Objective. The purpose of this study was to evaluate students' perceptions of the extent to which faculty-generated learning objectives were addressed in a problem-based learning (PBL) course.

Method. Twenty-seven students enrolled in a 12-week PBL course were randomly divided by age, gender, and grade point average into four tutorial groups. Each group rated on a 10-cm visual analog scale their perceptions of how well they believed the objectives for each of four cases were addressed. Repeated-measures analysis of variance was used to test the average differences among the tutorial groups for each case. Further, post hoc tests were performed to compare the means among groups for each objective.

Results. No significant differences were found in the average perceptions among the tutorial groups for any of the four cases. Student ratings indicated their overall perception that within each problem, preset objectives had been met.

Conclusion. The results support that students' interpretations of learning objectives for PBL cases are consistent with the problem developers' intended learning objectives. In addition, the similarities in the average scores for learning objectives across the four tutorial groups support the notion that PBL outcomes can be consistent among students, even though their study and discussions are in separate groups with different facilitators.


Occupational therapists have identified a need for the development of innovative and more relevant methods of instruction to better prepare graduates for the complexities of practice and a rapidly changing health care environment (MacKinnon, 1987; Schwartz, 1991). Specifically, occupational therapy clinicians and educators are emphasizing the need for courses that encourage problem solving, clinical reasoning, and synthesis of information across traditional discipline-specific boundaries to enhance graduates' preparation for the complexities of practice. Too often, however, courses or instructional components are developed and institutionalized without detailed and systematic reviews of the influence on the educational outcomes associated with the method of instruction.

Problem-based learning (PBL) and case-based methods are becoming increasingly popular in occupational therapy education. Although several articles have been published recently that speak to general impressions of these methods (Royeen, 1995; VanLeit, 1995; Watson & West, 1996) and overall curriculum design (Royeen & Salvatori, 1997), the only published research about PBL in
occupational therapy appears to be descriptions of student perceptions of their experiences with this method (Hammel et al., 1999; Sadlo, 1997; Stern 1997). More published research about outcomes of PBL in occupational therapy is needed (Vroman & MacRae 1999), specifically research about the effectiveness of the problems, which is the major vehicle for this instructional method.

Problems, or cases (terms used interchangeably in the literature), are the cornerstone of PBL. They provide the substance and content for tutorial sessions and influence the students’ paths of self-directed learning. Effective problems promote students’ inquiry and research that responds to the goals for the learning experience. Typically, as faculty members design sample problems to be used in teaching, they also identify learning objectives to be satisfied by the problem or outcomes that will be achieved. During small group PBL tutorial sessions, students uncover the content relevant to a particular problem. Thus, problems must be constructed and objectives determined in a way that facilitates their achieving the intended learning outcomes (Dolmans, Snellen-Balendong, Wolthagen, & Van Der Vluten, 1997).

PBL tutorial sessions typically are organized according to a 7-step format whereby students read the beginning of a problem aloud, identify and clarify unfamiliar terms, brainstorm questions, derive learning objectives from the questions, pursue between-session study, return to the tutorial with new information, and reevaluate the status of their knowledge (Schmidt, 1984). Because of the student-centered nature of the PBL process, some critics express concern that students may not address essential learning objectives in a PBL course or curriculum, with significant and irreparable differences between intended and actual learning outcomes. Another concern is the potential for unequal distribution of content across tutorial groups that could result in students receiving disparate education within an individual course.

Limited research pertains to the issue of problem effectiveness within PBL courses in medical school curricula. The effectiveness of problems has usually been evaluated in terms of the consistency between student-generated learning “issues” and faculty-determined learning “objectives.” In an instructor-centered course, the instructor determines and communicates the major content areas, usually as course or class session objectives, from the onset. In a student-centered PBL course, the content areas are established by the instructor, but they are left for the students to uncover or discover through tutorial group discussions. Students determine their group’s learning issues through the brainstorming and discussion steps that are hallmarks of PBL tutorials.

Coulson and Osborne (1984) were among the first to examine problem effectiveness within a PBL course. In their study, three independent raters collected and evaluated the student learning issues identified within the PBL groups. The raters compared the learning issues with a faculty-generated master list of objectives. Coulson and Osborne found that each tutorial group covered, on average, 61% of the essential learning objectives, but to achieve 100% agreement, the identified learning issues had to be pooled among tutorial groups.

Shahabudin (1987) compared student learning issues in a PBL course with faculty-generated learning objectives contained in a tutor guide. Tutorial groups listed all learning issues that arose from class discussion. These learning issues were then compiled into a smaller set of more general objectives that were compared with the faculty’s list of objectives to be covered by the tutorial groups. Shahabudin found general consistency between student-generated and faculty-determined learning objectives.

Dolmans, Gijselaers, Schmidt, and Van De Meer (1993) analyzed the relationship between preset faculty objectives and student-centered learning issues. One hundred twenty second-year medical students were randomly assigned to 12 tutorial groups. Each tutorial group generated learning issues for 12 cases in a 6-week course module on normal pregnancy and delivery. The findings indicated that 64% of faculty objectives were matched by all the tutorial groups. Only 15% of the faculty-designed objectives were not matched by any of the groups. The students also cited additional learning issues that were not included in the faculty-designed objectives. Faculty raters judged the “unexpected” learning issues as relevant and worthwhile and found that they tended to be related to prior knowledge deficiencies or clinical topics. They also reflected students’ personal interests and experiences in the subject matter.

Mpofu, Das, Murdoch, and Lanphear (1997) also examined whether students could comprehensively identify learning objectives, given a problem, that matched the objectives identified by the faculty. They looked at the congruency between the faculty-designed and student-generated learning objectives in an introduction to medicine course and reviewed unexpected learning objectives raised by students. Four tutorial groups consisting of 8 to 10 students per group met for 16 hours over 4 weeks. The learning objectives from each session were collected from all groups and given to “experts” in the content area. The experts, who were not involved as facilitators, used a 3-point scale to assess the extent to which the student learning objectives for each content area strongly, moderately, or slightly related to the faculty objectives. Also assessed was a fourth category of “no relationship” to content area objectives. The no-relationship issues were rated to determine whether they were irrelevant, neutral, or relevant to the content area objectives. Mpofu et al. found that the degree of congruency between student learning objectives and faculty objectives varied from 55% to 100% among the four groups.

The purpose of the present study was to evaluate the congruency between intended and actual learning outcomes
in a PBL course. Specifically, we wanted to determine the extent to which students viewed the learning outcomes of their tutorial group as consistent with learning objectives that faculty had developed for each of four PBL problems. Additionally, we sought to determine the consistency of students’ identified learning outcomes across four PBL tutorial groups and whether the tutorial groups were similar in their perceptions of learning outcomes.

**Method**

Occupational Performance Approaches is a 3-credit integrative course that is offered for 12 weeks during a summer term at Duquesne University’s occupational therapy program. The course is designed to provide students with opportunities to synthesize content across the curriculum, as this is one of the last courses the students complete before beginning their Level II fieldwork. This course consists of two 2-hr lectures and one 2-hr PBL tutorial session per week.

**Participants**

In the summer of 1998, 27 students were enrolled in the course. The students were randomly assigned by age, gender, and grade point average (GPA) to one of four tutorial groups. Each tutorial group was facilitated by an area clinician trained in leading PBL tutorials. Three of the tutors had led PBL tutorials for this course in 1997, and the other was new to this course but had led PBL tutorials at another institution. The principal investigator oriented students to PBL and the tutorial process before their first meeting with their tutors. Each group consisted of the same tutor and the same students throughout the course and research project.

For this study, relevant patient situations from acute care and rehabilitation settings were developed to represent various medical conditions, occupational performance issues, and approaches to intervention. Specific content and format varied from case to case. For example, some cases included information that would be available in a patient’s medical chart; some included an occupational therapy assessment that had been initiated but not completed; and others consisted of a brief description of symptoms or functional limitations. The case developers were the principal investigator and three other occupational therapists, all of whom had at least 2 years of experience writing cases or leading PBL tutorials.

**Procedure**

Two weeks before the course, tutors received an instructor’s packet of the five cases to be used in the course. Each case included an overall case description, a set of learning objectives, and the case content (see Appendix). Tutors were advised to review the cases and ask questions about the content, format, or objectives for each case.

All four tutorial groups worked on the same first case (pilot) simultaneously to help the students become familiar with the PBL process. The remaining four were research cases and used in the analysis for this study. All tutorial groups ultimately studied the same four research cases, but because of the potential for students from different tutorial groups to discuss the cases outside of the tutorial sessions, each group studied the cases in a different order. Each tutorial group completed all five cases during the 12-week term, spending 2 to 3 weeks per case.

In this study, problem effectiveness was measured by students’ ratings of their perceptions of how well preset, faculty-determined case objectives were met in their tutorial group discussion. At the conclusion of each case, each student completed a case outcomes rating form (see Figure 1) to elicit their feedback regarding the case they had just studied. The form contained the list of objectives that had been established for that case.

<table>
<thead>
<tr>
<th>Respondent: ______________________________________</th>
<th>Tutor: ______________________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Case:</strong> Emily</td>
<td></td>
</tr>
<tr>
<td><strong>Please rate the following case objectives according to how well you feel they were addressed within your tutorial group according to the continuum below.</strong> Mark an “x” on the line to indicate your response.</td>
<td></td>
</tr>
<tr>
<td><strong>Objectives</strong></td>
<td></td>
</tr>
<tr>
<td>1. Discuss issues related to functional performance for an individual with this medical condition.</td>
<td>not addressed</td>
</tr>
<tr>
<td>2. Discuss the impact of functional performance deficits on an individual’s independence.</td>
<td>not addressed</td>
</tr>
<tr>
<td>3. Explore home modifications required for accessibility.</td>
<td>not addressed</td>
</tr>
<tr>
<td>4. Identify adaptive equipment needs for an individual with this medical condition.</td>
<td>not addressed</td>
</tr>
<tr>
<td>5. Discuss medical procedures associated with the primary diagnosis.</td>
<td>not addressed</td>
</tr>
<tr>
<td>6. Discuss issues related to family involvement in the patient’s rehabilitation.</td>
<td>not addressed</td>
</tr>
</tbody>
</table>

Comments: Please list any other learning objectives that you feel were addressed in your tutorial group.

Figure 1. Occupational Performance Approaches Case Outcomes Rating Form.
Each student rated on a 10-cm visual analog scale (VAS) of not addressed to completely addressed how well he or she believed each objective was addressed through discussion within his or her tutorial group. The students were instructed through verbal and written directions to mark an x directly on the line to indicate their rating for the objective (see Figure 1). There were a total of 27 learning objectives across the four cases, and the number of learning objectives was different for each case (i.e., Case A = 8, Case B = 6, Case C = 7, Case D = 6).

Students submitted their case outcomes rating form to a research assistant who confirmed on a separate list that the form was submitted and filled out completely. The students were not identified by name on the rating form. They were identified by a student number to ensure that forms were returned from each student for the duration of the course. One hundred thirty-four out of 135 forms (99.3%) were filled out completely and returned.

The research assistant organized the rating forms by tutorial group. At the conclusion of the course, the research assistant translated the rating from each learning objective into a numerical score by measuring the 10-cm VAS and recording the data in mm. The principal investigator did not have access to the data until the completion of the course.

Statistical Analysis

Initially, descriptive statistics were calculated to examine the distributions of the scores for each case. The distributions of these scores were symmetric, and no statistical adjustment was required. Next, one-way analysis of variance (ANOVA) was used to test whether the averages were the same among the four tutorial groups for age and GPA (essentially testing the randomization process). The chi-square test was used to compare the percentage of women across the groups. These tests showed no significant differences among groups with respect to age, gender, and GPA.

The general approach for repeated-measures ANOVA (Kleinbaum, Kupper, Muller, & Nizam, 1998) was performed for each case, the repeated measure being the students’ responses on the VAS to each objective within each case. This approach allowed us to test the mean differences among the four groups as well as the mean differences among the various objectives for each case. Fisher’s least significant difference method (Dowdy & Wearden, 1991) of multiple comparisons was used as a post hoc test to compare the groups within the objectives. Tables 1 to 4 show the mean perception ratings for each objective for each tutorial group. All analyses were done using SAS PROC (SAS Institute, 1992), and significance was set at .05.

Results

Case A involved a child with cerebral palsy, and contained 8 learning objectives. The learning objectives for this case related to the following:

1. Medical complications associated with cerebral palsy
2. Functional performance issues
3. Medical options for managing spasticity
4. Orthopedic management of secondary conditions related to cerebral palsy
5. Education of children with disabilities
6. The occupational therapists’ role in school system practice
7. Comparison and contrast of the roles of various health care professionals
8. Occupational performance approaches that could guide one’s practice

No significant difference was found among groups on overall mean ratings for Case A (see Table 1).

Significant differences in group ratings were noted only for learning objective 8, which read: “Identify at least two occupational performance approaches that could guide one’s approach toward this case.” The differences occurred between Groups 2 and 4 and between Groups 1 and 4, with Groups 1 and 2 indicating stronger ratings for that objective.

Ratings for learning objective 4, “Discuss at least two strategies for the orthopedic management of secondary problems related to cerebral palsy,” were lower than for other objectives in this case, and these ratings were consistent among the four tutorial groups. This consistently low rating indicates that the students across the tutorial groups believed that the objective was not adequately addressed within their discussions.

Case B involved a young man who had sustained a spinal cord injury in a fall. The six learning objectives in this case related to the following:

1. Sensory and motor impairments associated with spinal cord injury
2. The impact of impairment on functional performance
3. The occupational therapists’ role
4. The concept of role change
5. Opportunities for family intervention
6. The occupational therapist as a legal witness

Table 1

<table>
<thead>
<tr>
<th>Group</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8*</th>
<th>Overall M</th>
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<td>1</td>
<td>90.3</td>
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<td>75.7</td>
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<td>80.4</td>
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<tr>
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<td>80.8</td>
<td>83.8</td>
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</tr>
<tr>
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<td>81.2</td>
<td>88.6</td>
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<td>87.6</td>
<td>82.1</td>
<td>45.3</td>
<td>77.9</td>
</tr>
</tbody>
</table>

*For this objective, at minimum, the difference between the largest and smallest mean rating is significant (Fisher’s least significant difference).
Results yielded significant differences among the groups for learning objectives 4 and 6. No significant difference was found among groups on overall mean ratings for Case B (see Table 2).

Groups 2 and 4 differed on learning objective 4, “Discuss the concept of role change as it relates to this case”; Group 2 indicated less agreement that this objective had been met. On learning objective 6, “Discuss potential role for occupational therapy as an expert witness in a legal situation,” Groups 2 and 3 showed significantly stronger ratings that the objective had been met within their tutorial discussion than did Groups 1 and 4.

Case C involved issues of determining competency and guardianship for an older woman with Alzheimer’s disease. Seven learning objectives had been identified for this case and related to the following:

1. Methods of assessment
2. Ethical dilemmas
3. Role and function of various occupational therapy personnel
4. Possible intervention strategies
5. Exploring community resources
6. Competency and guardianship
7. Administrative functions of an occupational therapist

Although no significant difference was found among the groups on overall mean ratings, significant differences were found on three learning objectives. Group 3 reflected the most differences from the other groups (see Table 3).

Differences were noted between Group 3 and each of the other groups for learning objective 1, “Identify appropriate methods for assessing an individual’s potential for independent living, given the setting.” Groups 1, 2, and 4 indicated that the objective had been met within their discussion, whereas Group 3 showed significantly weaker ratings. Group 3 also differed from Group 2 on learning objective 2, “Identify ethical dilemmas in collaborative intervention planning.” For learning objective 6, “Describe the issues of determining competency and/or guardianship,” differences were noted between Groups 3 and 4 and between Groups 3 and 2. Why Group 3 differed so much from the other groups on this case is not clear. It is important to note the consistency of ratings among the other three tutorial groups because the differences in Group 3 may reflect difficulties that particular group had with this case rather than flaws in how the case and its intended objectives were written.

Case D involved a middle-aged woman who was recovering from a cerebrovascular accident. The following six learning objectives had been identified for this case:

1. Issues related to functional performance
2. The impact of functional performance deficits on independence
3. Potential home modifications
4. Adaptive equipment
5. Medical procedures associated with the primary diagnosis
6. Family involvement

No significant difference was found among the groups on overall mean ratings for Case D (see Table 4).

Within this case, significant differences were noted among the groups on two of the six objectives. Group 4 differed from the other groups on learning objective 3, “Explore home modifications required for accessibility,” and learning objective 4, “Identify adaptive equipment needs for an individual with this medical condition.” Group 4 did not believe that the home modification and adaptive equipment issues were addressed as well as the other three groups had believed.

Discussion

Overall, several important findings emerged. First, no significant differences were found in average ratings among the four groups on the preset learning objectives for each case. For each of the four cases, the students’ perceptions of their learning outcomes were highly consistent with the faculty’s intended learning objectives (see overall group means in Tables 1–4). This consistency indicates that although the students were working in four separate groups with four different tutors, each group covered essentially the same content. This finding is particularly encouraging because it provides the first data in occupational therapy education that addresses PBL critics’ concerns that students may receive disparate education in these courses.

For each case, the few differences that occurred among the tutorial groups were minimal, and when differences did occur, they usually occurred between two groups, not among all four. Additionally, no one group appeared to always differ from the others. These positive outcomes indicate that the perceived differences in case outcomes were minimal and randomly scattered among groups. Given the student-centered, student-directed nature of PBL tutorial sessions, some minor variation among groups is to be expected. However, it is still important to attempt to reduce differences among groups to try to ensure that all students achieve the essential objectives.

Of note, the similarity among the groups sometimes meant that the students perceived an objective to be “less well met.” We still view this finding as a positive outcome because it indicates, nonetheless, similar perceptions among groups. Why an objective had a lower score is unclear but could reflect weaknesses in case design, tutors’
knowledge about isolated areas of case content, that particular group discussion, or chance. This finding is important because it may reflect a need for the tutors to receive additional information regarding case content to guide discussion more effectively.

Certain objectives reflected a substantial difference in scores: Case A, objective 8; Case B, objectives 4 and 6; Case C, objectives 1, 2, and 6; and Case D, objectives 3 and 4 (see Tables 1–4). A wide range of scores within a specific objective usually produced significant differences among the groups for that objective. Further, some objectives with a very narrow range of scores were rated by the students as essentially not met, for example, Case C, objective 4 (possible intervention strategies). Because as many as eight objectives were listed for a single case, it is possible that for any of the cases, one or more of the intended objectives was not realistic, given the scope of discussion and time frame for the tutorials.

Limitations

It is possible that students rated objectives highly or as having been met out of a desire to please the instructor. Students knew the cases were part of a research project, which may have influenced their ratings. However, the students were also aware that the instructor would not have access to the data until the end of the course after their grades had been submitted, which helped to minimize the "desire to please" limitation. Additionally, the number of students in each group was small. However, PBL tutorials are supposed to have small numbers of students in each group. Still, the overall mean ratings for each case (see Tables 1–4) are very similar. Although a greater number of students in each group might provide significant differences among the groups for that objective. Further, some objectives with a very narrow range of scores were rated by the students as essentially not met, for example, Case C, objective 4 (possible intervention strategies). Because as many as eight objectives were listed for a single case, it is possible that for any of the cases, one or more of the intended objectives was not realistic, given the scope of discussion and time frame for the tutorials.

Subsequent studies related to determining problem effectiveness should include control objectives to determine whether students discriminate among objectives that are and are not relevant to a case. Listing the objectives for all the cases on one rating form and having students select or identify the specific objectives intended for each case would strengthen this measure. These designs would reflect strategies that would determine students’ abilities to discriminate between relevant and not-relevant objectives.

Cases designed so that objectives would be linked according to major content areas across cases would enable researchers to study differences in overall content areas and would be useful in courses that had a more narrow scope of content. Finally, it would be important to assess problem effectiveness by comparing student ratings with tutor ratings of objectives. Each study reflects a variation on the overall theme of determining learning outcomes.

We have recently completed data collection for a follow-up to this study. Data were collected from students in five tutorial groups. Three groups included students from Duquesne’s “traditional” occupational therapy program as described here. Two included students from Duquesne’s "weekend” occupational therapy program. The weekend program is geared to adult, career-change students, and the curriculum is organized along an accelerated format in which students take courses in 8-week terms. Although the course content and case discussions are intended to be the same for both programs, we are interested to see whether

Table 3
Mean Ratings for Case C by Objective

<table>
<thead>
<tr>
<th>Group</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>Overall M</th>
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</tbody>
</table>

*For this objective, at minimum, the difference between the largest and smallest mean rating is significant (Fisher’s least significant difference).

Table 4
Mean Ratings for Case D by Objective

<table>
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<tr>
<th>Objective</th>
<th>Group</th>
<th>1</th>
<th>2</th>
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<th>4*</th>
<th>5</th>
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</table>

*For this objective, at minimum, the difference between the largest and smallest mean rating is significant (Fisher’s least significant difference).
students from the two different programs perceived the case outcomes similarly.

**Conclusion**

Because PBL is being implemented more and more within occupational therapy education, it is essential that curriculum and course planners pay close attention to the construction of problems and outcomes of their use because these problems represent the central content piece of PBL courses. This study provides encouraging and unique information about intended and actual learning outcomes in an occupational therapy PBL course. Research about problem effectiveness is slowly emerging in medical education. This study reflects the first of its kind in occupational therapy education. The results may help occupational therapy faculty to decide whether, or to what extent, to use PBL and can contribute to the design of more effective course materials. ▲

**Acknowledgments**

We thank Candace Hawthorne, MS, OTR, Audrey Heberle, MS, OTR, Nancy Mott, OTR, David Sadowski, MS, OTR, and the Duquesne University occupational therapy class of 1999 for their participation in this project.

**Appendix A**

Sample Case D, “Emily” (Written by David Sadowski, MS, OTR)

**Description**

This case is intended to generate discussion regarding the continuum of care from acute care to home services. Case discussion can be used to introduce changing family roles, family involvement, home modifications, accessibility issues, equipment, and positioning needs.

**Suggested Learning Objectives**

Upon completion of this case, students will:

- Discuss issues related to functional performance for a person with this medical condition.
- Discuss the impact of functional performance deficits on a person’s independence.
- Explore home modifications required for accessibility.
- Identify adaptive equipment needs for a person with this medical condition.
- Discuss medical procedures associated with the primary diagnosis.
- Discuss issues related to family involvement in the patient’s rehabilitation.

**Case: Emily**

Emily is a 43-year-old woman who was previously in a good state of health up until a few weeks ago before her hospital admission. She had not been feeling well for the past few weeks, with upper respiratory symptoms for which she took antibiotics. Gradually, she developed severe headaches that eventually led her to lose consciousness one morning. She was taken to a local hospital where a CAT [computetd tomography] scan revealed a large left frontal hemorrhage. Other tests revealed a bilateral occipital infarction and a right cerebellar infarction. An emergency craniotomy was completed to evacuate the frontal hemorrhage. Postoperatively, Emily required a tracheotomy and eventual PEG [percutaneous endoscopic gastrostomy] tube placement.

Emily lives at home with her husband in a three-story house. She has three children; the youngest is in junior high school. A home assessment notes her bathroom and bedroom on the second floor. Her medical history is nonsignificant, other than she smokes one pack of cigarettes a day.

Emily is oriented to person only. Her eyes are open; however, she is somewhat lethargic. Emily will respond with a head nod for yes or no, but she is inconsistent. She is expressive aphasic with passy muir valve in place. She has been weaned off the ventilator and is on a trach mask.

Neuromuscular status:

- BUE [both upper extremities]: WFL [within functional limits]
- No active range of motion noted except for her left hand, which moves nonpurposefully
- Tone: Diffuse rigidity throughout upper extremities and neck
- Contractures: None noted

Activities of daily living: Dependent

Mobility: Dependent

Miscellaneous: Requires frequent suctioning

Emily’s rigidity fluctuates depending on the time of day, intensity of treatment, and her anxiety level. She wears bilateral resting hand splints 2 hr on, 2 hr off, and on all night and bilateral elbow extension the opposite times.

Emily’s static sitting balance is poor. She exhibits thoracic kyphosis, and she has no tone in her trunk.

The family’s goal is to take Emily home.

**References**


