initiated by one or both disciplines depending on facility practices. Both OTs and PTs work on transfer training and bed mobility. At some facilities, OTs are responsible for the majority of wheelchair (WC) evaluation and prescription, whereas at other facilities, this is a PT responsibility. Thus, OTs worked with PTs to establish consistent treatment intervention descriptions for those

interventions that are a component of each discipline; the PT and OT taxonomy categories for bed mobility training, transfers, WC mobility, equipment evaluation/prescription, and respiratory management follow similar frameworks (17). During analysis, this consistency will allow researchers to examine the impact of WC mobility training or transfer training, for example, regardless of the discipline providing the training. In addition, consistent descriptions provide a common frame of reference to clinicians when they discuss development and use of their taxonomies within facilities and to aid in interpretation of findings.

Assessment/Evaluation

The OT documentation process first indicates areas of patient assessment and time spent performing the assessment. Because of the high prevalence of shoulder pain among patients with SCI (18–20), shoulder function is the only assessment topic that is defined further in this documentation. The indication for the shoulder assessment (chronic/acute pain or pain prevention) and the findings of the assessment (subluxation, positive impingement test, pectoralis tightness, decreased shoulder musculature, scapular elevation and scapular protraction/winging) are included (Table 3).

Activities of Daily Living

The next 7 OT activities come under the general rubric of self-care tasks or ADLs. For these activities, the OT assumes the role of a skills teacher (coach) and therapy consists of demonstrating the skill, teaching component or simplified steps, and teaching and rehearsing the entire sequence. Once a patient knows the basics, the OT helps the patient become more efficient at the skill through repeated practice.

Self-Feeding

Table 4 depicts the taxonomy information for OT work on self-feeding skills. It incorporates the main pieces of equipment used at the 6 SCIRehab centers to facilitate the self-feeding process and whether the patient practices this task in a (wheel) chair or in bed. Self-feeding in an upright, supported position, such as the WC, may lead to greater independence with the task than when a less supportive surface (eg, a hospital bed) is used. A variety of adaptive equipment for self-feeding is available; the OT taxonomy incorporates the main pieces of equipment used at the 6 SCIRehab centers.

Grooming

Grooming, like self-feeding, may be facilitated by position (in bed, WC, or standing; Table 5). The OT taxonomy includes this position along with the specific grooming tasks (eg, face washing, hair combing) worked on during the session, the type of equipment used with each task, and the amount of assistance need for each task, because a different level of assistance may be needed for each aspect of grooming. For patients with

Table 1. OT Activities and Session Variables

Session Level Variables	
Session Descriptors	Factors Impacting Session ^a
Type	Pain
Group as group ^b	Spasticity
Group as individual	Involuntary bowel/bladder
Individual	Orthostasis
Co-Treating discipline(s), if applicable	Autonomic dysreflexia
Missed therapy information (if applicable)	Heterotopic ossification
Time missed (in minutes)	Fatigue
Reason	Contracture/deformity
Refused	Respiratory status
Patient not available/ready	Active ventilator weaning
Equipment or therapist not available/ready	Wound/wound vacs
Medical complication	Bed rest
Patient/caregiver Involvement	Weight-bearing status
Patient participation scale	Surgical precautions
None	Orthoses
Poor	Halo
Fair	Behavioral issue
Good	Cognitive issue
Very good	Visual/hearing impairment
Excellent	Cultural issues
Not applicable	Positioning
Extent to which patient directed care	Refused
Not applicable	Equipment malfunction
All	Psychosocial support
≥50%	In-room isolation
<50%	Psychosocial support
None	
Family or caregiver participation	Administrative information
Not present	Date
Observed session only	Session start time
Received verbal instruction	Patient name
Demonstrated skill with assistance	Therapist name
Demonstrated skill independently	
Activities ^{c,d}	
Assessment/evaluation (Table 3)	Therapeutic activities (Table 13)
Self-Feeding (Table 4)	Strengthening/endurance (Table 14)
Grooming (Table 5)	Range of motion/stretching (Table 15)
Bathing (Table 6)	Balance (Table 16)
Dressing—upper body (Table 7)	Modalities (Table 17)
Dressing—lower body (Table 7)	Wheelchair mobility—manual (Table 18)
Toileting for clothing management and hygiene (Table 8)	Wheelchair mobility—power (Table 18)
Bowel management (Table 8)	Community reintegration outing (Table 19)
Bladder management (Table 8)	Equipment evaluation (Table 20)
Communication (Table 9)	Skin management (Table 20)
Assistive technology (Table 9)	Splint/cast fabrication (Table 20)
Home management skills (Table 10)	Airway/respiratory management (Table 20)
Bed mobility (Table 11)	Education not covered by other activities (Table 21)
Transfers (Table 12)	

^a Clinicians may select multiple factors from this list.

^b Group as Individual allows for patient-specific information to be entered; when Group as Group is selected, only information applicable to all patients in the group can be entered, except for patient names.

^c Time spent on each activity is documented.

^d More than one activity may be documented. Additional descriptors for each activity are specified in Tables 3–21.

Table 2. Options for the Level of Assistance and Education Only Descriptors

Levels of Assistance	Education Only
Total assistance of >1 person	Patient education
Total assistance of 1 person	Family/caregiver education
Maximum assistance	Patient and family/caregiver education
Moderate assistance	
Minimal assistance	
Supervision	
Modified independent	
Independent	

less severe injuries who are able to work on “all grooming tasks,” LOA is associated with the full task.

Bathing

Bathing information captured is similar to self-feeding and grooming information (Table 6). However, designation of equipment needed for task completion is limited to none, prefabricated adaptive equipment, or custom adaptive equipment because adaptive equipment used during bathing varies greatly between centers, especially the custom equipment.

Dressing

Table 7 combines details for upper and lower body dressing; however, they are separate in the OT taxonomy because the equipment used, clothing type, and amount of assistance needed to complete each task often is different. Documentation for both upper and lower body dressing includes the surface where the task occurs, patient position, and adaptive equipment used. Lower body dressing also includes type of clothing donned or doffed during the session.

Toileting: Clothing Management and Hygiene

The OT taxonomy includes as separate activities toileting, bladder management, and bowel management, but in

Table 3. Assessment/Evaluation

Type	Indication ^a	Shoulder/Scapula Assessment ^a
ADLs	Chronic pain	Subluxation
ASIA ^b testing	Acute pain	Positive impingement
Motor	Prevention/general	test
Range of motion		Pectoralis tightness
Sensory		Decreased shoulder muscle strength
Shoulder ^a		Scapular elevation
		Scapular protraction/winging

^a Additional details for shoulder assessment.

^b American Spinal Injury Association.

Table 4. Self-Feeding^a

Location	Equipment
Bed	None
Wheelchair	Adaptive equipment
	Short opponens
	Bioness
	Electrical stimulation
	Mobile arm support
	Splint
	Swedish sling
	Wrist driven flexor handbrace
	Other

^a Level of assistance or education only descriptor (Table 2) is documented for self-feeding.

Table 8 they are combined. Toileting includes the patient’s ability to manage clothing and hygiene, similar to the FIM toileting item. As shown in Table 8, the only information captured for toileting is type of equipment (bed, commode type, tub bench with cut-out) used and assistance needs.

Bowel Management

Protocols for teaching bowel and bladder management vary significantly among SCIR rehab centers. Nurses at some centers address all teaching needs regarding bowel/bladder management. Some other centers use collaborative efforts of nursing and OT. The remaining centers divide the task based on the patient’s level of injury; nursing works with patients with paraplegia, whereas OTs focus on patients with tetraplegia. The SCIR rehab centers also vary in how OTs assist patients with upper motor neuron deficits to get consistent bowel results. Table 8 shows taxonomy options for surface, whether training involves a simulation (common before actual performance of the technique is attempted) or an

Table 5. Grooming

Position	Type ^a	Equipment
Bed(s)	All grooming tasks	None
Standing	Hair	Adaptive equip—custom
Wheelchair	Shaving	Adaptive equip—prefabricated
	Wash face	Bioness
	Wash hands	Dorsal wrist support
	Brush teeth	Foam handles
	Apply makeup	Mobile arm support
	Eye care	Short opponens
	Deodorant	U-Cuff
	Nail care	Wash mitt
		Wrist-driven flexor handbrace
		Other

^a Each grooming type is associated with a level of assistance or education only descriptor (see Table 2).

Table 6. Bathing^a

Location	Body Part	Equipment
Tub	Upper	None
Shower	Lower	Custom-made adaptive equipment
Wheelchair	Total	Prefabricated adaptive equipment
In bed		
Edge of bed		
Sink		

^a Level of assistance or education only descriptor (Table 2) is documented for bathing.

actual performance of bowel management, and techniques and adaptive equipment used for bowel management. Not included in the OT taxonomy are techniques such as drinking a hot beverage before attempts to elicit a bowel movement. However, the time of the treatment session is documented in the SCIREhab study so that bowel management technique training can be associated with mealtimes (eg, rectal clear after breakfast or lunch).

Bladder Management

Between-center variation also is seen for bladder management, and the OT taxonomy allows tracking of such differences. Some centers use a sterile closed technique (prelubricated catheter in a clear collection bag with an introducer tip on 1 end that allows the catheter to be touched less), others use a sterile open system (separately

packaged catheters and lubrication), and others use clean (soap and water, no gloves) techniques for catheterization. In addition to the variations in technique used, centers also vary in the type of adaptive equipment used in bladder management and catheterization types for patients with tetraplegia (intermittent catheterization, indwelling [suprapubic] catheter, leg bag, or external collectors).

Communication and Assistive Technology

The OT taxonomy includes 3 types of communication activities: writing, page turning, and phone use. It also includes 2 types of assistive technology: computer access and electronic aids for daily living (EADLs)/call system. Equipment lists include various types of writing devices, splints, and telephones. Generic categories for phone types are included so that rapidly changing technology will fit into these categories over time. In addition, devices to assist with upper extremity function (eg, mobile arm support and overhead sling) are included for assistive technology. Table 9 combines details for communication and assistive technology activities; however, they are separate in the OT taxonomy.

Home Management Skills

The OT taxonomy includes time spent on teaching instrumental ADLs (IADLs) such as childcare, cleaning, laundry, and meal preparation (Table 10). All patients engage in some IADLs; however, focus on a particular skill may vary by age, sex, and stage of life.

Table 7. Dressing: Upper and Lower

Surface ^a	Position ^b	Dressing Equipment	Clothing Type ^c
Hospital bed/regular mattress	Short—sit/edge of bed	<u>Upper and lower</u>	Sweat pants
Hospital bed/specialty mattress	Long—sit	None	Jeans/pants
Bed—regular	Ring—sit	Bioness	Shoes
Wheelchair	Supported long—sit	Button hooks	Socks
Chair	Standing	Dycem gloves	TED hose
Mat	Supine	Loops—bed ladder or chain	Skirt
Standing		Reacher	Underwear
		Short opponens	Shorts
		Walker	Prosthesis
		Wrist-driven flexor handbrace	
		Zipper pulls	
		Other	
		<u>Lower only</u>	
		Dressing stick	
		Elastic shoelaces	
		Leg lifter	
		Loops—leg	
		Loops—pant	
		Shoehorn	
		Sock aid	

^a Each surface type is associated with a level of assistance or education only descriptor (see Table 2).

^b Position is associated with bed surfaces only.

^c Clothing type is associated with lower body dressing only.

Table 8. Bowel and Bladder Management, Toileting: Clothing Management, and Hygiene^a

Surface	Type	Technique	Adaptive Equipment	Catheterization Type
<u>Bowel and bladder management and toileting—clothing management</u>	<u>Bowel and bladder management</u>	<u>Bowel management</u>	<u>Bowel management only</u>	
Bed(s)	Simulation	Digital stimulation ^b	None—finger stimulation	
Bedside commode	Actual	Rectal clear/manual removal	Custom	
Raised toilet seat		Abdominal massage	Prefabricated	
Rolling shower chair		Suppository		
Regular toilet		Colostomy		
Tub bench with cut-out				
Wheelchair		<u>Bladder management</u>	<u>Bladder management only</u>	<u>Bladder management</u>
		Sterile/closed	Electric leg bag emptier	Intermittent catheter—urethra
		Sterile/open	Pants holder	Suprapubic/Mitrofanoff
		Clean/open	Quad catheter inserter	Leg bag
				External collector (condom)
			<u>Bowel and bladder management</u>	
			Bioness	
			Short opponens	
			Wrist-driven flexor	
			handbrace	
			Other	

^a Level of assistance or education only descriptor (Table 2) is documented for bowel management, bladder management, and toileting: clothing management and hygiene activities.

^b Duration of digital stimulation is recorded: <5, 5–15, >15 minutes.

Bed Mobility

Bed mobility is a skill that is inherent in the completion of many ADL tasks (eg, lower body dressing), transfers out of bed, and correct positioning in bed for skin protection and comfort (Table 11). The PT and OT taxonomies follow a similar framework for bed mobility training (17).

It is common to work on just 1 or 2 elements of bed mobility (positioning, rolling, supine-to-sit, and/or scooting) during an OT treatment session. Capturing level of assistance and other details about each bed mobility component describes independence differences that would not be apparent using standard documentation formats such as the FIM. Rolling on a treatment mat or in a hospital bed using railings often is easier than on a standard bed. Learning positioning on a large treatment mat is different than learning positioning in the confined space of a hospital bed. Thus, the taxonomy includes the surface on which bed mobility components are performed. As with many OT activities, adaptive equipment facilitates task completion.

Transfers

OTs and PTs worked together to dissect transfer components and develop a common definition of transfers, including surfaces involved and type of transfer

(Table 12). Because therapists intuitively think about a transfer as 1 action back-and-forth between 2 surfaces (eg, getting into and out of a car is considered 1 action) a transfer was defined as a back-and-forth action between 2 surfaces. The PT and OT taxonomies incorporate the same definition of “transfer” and follow a similar framework (17).

A unique transfer training detail included only in the OT taxonomy, however, is whether a transfer is performed dressed or undressed. It is common to have an OT treatment session where tasks such as toilet or bathing transfers are performed with clothing on for the purpose of training; however, in real life, this transfer would most likely be performed undressed. Many individuals require increased assistance when transfers are performed undressed, because they are more prone to stick to the surface or are unable to slide across the transfer board as they may have become accustomed to doing when clothed. Performing transfers with vs without clothing also may have an impact on skin integrity.

Therapeutic Activities

The OT taxonomy category named “therapeutic activities” may be a bit confusing, because all activities conducted during OT sessions are considered therapeutic

Table 9. Communication and Assistive Technology

Type ^a	Location	Equipment
<u>Communication</u>	<u>Communication</u>	<u>Communication</u>
Writing	Bed(s)	Bioness
Page turning	Wheelchair	Phone—Bluetooth
Phone use		Phone—regular
		Phone—cell
		Phone—speaker
		Short opponens
		Wanchik—long
		Wanchik—short
		Wrist-driven flexor
		handbrace
		Writing board
<u>Assistive technology</u>		<u>Assistive technology</u>
Computer access		Adaptive mouse
Electronic aids for daily living/call system		Pneumatic devices
		Switches
		Voice-activated equipment
		X-10 devices
		<u>Both communication and assistive technology</u>
		None
		Foam handles
		Mobile arm support
		Mouth stick
		Overhead sling
		Right angle pocket
		Rubber finger
		Swedish aid
		Typing aid
		U-Cuff
		Other

^a Each type is associated with a level of assistance or education only descriptor (see Table 2).

(Table 13). This all-encompassing category of therapeutic activities includes 10 OT treatments that do not fit easily into any of the other identified OT activities, including edema management, breathing exercise, visual/perceptual training, and cognitive retraining. Selection of “tenodesis training” or “practice of fine motor activities” prompts for additional information about pinch type and splint use.

Strengthening/Endurance

The OT taxonomy includes 14 categories for strengthening and increasing endurance; some are common across sites and others are used at some, but not all sites (eg, Motomed; Video Simulation; Playstation EyeToy [Trademark of Sony Computer Entertainment, Europe]; Wii [Nintendo of America, Inc., Redmond, WA]; and yoga; Table 14). When applicable, the OT taxonomy captures

Table 10. Home Management Skills

Type	Patient Performs/Education
Child care	Patient performs
Cleaning—heavy	Patient education only
Cleaning—light	Family/caregiver education only
Household accessibility	Patient/family/caregiver education only
Laundry	
Meal prep—cold	
Meal prep—hot	
Community accessibility	

information about body position, involved body part, and direction of movement (eg, flexion, extension, protraction) for each of the 14 categories. Position is especially important when using “basic/low-tech equipment” or “no equipment,” because progressing from supine to sitting or from a WC to short sit (unsupported) can represent improvement in strength and balance.

Range of Motion/Stretching

Information about the type of range of motion (ROM) or stretching provided to specific body parts is captured (Table 15). “Intervention” includes the type of range of motion treatment delivered or treatments, such as manual/orthopedic treatment and thermal agents that are common adjuncts to range of motion and stretching.

Balance

A patient’s balance performance can differ significantly depending on her/his body position and the amount of movement involved (Table 16). Thus, movement is categorized as static or dynamic and includes the body position from which balance is addressed.

Modalities

The OT taxonomy seeks to classify and quantify application of specific modalities used with patients with SCI. Table 17 lists the types of modalities included and the

Table 11. Bed Mobility

Movement Type ^a	Surface	Equipment
Rolling	Hospital bed/regular mattress	None
Supine-to-sit		Bed straps/chain loops
Scotting	Hospital bed/specialty mattress	Wheelchair
Positioning	Bed rails	Leg loops
	Bed—regular	Pillows
	Wheelchair	Draw sheet
	Chair	Trapeze
	Mat	Other

^a Each movement type is associated with a level of assistance or education only descriptor (see Table 2).

Table 12. Transfers

Surface A	Surface B	Even or Uneven Surface	Clothing	Type ^a
Mat	(Same list as for Surface A)	Even surface	Dressed	Slideboard
Bed		Uneven surface	Undressed	Pop-over with board
Wheelchair		Not applicable		Pop-over without board
Chair				Squat—pivot
Sofa				Stand—pivot
Toilet/no equipment				Dependent with lift
Tub/no equipment				Sit-to-stand
Shower/no equipment				Beezy board
Bedside commode				Other
Bath seat				
Rolling shower commode chair				
Raised toilet seat				
Transfer bench with cutout				
Transfer bench without cutout				
Vehicle				
Floor				
Standing				
Aisle seat				
Airline seat				
Other				

^a Each transfer type is associated with a level of assistance or education only descriptor (see Table 2).

indication for use and the anatomic location of application. Modalities can be used for various reasons; for example, Kinesiotape can be used for pain management, neuromuscular re-education, or for edema management.

Wheelchair Mobility

Teaching WC mobility is a crucial OT intervention in SCI rehabilitation to enable environmental exploration and to perform daily tasks at home. Like the skills of bed mobility and transfers, WC mobility skill training falls under other disciplines' scope of practice as well (17). The OT and PT taxonomies capture important attributes of these cross-disciplinary skills as applicable to that discipline. Table 18 combines details for power and manual WC mobility

training; however, documentation for each is separate in the OT taxonomy.

The OT taxonomy includes various manual and power WC mobility skills and skill-specific details; there is some overlap of skill by chair type. Level of independence and surface type is tracked separately for individual skills including propulsion, ramps, and wheelies.

Adaptive equipment often is used with both manual and power WC mobility training to increase the patient's independence. For example, a patient may be unable to propel a manual chair without having a tubing wrap on the wheels.

Management of doors, elevators, and curbs is important for community mobility in either type of chair. Additionally, 2 skills unique to the power chair (WC

Table 13. Therapeutic Activities

Type	Location ^a	Pinch Type ^b	Splint ^b
Fine motor activity	Lower extremity	Lateral	None
Tenodesis training	All upper extremities	3-point	With short opponens
Manual therapy	Scapula		Wrist-driven flexor hand brace
Vestibular training	Elbow		
Edema management	Forearm		
Breathing exercise	Wrist		
Cognitive retraining	Fingers		
Visual/perceptual training	Cervical		
Desensitization	Trunk		
Don/Doff adaptive equip	Head/face		

^a Location associated with manual therapy only.

^b Pinch type and splint are associated with fine motor activities and tenodesis training only.

Table 14. Strengthening/Endurance

Type	Position ^a	Involved Body Part ^b	Movement
Sitting tolerance	Wheelchair	Lower extremity	All
Manual resistance	Standing	All upper extremities	Subluxation
Strengthening/no equipment	Prone	Shoulder	Flexion
Basic/low-tech equipment	Short—sit	Scapula	Extension
Gym machines	Long—sit	Elbow	Abduction
Overhead slings/mobile arm support	Ring—sit	Forearm	Adduction
Neuromuscular re-education	Tall knee	Wrist	Elevation
Arm ergometer	Quadruped	Finger(s)	Retraction
Motomed	Half kneeling	Cervical area	Depression
Participation sport	Supine	Trunk	Supination
Video simulation/eyeToy	Side-lying		Pronation
Yoga	Other		Protraction
Pilates			
Standing frame/tilt table			
Wii			

^a Position associated with manual resistance or basic/low-tech equipment only.

^b Body part and movement associated with sitting tolerance, manual resistance, strengthening/no equip, basic/low tech, gym machines, overhead slings/mobile arm support, and Wii only.

management and power functions) are included, because patients need to be able to manage seating functions and to position their drive controls properly or to direct someone else in doing so.

Community Reintegration Outings

Community outings help to reintegrate the patient into the community. The OT taxonomy includes the location of the outing and descriptions of the integral role that OTs have in showing the newly injured patient how to cross a street in a WC, navigate curbs, manage money, perform catheterization in a community bathroom (especially the first time), and deal with the stigma or other emotional issues that come with community exposure (Table 19). Therapeutic recreation and PT also include details of community outings in their respective taxonomies.

The following 4 activities are combined into a single table (Table 20).

Skin Management

SCI centers follow skin care programs to prevent pressure ulcers. OTs, like their colleagues in other disciplines, adhere to pressure relief programs and are involved in procurement of appropriate equipment. Activities and

specific therapy interventions included in the skin management section of the OT taxonomy mirror the activities in the PT taxonomy (17).

Equipment Evaluation

Evaluations for ordering of WCs, transfer devices, and equipment for bed, bathing, and toileting are the primary responsibility of OTs in some centers and of PTs in other facilities. Thus, this activity is included in both the OT and PT taxonomies (17).

Adaptive equipment evaluation focuses on identifying a patient's functional deficits (eg, decreased muscle strength, ROM, or fine motor skills) and determining the most appropriate piece of adaptive equipment to optimize independence.

Splint/Cast Fabrication

Throughout the course of rehabilitation, splints and casts may be used in therapy to promote function, for

Table 15. Range of Motion/Stretching

Body Part	Intervention
Upper extremity	Passive range of motion
Lower extremity	Active range of motion
Thoracic area	Active assist range of motion
Lumbar/sacral area	Thermal agents
Cervical area	Manual/orthopedic treatment

Table 16. Balance^a

Position	Type
Standing	Both static and dynamic
Short—sit	Static
Long—sit	Dynamic Wii
Ring—sit	
Wheelchair—sit	
Tall knee	
Quadruped	
Half kneel	

^a Level of assistance or education only descriptor (Table 2) is documented for balance.

Table 17. Modalities

Type	Indication	Side	Location
Bioness	Pain management	Left upper extremity	Shoulder
Biofeedback	Positioning	Right upper extremity	Scapula
Ultrasound	Strengthening	Right and left upper extremities	Elbow
Electrical stimulation	Neuromuscular re-education		Forearm
Fluido	Edema management		Wrist
Hot/cold pack			Finger(s)
Iontophoresis			Cervical
Kinesio tape			Back
Paraffin			
Rigid tape			

contracture management, or for maintenance of a functional hand position (Table 20). Fabrication of the most commonly used splints is included in the OT taxonomy. The process of splinting and casting may continue throughout the rehabilitation process as patient function changes. Often, it is necessary to adapt existing splints to improve their functional use; this is termed “adaptation to prior” in the OT taxonomy.

Airway/Respiratory Management

OT practice in respiratory management varies greatly among centers, as does respiratory management by PT. The airway management section of both taxonomies includes documentation of chest physical therapy, respiratory exercises, suctioning, and coughing interventions only and an indication of whether the therapist educated the patient and/or family on components of respiratory management.

Education Not Covered By Other Activity Area

Education is an integral component of training in every functional activity and not included separately in the OT taxonomy (Table 21). As stated earlier, if the patient does not practice the functional task, the OT includes this education in the appropriate functional task activity (Tables 4–20) by selecting an education only option in the level of assistance field (if the functional task is not practiced, there is no assistance needed) in Table 2. For example, the OT reviews transfers techniques with the patient but the patient does not perform the transfer. Because this is education about a functional task that is included in the OT taxonomy, it is recorded in the transfer activity, and the level of assistance is documented as patient education only.

However, much OT education also is provided in the absence of functional task work, and thus, is included separately in the OT taxonomy. As presented in Table 21,

Table 18. Wheelchair Mobility—Manual and Power

Skill ^a	Adaptive Equipment	Drive Type	Surface/Terrain ^b
<u>Both manual and power</u>	<u>Both manual and power</u>		<u>Both manual and power</u>
Propulsion	None		Level
Door management	Dycem gloves		Rough terrain
Elevator(s)	Dorsal wrist splint		
Positioning in chair	Other		
<u>Manual only</u>	<u>Manual only</u>		<u>Manual only</u>
Stairs	Short opponens		Inclines
Curbs	Tubing wrap		
Escalator(s)	Rim projections	<u>Power only</u>	
Bumping	Power assist	Power hand	
Assembly/breakdown		Power head	
Up-righting		Power sip and puff	
Wheelies		Power tongue	
<u>Power only</u>	<u>Power only</u>	Power chin	
Wheelchair management	Overhead sling	Power overhead sling	
Power functions	Adaptive joystick	Attendant driving	

^a Each skill type is associated with a level of assistance or education only descriptor (see Table 2).

^b Surface/terrain associated with propulsion and wheelies only.

Table 19. Community Reintegration Outing

Type	Mobility	Skill/Education Type
Airport	Wheelchair	Adaptive equipment
Restaurant	Ambulation	Accessibility
Shopping	Both wheelchair and ambulation	Door management
Athletic club		Money management
Bowling alley/billiards hall		Social skills
Museum/zoo/botanical gardens		Surface—curbs
Park/bike path		Surface—inclines/ramps
Spectator sports/entertainment		Surface—level
Transportation—bus		Surface—rough terrain/uneven
Transportation—car		Time management
Transportation—train		Transfers
Transportation—van		Transportation
		Elevator
		Escalator
		Advocacy
		Assertiveness
		Bowel/bladder management
		Energy conservation
		Feeding
		Inclement weather
		Problem solving
		Self image
		Skin management

the OT taxonomy includes topics that may be reviewed with a patient in an education-only session (eg, home modifications needed for optimal home independence) or during a functional work session with a different focus (eg, during tenodesis training the therapist educates the patient or family on transportation issues). If the education overlaps with a different functional activity, the therapist documents “yes—overlaps with functional work” so that minutes spent on the education do not “double count” minutes spent on the functional work.

DISCUSSION

DeJong et al (5) outlined criteria that define the usefulness of taxonomy efforts, which helped to guide development of the SCIRehab OT taxonomy. The PBE approach, which relies primarily on the expertise and experience of practicing clinicians who develop the taxonomy, set the groundwork to capture a comprehensive description of OT activities and interventions within the SCI rehabilitation setting. Capturing all domains of OT for SCI rehabilitation, as was desired for the SCIRehab project, is a lengthy process. However, clinicians believe this granularity is important to classify and describe each dimension systematically, and thus, the OT taxonomy for SCIRehab incorporates and organizes each component (theoretical integrity). We hypothesize that 1 of the reasons this classification has not been done previously is because of the complex multidimensionality; it is not practical to use a classification system in a paper format, which would be many pages long. The use of the

SCIRehab electronic data capture method (14), however, provides a reliable, efficient, and minimally burdensome method to capture detailed data that fits the busy schedule of OT clinicians. Research utility will be explored when data collection is complete and we attempt to relate OT processes with outcomes in the SCIRehab analyses.

OT lead clinicians, like other discipline leaders involved in this project, recognized the fine line between collecting sufficient detail to show variation in treatment, which will be used subsequently for associating treatment types, amounts, or sequences with outcomes, and collecting too much information to make the process overly burdensome to front-line clinicians. If documentation is so detailed that the clinician has to spend significant time and energy entering the data, there is a significant risk of a decrease in data quality. The electronic data capture method makes gathering most supplemental taxonomic details collected for research purposes in the SCIRehab study acceptable; however, when an OT session involves multiple ADL activities during 1 session (eg, bathing, grooming, and upper and lower body dressing), the documentation burden becomes greater. OT lead clinicians were aware of this risk at the time of development but agreed that the elements included in the taxonomy were necessary to identify and quantify these complex sessions.

The PBE method provides the unique opportunity to examine the totality of the rehabilitation process in all its natural variations and differences in practice among the 6 centers. OTs from the 6 centers shared treatment

Table 20. Other Activities

Activity	Intervention Detail	
Skin management ^a	Weight shift/pressure relief—lateral Weight shift/pressure relief—forward Weight shift/pressure relief—tilt/recline Weight shift/pressure relief—push up	Pressure mapping Skin inspection Padding/positioning
Equipment evaluation ^b	Wheelchair assessment/prescription/trials Wheelchair fitting Transfer devices	Adaptive equipment Bathing equipment Toileting equipment Bed
Splint/cast fabrication	Short opponens Long opponens Resting hand splint Tenodesis splint Intrinsic plus MP Stop/Wynn Perry Short arm cast Long arm cast Finger shell Dolphin splint	Drop arm cast Dynasplint Elbow extension splint Wrist cock-up (dorsal wrist support) Adaptation to prior Dill splint Anti-spasticity splint
Airway/respiratory management ^a	Chest physical therapy Respiration therapeutic exercise Suctioning Coughing	

^a A level of assistance or education only descriptor (Table 2) is documented for skin management and respiratory management.

^b An education only descriptor (Table 2) is documented for equipment evaluation.

techniques, some of which were unique to 1 or a few centers, but for which there is little literature to describe effectiveness. One example is the use of short opponens splints to facilitate tenodesis, for which there is minimal evidence. DiPasquale-Lehnerz (21) and Harvey et al (22) offered differing opinions of the utilization of orthoses to facilitate tenodesis. Although the intention of the SCIRehab project is to capture what occurs in day-to-day therapy sessions and not to change practice, participation in these types of discussions may indeed have an effect on practice. Insightful discussions on the perceived benefits of orthoses and the inclusion of these orthoses, for example, in the OT taxonomy may have influenced clinicians to try approaches that would not have been used previously. This may be similar to attending a professional conference where discussions of the advantages of specific interventions spark an interest in clinicians to try the intervention.

Continued refinement of the OT taxonomy for incorporation into permanent rehabilitation center documentation or for future research projects may be influenced by experience with the current taxonomy. For example, clinicians might add leg management skills as an additional component to the “bed mobility” activity. Although this skill is inherent in other components of bed mobility (eg, rolling, scooting), leg management skills also are needed specifically for the task of lower body dressing.

This was not included in the SCIRehab taxonomy because of the desire to maintain as much consistency as possible among activities that overlap PT and OT domains, and leg management is not within the PT realm for bed mobility activities. The “upper body dressing” activity is another area where more information might be beneficial; information about specific components of dressing might be added, which would be similar to including donning pants, socks, shoes, etc, in “lower body dressing.” Clinicians suggest that including “upper body dressing” components such as bra, button-up shirt, and pullover shirt, could show increments of increased independence that are otherwise not measured. However, we believe such gaps in the taxonomy are minor.

The OT taxonomy has already had a direct impact on daily documentation at several centers. Some centers report a change in how they view OT documentation and are paying more attention to recording the 26 OT taxonomy activities and their associated details. One center’s current system of documentation, which uses the subjective/objective/assessment/plan notes approach, requires a significant amount of detail but is not as efficient as the OT taxonomy; they would like to reorganize the daily documentation system to be more similar to the data collection system created for the SCIRehab study. Other centers see the value of including more detailed process information, similar to what is in the OT taxonomy, and are

Table 21. Education Not Covered by Other Activity Areas (Described in Tables 4–20)

Topics	Overlap with Functional Activity?
Activities of daily living	Yes
Adaptive equipment	No
Assistive devices	
Bowel/bladder	
Community resources	
Durable medical equipment	
Energy conservation	
Home exercise program	
Home modification—in center	
Home modification—home visit	
Nutrition	
Positioning	
Respiratory	
Safety	
School	
SCI general education	
Sexuality	
Shoulder	
Skin care	
Splints/casts	
Tendon transfer	
Transportation	
Wheelchair management	

using the taxonomy as a guide for documentation system revisions. One center decided to use the taxonomy to aid in the creation of week-by-week care pathways to ensure consistent treatment, regardless of clinician experience.

CONCLUSIONS

When clinicians in the field are invited to be part of research and realize that the details of their many clinical efforts may contribute to decisions on what interventions work best for what types of patients, they become engaged in the process and continue to ask interesting questions. Can the OT taxonomy be developed further to be used for daily documentation? Could a computerized documentation system incorporate the 26 OT taxonomy activities? Care delivered could be guided by research based on actual data they themselves contributed—evidence-based practice resulting from PBE!

REFERENCES

1. Bennett S, Bennett J. The process of evidence-based practice in occupational therapy: informing clinical decisions. *Austr Occup Ther.* 2000;47(4):171–180.
2. Sonn U, Törnquist K, Svensson E. The ADL taxonomy: from individual categorical data to ordinal categorical data. *Scand J Occup Ther.* 1999;6(1):11–20.
3. American Occupational Therapy Association. Occupational therapy practice framework: domain and process. *Am J Occup Ther.* 2002;56(6):609–639.

4. Keith R. Treatment strength in rehabilitation. *Arch Phys Med Rehabil.* 1997;78(12):1298–1304.
5. DeJong G, Horn S, Gassaway J, Slavin M, Dijkers M. Toward a taxonomy of rehabilitation interventions: using an inductive approach to examine the “black box” of rehabilitation. *Arch Phys Med Rehabil.* 2004;85(4):678–686.
6. DeJong G, Horn S, Conroy B, Nichols D, Heaton E. Opening the black box of poststroke rehabilitation: stroke rehabilitation patients, processes, and outcomes. *Arch Phys Med Rehabil.* 2005;86(12 suppl 2):S1–S7.
7. Richards LG, Latham NK, Jette DU, Rosenberg L, Smout RJ, DeJong G. Characterizing occupational therapy practice in stroke rehabilitation. *Arch Phys Med Rehabil.* 2005;86(12 suppl 2):S51–S60.
8. Maulden S, Gassaway J, Horn S, Smout R, DeJong G. Timing of initiation of rehabilitation after stroke. *Arch Phys Med Rehabil.* 2005;86(12 suppl 2):S34–S40.
9. Hatfield B, Millet D, Coles J, Gassaway J, Conroy B, Smout R. Characterizing speech and language pathology outcomes in stroke rehabilitation. *Arch Phys Med Rehabil.* 2005;86(12 suppl 2):S61–S72.
10. Latham N, Jette D, Slavin M, et al. Physical therapy during stroke rehabilitation for people with different walking abilities. *Arch Phys Med Rehabil.* 2005;86(12 suppl 2):S41–S50.
11. van Langeveld S, Post M, van Asbeck F, Postma K, Ten Dam D, Pons K. Development of a classification of physical therapy, occupational therapy and sports therapy interventions to document mobility and self-care in spinal cord injury rehabilitation. *J Neurol Phys Ther.* 2008;32(1):2–7.
12. van Langeveld S, Post M, van Asbeck F, Postma K, Ten Dam D, Pons K. Feasibility of a classification system for physical therapy, occupational therapy and sports therapy interventions for mobility and self-care in spinal cord injury rehabilitation. *Arch Phys Med Rehabil.* 2008;89(8):1454–1459.
13. Whiteneck G, Gassaway J, Dijkers M, Jha A. New approach to study the content and outcomes of spinal cord injury rehabilitation: The SCIRehab Project. *J Spinal Cord Med.* 2009;32(3):251–259.
14. Gassaway J, Whiteneck G, Dijkers M. Clinical taxonomy development and application in spinal cord injury research: The SCIRehab Project. *J Spinal Cord Med.* 2009;32(3):260–269.
15. Fielder R, Granger C. Functional Independence Measure: a measurement of disability and medical rehabilitation. In: *Functional Evaluation of Stroke Patients.* Tokyo: Springer-Verlag; 1996:75–92.
16. UB Foundation Activities. *IRF-PAI Training Manual. Section III—The FIM Instrument: Underlying Principles for Use of the FIM.* UB Foundation Activities; 2004.
17. Natale A, Taylor S, LaBarbera J, et al. SCIRehab Project Series: the physical therapy taxonomy. *J Spinal Cord Med.* 2009;32(3):270–282.
18. Dalyan M, Cardenas D, Gerard B. Upper extremity pain after spinal cord injury. *Spinal Cord.* 1999;37(3):191–195.
19. Jensen M, Hoffman A, Cardenas D. Chronic pain in individuals with spinal cord injury: a survey and longitudinal study. *Spinal Cord.* 2005;43(12):704–712.
20. Gutierrez DD, Thompson L, Kemp B, Mulroy SJ. The relationship of shoulder pain intensity to quality of life,

- physical activity, and community participation in persons with paraplegia. *J Spinal Cord Med.* 2007;30(3):251–255.
21. DiPasquale-Lehnerz P. Orthotic intervention for development of hand function with C-6 quadriplegia. *Am J Occup Ther.* 1994;48(2):138–143.
22. Harvey L, Baillie R, Bronwyn R, Simpson D, Pironello D, Glinsky J. Does three months of nightly splinting reduce the extensibility of the flexor pollicis longus muscle in people with tetraplegia? *Physiother Res Int.* 2007;12(1): 5–13.