OBJECTIVE. To prospectively monitor occupational therapy activities and intervention techniques used during inpatient stroke rehabilitation in order to provide a description of current clinical practice.

METHODS. Data were collected prospectively from 954 clients with stroke receiving occupational therapy from six U.S. rehabilitation hospitals. Descriptive statistics summarized frequency, intensity, and duration of occupational therapy sessions; proportion of time spent in 16 therapeutic activities; and proportion of those activities that included any of 31 interventions.

RESULTS. Clients received on average 11.8 days ($SD = 7.2$) of occupational therapy, with each session lasting on average 39.4 min ($SD = 16.9$). Upper-extremity control (22.9% of treatment time) and dressing (14.2% of treatment time) were the most frequently provided activities. Interventions provided most frequently during upper-extremity control activities were strengthening, motor learning, and postural awareness.

CONCLUSION. Occupational therapy provided reflected an integration of treatment approaches. Upper-extremity control and basic activities of daily living were the most frequent activities. A small proportion of sessions addressed community integration.

Stroke is the third largest cause of death and one of the leading causes of long-term disability in the United States (Centers for Disease Control and Prevention, 2000). Significant progress has been made in stroke care over the past 30 years and as a result the proportion of people who survive a stroke has increased (Centers for Disease Control and Prevention, 2000). It is now well established that differences in post-stroke care and rehabilitation have a significant effect on outcome, with one systematic review finding that clients who received organized inpatient care in a stroke unit were more likely to be alive, independent, and living at home 1 year after the stroke (Stroke Unit Trialists' Collaboration, 2003). However, despite evidence that post-stroke care influences outcomes, the ideal activities or approaches to treatment that should be included in stroke rehabilitation are still not well established (Wade & de Jong, 2000).

Occupational therapists play an important role in post-stroke rehabilitation. The National Board for Certification in Occupational Therapy (NBCOT) Practice Analysis reported that cerebrovascular accident was the most frequent diagnosis seen by their survey respondents (NBCOT, 2004). Several recent systematic reviews suggest that occupational therapy after a stroke improves the performance of some functional tasks and reduces some impairments (Ma & Trombly, 2002; Steultjens et al., 2003; Trombly & Ma, 2002). However, despite evidence that post-stroke care influences outcomes, the ideal activities or approaches to treatment that should be included in stroke rehabilitation are still not well established (Wade & de Jong, 2000).

Few observational studies exist that describe the nature of occupational therapy interventions currently being used for stroke rehabilitation in the United States. Most studies to date have been conducted in countries outside the United States (Alexander, Bugge, & Hagen, 2001; Ballinger, Ashburn, Low, & Roderick, 1999;
deWeerdt et al., 2000); have described treatment activities only in terms of duration or frequency (Alexander et al., 2001; Bernhardt, Dewey, Thrift, & Donnan, 2004; Sulch, Perez, Melbourn, & Karla, 2000); or have involved a limited number of clients (Ballinger et al., 1999; deWeerdt et al., 2000). The Practice Analysis (NBCOT, 2004) reports the frequency with which entry-level practitioners use specific interventions, but does not break these down by client condition and surveyed therapists only within the first 3 years of their practice.

Given the limitations of reported studies and a lack of information about how clients with stroke are treated by occupational therapists in the United States, we undertook a study to describe the care provided by occupational therapists for clients with stroke in six hospital-based rehabilitation settings within the United States. Our aim was to describe the occupational therapy plan of care by describing the types of therapeutic activities that therapists used with each client. We defined therapeutic activities as whole tasks that were the focus of a therapy session. In addition, we wished to capture the intervention techniques that the occupational therapists used during each of these activities. We defined intervention techniques as specific treatment approaches used by occupational therapy practitioners to facilitate activities. Finally, we collected data about the duration, frequency, and intensity of occupational therapy sessions, and the personnel who provided them. This information complements and expands information in the NBCOT Practice Analysis (2004), by providing more detailed information about current practice with a specific clinical population by practitioners with a broader range of experience. In addition, it may provide guidance to clinical researchers about important elements of occupational therapy that need to be documented in future studies of rehabilitation outcomes.

Methods

Subjects

As part of the Post-Stroke Rehabilitation Outcomes Project (PSROP), data were collected between March 2001 to August 2003 from consecutive clients with stroke seen at six rehabilitation hospitals in the United States (DeJong et al., 2005). The sites were geographically dispersed (3 in the West, 1 in the Central Mountain region, 1 in the South, and 1 in the East). The facilities were a mixture of free-standing rehabilitation hospitals and rehabilitation units that were linked to acute care hospitals. Physical Medicine and Rehabilitation residents were involved in stroke management in 2 out of 6 of the facilities. For this observational cohort study, a Clinical Practice Improvement approach was used in which detailed client, process, and outcome variables were obtained (Horn, 1997). This study was approved by the institutional review boards at Boston University and at each of the participating hospitals and was classified as exempt because of its observational nature.

Nine hundred and fifty-four clients met the inclusion criteria, which were a diagnosis code indicating that the person had experienced a stroke (ICD-9-CM of 430–438.99), was older than 18 years of age, had a recent stroke (within 1 year of admission) as the reason for admission, and had no interruption in rehabilitation services of greater than 30 days (see Table 1 for client characteristics). The mean age of clients was 66.2 years ($SD = 14.2$). Men composed 51% of the sample and women 49%. Fifty-seven percent of clients were White, 24% were African American, 4.9% were Asian, and the remaining were of other backgrounds or unknown race. Forty-three percent of clients had left-sided hemiplegia, 43% had right-sided hemiplegia, 10% had bilateral involvement, and the remainder had other types of involvement.

A total of 180 occupational therapy staff participated in this study, and of these, 61% were occupational therapists, 38% were occupational therapy assistants, and 1% were students. In the subset of therapists who provided detailed information about their work experience (i.e., 27%), the occupational therapists had an average of 10.3 years of experience ($SD = 8.2$, range = 1–32) and the occupational therapy assistants had 8.3 years ($SD = 5.6$, range = 2–23). Most occupational therapists or occupational therapy assistants (69%) worked full time (i.e., 40 hr per week). The majority of therapists and assistants had obtained some advanced training in neurology-related or geriatric-related courses in the past 2 years. The most frequently reported

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>$N = 954$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>66</td>
</tr>
<tr>
<td>SD</td>
<td>14</td>
</tr>
<tr>
<td>Range</td>
<td>18–95</td>
</tr>
<tr>
<td>Gender % (n)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>51 (487)</td>
</tr>
<tr>
<td>Female</td>
<td>49 (467)</td>
</tr>
<tr>
<td>Race % (n)</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>57.2 (546)</td>
</tr>
<tr>
<td>African American</td>
<td>24.0 (229)</td>
</tr>
<tr>
<td>Asian</td>
<td>4.9 (47)</td>
</tr>
<tr>
<td>Other or unknown</td>
<td>13.9 (122)</td>
</tr>
<tr>
<td>Impairment % (n)</td>
<td></td>
</tr>
<tr>
<td>Left hemiplegia</td>
<td>43.6 (416)</td>
</tr>
<tr>
<td>Right hemiplegia</td>
<td>43.6 (416)</td>
</tr>
<tr>
<td>Bilateral involvement</td>
<td>10.1 (96)</td>
</tr>
<tr>
<td>Other</td>
<td>2.7 (26)</td>
</tr>
</tbody>
</table>
type of training was in neuromuscular interventions (i.e., NDT or neurodevelopmental treatment), in which 59% of respondents said that they had participated during the past 2 years.

**Instrumentation**

Forms to record activity and intervention data from each occupational therapy session and definitions for each of these terms were developed with input from occupational therapists involved in care of clients with stroke at each facility participating in the PSROP (DeJong et al., 2004). The data collection forms allowed occupational therapy providers to describe sessions using 16 possible categories of activities. These included Examination/Evaluation and activities to remediate performance skill deficits or body function or structure or function impairments (i.e., Pre-functional, Upper Extremity Control, Sitting Balance/Trunk Control, Transfers, Functional Mobility, Bed Mobility); Activities of Daily Living (ADL: Bathing, Dressing, Grooming, Toileting, Feeding/Eating), and Instrumental Activities of Daily Living (IADL: Home Management, Community Integration, Leisure Performance, Wheelchair Management). Therapists recorded the amount of time spent on each activity with the client in 5-min increments and up to 5 specific intervention techniques (from a list of 31) that they used to facilitate performance of that activity. Options included neuromuscular interventions (7), musculoskeletal interventions (4), cardiopulmonary interventions (2), modality interventions (3), cognitive/perceptual/sensory interventions (4), adaptive and compensatory interventions (4), equipment interventions (i.e., prescription, application, fabrication, and ordering), and education and training interventions (3). Training in the use of assistive devices or equipment during therapy could be recorded under each treatment activity, with a list of 20 devices provided. One category was provided for writing in interventions or equipment not provided on the form. Additional information recorded on each session included: the amount of time spent in evaluation, in cotreatment with other disciplines, and in therapy sessions that included more than one client, as well as which providers gave care during the session, including occupational therapists, occupational therapy assistants, and students (see Figure 1).

**Procedure**

One occupational therapist at each site was selected as the lead occupational therapist for this project, and participated in a 90-min train-the-trainer session, which was conducted by project staff. Before this session, each lead occupational therapist received a training manual that contained the occupational therapy intervention documentation form, written instructions for completion of the form, and definitions of all terms used on the form. The training manual also contained case studies that provided scenarios of three occupational therapy sessions. A trainer’s and a trainee’s copy of each case study were provided. The trainer’s copy provided instructions and descriptive notes about each case study session, followed by the actual case studies that described an occupational therapy session, including amount of time spent on specific activities and assessments and a completed intervention documentation form. During the train-the-trainer session conducted by project staff with the lead occupational therapists, the project team reviewed the form, instructions, definitions, and care studies in detail. Participants were encouraged to ask questions and discuss possible scenarios that might be raised during their upcoming training sessions with their colleagues at their respective facilities.

During each site’s internal training sessions (lasting about 60 min), the lead occupational therapy trainer reviewed the intervention documentation form (of which most occupational therapists were familiar because of participation in development efforts), instructions for completing the form, and the definitions of each term used on the form. The trainer then reviewed the first case scenario with the trainees and described how the intervention documentation form was completed. Individually, trainees then read the second case study and completed the form. The trainer reviewed the second case study with the group and discussed form completion. Trainees then completed the third case scenario and discussed completion of the form.

After this training, during the first month of occupational therapy intervention documentation form use, each site’s lead occupational therapist conducted random “co-sessions” with other therapists. During this time, the lead occupational therapist would observe an occupational therapy session and record it on an intervention documentation form. The therapist providing the treatment session would also complete a form and the two were compared and discussed. The lead occupational therapist continued to serve as a resource person to the other occupational therapists throughout the entire form use period.

A member of each site’s project team (admitting nurse, medical director, project manager) identified clients to enroll into the study on admission and flagged the client chart as being a study patient. Other rehabilitation providers (physicians, therapists [physical, speech, recreational], nurses, social workers) completed their respective project documentation form for each encounter with each enrolled client. Data regarding other client characteristics (e.g., demographics, severity of illness, medications) were collected from clients’ medical records after their discharge.
Descriptive statistics were used to examine characteristics of clients and characteristics of their episodes of care including length of stay, number of days occupational therapy was provided, number of occupational therapy sessions per day, and intensity of occupational therapy (defined as the number of days occupational therapy was provided divided by the total length of stay). The content of treatment sessions was described by determining duration of each session, the proportion of all occupational therapy time spent directed to the activities listed above, and the proportion of those activities that included specific interventions. We examined the proportion of all occupational therapy sessions in which more than one client was treated by a single provider and the proportion of sessions for which occupational therapists, occupational therapy assistants, or students were involved in the care. We also determined combinations of

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**Figure 1. Occupational therapy data collection form**


**Data Analysis**
activities provided to clients during sessions, the proportion of sessions that included examination or evaluation, and the proportion of clients and families who received an educational intervention.

Results
The mean length of stay for the episode of care was 18.8 days ($SD = 10.3$, range = $1–75$; see Table 2). Clients received occupational therapy, on average, 11.8 days ($SD = 7.2$, range = $1–53$) during an episode of care. On days that the clients received occupational therapy, the average number of occupational therapy sessions per day was 1.6 ($SD = 0.4$, range = $1–3$), and the average time for each session was 39.4 min ($SD = 16.9$, range = $5–240$).

Seventy percent of the sessions were provided by occupational therapists, 33% by occupational therapy assistants or aides, and 7% by students. The vast majority of the sessions (91%) were provided one-on-one by an occupational therapy provider. Only 5% of sessions consisted of cotreatment with another discipline, and in only 11% of sessions did a group session occur (i.e., more than one client was treated by a single provider). See Table 3.

More than 94% of clients had some form of examination or evaluation time recorded, and approximately 7% of sessions included only examination or evaluation. Table 2 gives the percentage time clients spent in each occupational therapy activity. Upper-extremity control (22.9% of total treatment time) and dressing activities (14.2% of total treatment time) were the most frequently used activities, with examination or evaluation (10.8%) and pre-functional activities (9%), the third and fourth most common activities (see Table 3). Upper-extremity control activities were defined as the training or facilitation of normal movement, strength, range of movement, or alignment in the upper extremity. Dressing activities were defined as selecting appropriate clothing and accessories, obtaining clothing from storage area, dressing and undressing in a sequential fashion, and fastening and adjusting clothing, shoes, or personal devices. Pre-functional activities were described as activities that were related to or provided preparation for functional activities.

Table 2 provides data on the types of interventions that occupational therapy providers used in each therapeutic activity with their patients. Of a total of 24 types of direct interventions from which providers could choose, 19 interventions were used during at least 5% of the sessions for one or more of the therapeutic activities. All seven educational or equipment provision interventions were used during 5% of sessions for any activity. A wheelchair was the only device used during at least 5% of sessions for any activity. Only 6.5% of patients used a wheelchair during at least one session and it was used primarily in transfer and wheelchair management activities.
Overall, 97% of patients or their families received some educational intervention and 22.8% of all sessions for all patients included some form of education. Of all the sessions with some form of patient and caregiver education, 28.2% included education related to community integration, 24.2% included education related to home management, and 20.8% included education related to upper-extremity control activities.

We looked particularly at the interventions used in the most frequent activities cited: upper-extremity control and dressing. Interventions provided most frequently to address upper-extremity control were strengthening (included in 53.7% of sessions), motor learning (51.4% of sessions), passive range of motion (42.5% of sessions), and postural awareness (42.3% of sessions). In all the sessions that addressed dressing activities, the interventions most frequently provided were balance (included in 66.1% of sessions), postural awareness (64.5% of sessions), motor learning (54.3% of sessions), one-handed skills (48.8% of sessions), and cognitive therapy (44.5% of sessions). These data probably reflect the large emphasis placed on regaining sensorimotor skills in this population.

A total of 40.2% of therapy time was spent on direct practice of daily life activities, the majority of this time (28.1%) in basic ADL. Clients engaged in the more complex activities of leisure performance, home management, or community integration 12.1% of the time.
almost half their time in occupational therapy, clients were engaged in activities that directly targeted remediating performance skill deficits or body structure and function impairments (i.e., upper-extremity control, sitting balance, bed mobility, wheelchair, pre-functional, transfers).

Discussion

In this descriptive study of occupational therapy provided to clients during stroke rehabilitation, about 40% of the occupational therapy provided directly targeted life activities (i.e., ADL and IADL), whereas half of the therapy time targeted body function and structure or motor skills that are presumed to underlie functional limitations post-stroke. Upper-extremity tasks and dressing were the most frequently provided activities, and accounted for almost half of the treatment that clients received. Evaluation or examination activities also composed a significant proportion (10%) of occupational therapy time. In 6% of patients, no evaluation or examination session was documented. It is probable that in many of these cases the therapist did do an evaluation, but the time devoted to this was included under each activity (i.e., a dressing evaluation was recorded under dressing instead of examination or evaluation).

When types of activities were compared, there was clearly a greater emphasis on basic ADL, such as dressing, grooming, eating, and toileting than on IADL, such as home maintenance, or on community integration and leisure performance. This focus on more basic activities probably reflects the fact that therapy was taking place in a hospital setting with clients who were still in the early rehabilitation phase. In addition, the average length of stay was less than 3 weeks, which could limit the time that is available for more advanced activities. It is interesting to note that, in the Practice Analysis, 65% of therapists reported that dressing was the focus of intervention for more than 25% of their clients (NBCOT, 2004). This percentage was among the five most frequent interventions listed in that analysis, which covered all practice areas.

Occupational therapists reported using a variety of interventions to enable each activity. The most commonly used interventions were neuromuscular interventions, especially balance training, postural awareness, and motor learning; however, adaptive approaches, such as teaching one-handed skills for ADL tasks, were also reported frequently. The therapists were clearly selective in the interventions that they chose to use with each activity, because there was variation in the interventions that were used in each activity. For example, whereas strengthening was used overall in 31.5% of sessions, it was used in more than half (53.7%) of upper-extremity activity sessions but in less than 1/5 (17%) of bathing activities. The frequencies for environmental adaptations and use of adaptive equipment also varied by activity, with certain activities (e.g., bathing and toileting) having much higher frequencies than others. These differences likely reflect differences in the movement demands of these important hygiene activities, and the extent to which commonly available adaptive equipment such as shower stools may be needed to enable early, safe participation in the activities.

There are few current evidence-based guidelines for the provision of intervention to persons with stroke. The Agency for Health Care Policy and Research Guidelines for Post-Stroke Rehabilitation (Gresham et al., 1995) are now outdated and the agency cautions that they should no longer be viewed as guidance for current practice. The most recent update of the National Clinical Guidelines for Stroke published in the United Kingdom (Royal College of Physicians, 2004) includes the general guideline that “Emerging evidence is showing advantages of a task-specific training or practice approach over impairment focused approaches. Giving clients the opportunity to practice tasks is a major element in improved outcomes” (p. 9). Evidence that supports this general guideline has been presented in two syntheses by Trombly and Ma (Ma & Trombly, 2002; Trombly & Ma, 2002). These authors also present more specific guidelines regarding the conditions under which particular approaches appear to improve outcomes (e.g., that practicing movements with specific goals appears to result in more normalized movement trajectories). However, there is also evidence that some interventions that target body structure and function impairments also contribute to improved rehabilitation outcomes post-stroke. For example, the Royal College of Physicians (2002) guidelines suggest that emerging evidence supports the use of resisted exercise to improve motor function, which suggests that a combination of approaches may lead to successful outcomes.

Given these recommendations, it is perhaps noteworthy that a large proportion of occupational therapy time was spent at the body structure and function impairment or performance skill level, and 16% of sessions involved only upper-extremity-control activities. These activities target remediation of performance skill deficits and client factors (American Occupational Therapy Association, 2002). A variety of interventions appear to be used in these activities, including balance training (44.5%), motor learning (42.6%), and strengthening (31.5%). Overall, the findings suggest a shift away from neurofacilitation techniques advocated in the 1960s toward more application of motor control and motor learning approaches. Therapists reported using Brunnstrom techniques (Brunnstrom, 1970) in fewer
than 2% of sessions, and the percent of sessions in which proprioceptive neuromuscular facilitation (PNF) techniques were used was also low. However, NDT was reported more frequently, with a maximum of 28.6% in bed mobility sessions. A recent analysis of physical therapy intervention with this same sample noted a similar shift in intervention patterns away from facilitation techniques toward application of motor control and motor learning approaches in the context of functional activities (Jette et al., in press).

Both cognitive therapy and perceptual training were reported as being used with high frequency during many of the ADL. In the data collection protocol, cognitive therapy is defined as including “impulse control, attention, orientation, memory, problem solving, sequencing, social skills, safety, insight, and goal setting,” whereas perceptual training includes “interventions to address apraxia, neglect, awareness in space, figure ground, and care of sensory impaired body parts” (full definitions are available from the first author of this study). Both of these categories contain a diverse range of approaches, some of which have more supportive evidence than others. Trombly and Ma recommend cognitive approaches such as structured instruction and feedback to improve activity performance (Ma & Trombly, 2002; Trombly & Ma, 2002). Some evidence also supports interventions that involve forced awareness of neglected space (in persons with unilateral neglect), which may be included in the “perceptual training” category. One limitation of the present study is that we cannot determine more precisely how the reported interventions were applied and the extent to which the applications were consistent with emerging evidence in this area. This applications research would be a valuable area for further investigation.

As recommended by current occupational therapy practice guidelines, client education was a significant intervention component for all activities. As might be expected, this category was the most frequent intervention for sessions that were addressing community integration. Caregiver education was a less frequent intervention for most activities, which is likely explained by the fact that families were not present during the majority of sessions. Nonetheless, caregiver education was a feature of almost 20% of sessions that addressed community integration. Thus, it appears that practitioners are actively engaging both the client and family when discharge with return to community is the focus of treatment. On the downside, only 5% of sessions addressed either community integration or leisure performance. The paucity of time spent in community integration or leisure performance is unfortunate because many persons with stroke have significant restriction in activities after discharge (Corr & Bayer, 1992) and activity restriction has been shown to be highly related to depression (Nieboer et al., 1998; Williamson, 2000; Williamson & Schulz, 1992). Button (2000) found that patients considered that the real rehabilitation was the translation of learning from the rehabilitation context to the home and community context.

Although this study provides an initial description of actual occupational therapy practice for persons with stroke, it is important to note several limitations. Most important, we did not have specific information about each client's pattern of impairments, and thus were unable to link the choice of specific interventions to the client's unique profile of difficulties. Thus, we were not able to examine variations in practice for persons with similar impairment profiles. This study also summarized the activities for all clients across their entire therapy episode. Future analyses might explore whether clients with greater functional abilities or clients who were preparing for discharge participated in more advanced activities.

Although the therapists who provided data for this study were trained in the use of data collection forms, and written definitions were provided in the training manual, no specific test of reporting reliability was conducted. Thus, there may have been some degree of misclassification of interventions and activities. However, given the large number of participants and sessions, we do not expect these random errors to have had a large effect on the results.

This study provided a broad sketch of current occupational therapy practice for persons with stroke. It suggests an initial framework to describe intervention techniques and activities, from which more refined descriptions may be developed. Without such work to characterize the actual processes of occupational therapy, it will be difficult to conduct more precise examinations of the effectiveness of our services. Such studies are needed in order to identify the specific elements or approaches that lead to better outcomes for persons with stroke.

**Conclusion**

Occupational therapy provided to clients with stroke at inpatient rehabilitation facilities reflected an integration of multiple treatment approaches to facilitate performance of daily activities. The greatest emphasis was on increasing upper-extremity control and improving performance of basic ADL. Most occupational therapy was provided on an individual basis, for an average duration of about 40 min per session, across an average hospital stay of less than 3 weeks. A small proportion of therapy time was spent on leisure and community integration, suggesting the need for occupational therapy services after discharge that address these activities.
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