Teaching Evidence-Based Practice Using the American Academy of Cerebral Palsy and Developmental Medicine Methodology

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Evidence-based practitioners are expected to conduct evaluations and provide interventions that are both effective and cost-efficient. To help students achieve this goal by the time of graduation, educational programs in occupational therapy provide as many learning experiences as possible for gaining technical skills in performing evaluations and interventions on clients with real needs. However, technical skills alone do not equip the beginning therapist with the ability to deliver effective services. The health care community, including consumers and reimbursement agencies, expects therapists to know not only how to provide the intervention, but also the likelihood of its effectiveness. That is, the therapist must ask the following question: What evidence exists to show that a given intervention will work for a given client with unique needs and symptoms? When therapists have taken the time to investigate the scientific literature examining the effectiveness of an intervention and use this information along with the client's perspective to guide their clinical decisions, they greatly enhance the likelihood of providing effective services. This process is referred to as evidence-based practice (Sackett, Straus, Richardson, Rosenberg, & Haynes, 2000).

Being an evidence-based practitioner is no small achievement for new graduates. A number of barriers may prevent clinicians from using the research evidence intended for them, including limited time and limited access to resources in many work environments (Law & Baum, 1998). A more important constraint may be a limited understanding of how to appraise research articles critically and draw reasonable conclusions about clients on the basis of the research evidence. Hence, how can faculty in occupational therapy programs help prepare students to provide evidence-based occupational therapy?

Although many means exist to achieve this end, generally, entry-level therapists must acquire attitudes, knowledge, and skills that will aid in efficiently making use of the research evidence for guiding clinical decisions. The Accreditation Council for Occupational Therapy Education (ACOTE) adopted several standards for entry-level occupational therapists, which can be summarized as follows: (a) valuing the role of research as a foundation for practice and development of the profession, (b) understanding basic statistics and research methods, and (c) becoming skilled at accessing and consuming research evidence in the scientific literature.

The aim of this article is to describe the American Academy of Cerebral Palsy and Developmental Medicine (AACPDM) methodology for generating evidence about interventions used by occupational therapists or related rehabilitation professionals. This methodology is well suited for helping students develop the attitudes, knowledge, and skills set forth in the Standards for an Accredited Educational Program for the Occupational Therapist (ACOTE, 1999).

AACPDM Methodology

The Treatment Outcomes Committee of the AACPDM developed a procedures manual titled AACPDM Methodology for Developing Evidence Tables and Reviewing Treatment Outcome Research (Butler, 1999). The goal of this document was to organize and provide a systematic format for presenting evidence on interventions in developmental medicine. The end-product is a summary of the research evidence on a given intervention in narrative and table format. The evidence tables afford an efficient way to display a great deal of information about the findings from a review of several research articles.

The AACPDM methodology includes 12 steps toward completing evidence tables. To demonstrate this process, the intervention of constraint-induced movement therapy (CIMT) is used herein as an example. This topic was used recently with a group of students enrolled in the Research Seminar II course at Concordia University in Wisconsin. It was selected because a preliminary examination of the literature revealed a reasonable number of research studies (i.e., 7–8), and the topic had relevance to the students as future clinicians. The intent of using an intervention example here is for demonstration of the methodology and not as an exhaustive review of all the literature examining the effectiveness of CIMT intervention. Twelve steps are recommended in the AACPDM methodology; however, only the first 10 are presented here. The last 2—writing a
narrative summary and submitting for publication—are not included because of space limitations.

**Step 1: Define the Intervention**
CIMT intervention has been used to improve control and coordination of the upper limb in persons with hemiplegia secondary to stroke or traumatic brain injury (TBI) (Kunkel et al., 1999; Taub & Uswatte, 1999). This intervention essentially involves constraining the use of the unaffected upper extremity with a sling or splint while eliciting a massed practice of the affected upper extremity (Taub & Uswatte, 1999). Interventions typically involve a 2-week period, with the sling or splint worn 90% of the waking hours and some form of guided practice in the use of the affected upper extremity. Other authors have referred to this technique as forced use (van der Lee et al., 1999; Wolf, Lecraw, Barton, & Jann, 1989). Studies that used either CIMT or forced use as defined here were included in the review.

**Step 2: Define the Population for Whom the Intervention Will Be Reviewed**
Participant characteristics, such as diagnosed condition, age, and number of years since stroke onset, were defined in advance to aid in narrowing the search. Only those studies with participant characteristics of upper-extremity hemiplegia secondary to stroke were included (one study had a small number of participants with TBI in addition to the participants with stroke). No studies with children as participants were included.

**Step 3: Identify and Record Sources To Be Used in This Search**
Sources used to identify research articles included automated databases (e.g., Cumulative Index to Nursing and Allied Health Literature, MEDLINE), online library searching systems, and citations from bibliographies in texts or reference lists from articles.

**Step 4: Keep a Record of the Search Process and Report It**
The review of literature yielded 11 articles from 7 different scientific journals. Most were located via electronic sources.

**Step 5: Select Relevant Studies**
Of the 11 research articles located, 3 focused on pediatric populations and, therefore, were not included. One review article on CIMT included 91 references (Taub & Uswatte, 1999), but it was not a research study and, therefore, not included. Seven studies examined the effectiveness of CIMT for persons with hemiplegia secondary to stroke.

**Step 6: Extract and Record Data From Each Study**
To characterize each study separately, the type of CIMT intervention used, participant characteristics, sample size, and age were recorded in Table 1. While summarizing information from each study, two important factors were identified. First, all the studies selected used similar methods for the CIMT intervention (i.e., approximately 2 weeks in length, use of a sling or splint, additional training to the affected upper extremity). Often, the same intervention is applied inconsistent-ly across studies, making interpretation of findings difficult because variability in success could be accounted for by variability in its application. Second, most of the studies recruited participants who experienced their stroke more than 1 year and, in some cases, several years earlier. It is likely that the authors targeted this population because they were attempting to control for the spontaneous recovery factor (see Table 1).

**Step 7: Code Each Measured Anecdotal Treatment Outcome for the Dimension of Disability It Represents**
In the far right column of Table 2, the heading “Dimension” reflects the dimension of the disability framework at which the outcome is measured. The AACPDM developed a five-level disability framework that is based on the ICIDH-2 (International Classification of Functioning, Disability, and Health), NCMRR (National Center for Medical Rehabilitation Research) (National Institutes of Health, 1993), and Nāgī disability models (Nāgī, 1991). These levels are pathophysiology, impairment, functional limitation, disability, and societal limitation. Coding outcomes by level of disability is not necessarily easy or obvious for all outcome measures. The AACPDM methodology devotes significant discussion with examples to provide reviewers insight into the dimensions of the disability the intervention may or may not be effective at remediating. On examination of Table 2, most outcome measures for the studies examining CIMT were coded at the impairment or functional limitation dimensions.

**Steps 8 and 9: Code Each Study for Level of Evidence It Represents and Create a Summary Table of the Studies**
The idea of level of evidence suggests that not all studies are created equally in terms of both their design and the rigor with which attempts at control were made (i.e., internal validity). The AACPDM uses a five-level system of grading the believability or strength of the evidence from an article. These levels in order of strongest to weakest are Level I, randomized controlled trial; Level II, nonrandomized controlled trial; Level III, case-control study; Level IV, case series without control group; and Level V, case reports, anecdotes, and expert opinion. The AACPDM methodology procedure manual discusses in detail how to determine level of evidence for group and single-subject designs. For example, the experimental design of Miltner, Bauder, Sommer, Dettmers, and Taub (1999) included a single group of participants tested before, during, and after intervention. The study was graded as a Level IV because it was a case series without control group. Moreover, work sheets provided in the procedure manual prompt the reader with questions to consider for determining the internal validity of the article. For each type of research design, the AACPDM methodology suggests that a study’s rating be decreased by one level if the authors did not control important factors leading to alternative explanations.

The remaining pieces of information in Table 2 include the results, or a face value subjective judgment of the findings, which are coded as improvement (+), worsening (–), or no change (?); the clinical importance, or a subjective judgment of whether the effects of treatment are large enough to be clinically important (not based on effect size calculations); and results of inferential statistics, if available. From Table 2, it is evident that for most of the outcomes measured, the group who received CIMT performed better than the control group (in the case of studies with no control group, the posi-
Table 1
Type of CIMT Intervention, Participant Characteristics, and Sample Size by Study

<table>
<thead>
<tr>
<th>Study</th>
<th>CIMT Intervention</th>
<th>Participant Characteristics</th>
<th>n</th>
<th>Age (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>van der Lee et al. (1999)</td>
<td>CIMT for 2 weeks; splint and sling; additional training to affected UE</td>
<td>Minimum of 1 year poststroke; active hand–wrist movement; ambulatory; no severe aphasia or cognitive impairment</td>
<td>66</td>
<td>Range = 18–80</td>
</tr>
<tr>
<td>Taub et al. (1993)</td>
<td>CIMT for 2 weeks; sling for 90% of waking hours; additional training to affected UE</td>
<td>Mean years poststroke = 3.7; active hand–wrist movement; ambulatory; no serious cognitive deficit or severe spasticity; &lt; 75 years of age; right hand dominant only</td>
<td>9</td>
<td>Median = 64</td>
</tr>
<tr>
<td>Wolf et al. (1989)</td>
<td>CIMT for 2 weeks; sling for hand during waking hours; no additional training to affected UE</td>
<td>Minimum of 1 year poststroke or TBI; no communication or cognitive deficits; protective response present; good vision; active hand–wrist movement</td>
<td>21</td>
<td>Mean = 51</td>
</tr>
<tr>
<td>Miltner et al. (1999)</td>
<td>CIMT for 12 days; splint/sling for 90% of waking hours; additional training to affected UE</td>
<td>Mean years poststroke = 5; active hand–wrist movement; no severe balance problem; no serious cognitive or medical deficit; no severe spasticity</td>
<td>15</td>
<td>Mean = 54 (range = 33–73)</td>
</tr>
<tr>
<td>Kunkel et al. (1999)</td>
<td>CIMT for 2 weeks; splint and sling for 90% of waking hours; additional training to affected UE</td>
<td>Mean years poststroke = 7; no serious cognitive or communication deficits; lesion to primary sensory or motor cortex; active hand–wrist movement; &lt; 80 years of age; right hand dominant only</td>
<td>5</td>
<td>Median = 53 (range = 47–66)</td>
</tr>
<tr>
<td>Blanton and Wolf (1999)</td>
<td>CIMT for 2 weeks; hand mitt during most waking hours; additional training affected UE</td>
<td>Months poststroke = 4; active hand–wrist movement; no significant UE contractures; transfers independently with minimal balance problems; Years poststroke = 1.5; active UE movements present but dominated by synergies</td>
<td>1</td>
<td>61</td>
</tr>
<tr>
<td>Ostenendorf and Wolf (1981)</td>
<td>CIMT for 1 week; sling on during waking hours; no training to affected UE</td>
<td>Years poststroke = 1.5; active UE movements present but dominated by synergies</td>
<td>1</td>
<td>50</td>
</tr>
</tbody>
</table>

Note. CIMT = constraint-induced movement therapy; UE = upper extremity; TBI = traumatic brain injury.

tive results indicated an improvement from pretest to posttest, and in many cases, this difference was statistically significant. Moreover, in most cases, the results were considered not only statistically significant, but also clinically important.

Step 10: Create the Evidence Tables
Although Table 3 may not be easy to interpret at first glance, it provides several pieces of information about the evidence on CIMT after a quick look. The data on the left half refer to results after the 2-week intervention period, and the right half represents follow-up results at various times intervals. The +*, +, –, and ± column headings represent findings that are positive and significant, positive but not significant, negative, and no effect, respectively. The no effect heading implies that CIMT was no better than a control group or no change was found from pretest to posttest for a one-group design. To read Table 3, examine, for example, the outcome of upper-extremity motor function, an impairment dimension outcome. This cell shows two Level IV studies, one Level III study, and one Level II study that reported positive and significant findings for CIMT. Visual inspection of Table 3 reveals that the bulk of the studies have reported positive and significant findings. In addition, the right side of Table 3 shows that several studies performed follow-up measurements that also indicated positive findings for CIMT.

Discussion
After creating the evidence tables for CIMT, it was possible to make statements about (a) the levels of evidence for the studies reviewed, (b) the findings for this intervention (i.e., positive or otherwise), (c) the dimensions of the disability framework the majority of the outcomes targeted, and (d) whether the effects of the intervention were short term only or both short term and long term. Additionally, although no studies on the CIMT intervention reported negative effects, such as injuries, it was possible to develop a list of client characteristics on the basis of exclusion criteria from the reviewed studies for which this intervention might be contraindicated. For example, persons with balance problems, little to no active movement in the affected upper limb, or limited motivation may not be good candidates for this CIMT intervention.

The students involved in this project gained a deep understanding of CIMT intervention and the research evidence on its effectiveness. The process the students experienced while producing the evidence tables also was valuable for several reasons. First, the process afforded them the opportunity to practice and improve skills in accessing the scientific literature. Second, while reviewing several studies for level of evidence, students gained a deeper understanding of methodological design and statistical issues; that is, the students not only needed to read and understand each research study, but also had to appraise or judge the validity of the findings critically. Factors such as sample size, type of design, threats to internal validity, and appropriateness of statistical measures must be considered. Of these, threats to internal validity seemed to be the most
difficult for students to discern. Third, and perhaps most importantly, the AACPDM methodology provided a vehicle for students to learn about evidence-based practice that linked research and practice. When teaching research and clinical concepts separately, there is a risk that students will grasp ideas in both areas but never integrate them together. In this case, students do not fully grasp the importance and value of research for clinical practice. Learning about evidence-based practice via a methodology such as AACPDM’s provides the clinical meaning and purpose to using and doing research. A limitation of the AACPDM methodology, or any other systematic review, is that it is a time-consuming process. Expecting entry-level (or experienced) therapists to systematically review the entire body of literature on an intervention is unrealistic. However, entry-level therapists more likely will be reading research studies with specific clients in mind. If this process helps them access and use information from a single research study efficiently, the therapists will be bet-

### Table 2

<table>
<thead>
<tr>
<th>Study</th>
<th>LOE</th>
<th>Outcome</th>
<th>Measure</th>
<th>Results</th>
<th>Clinical Implications</th>
<th>Statistically Valid</th>
<th>Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>van der Lee et al.</td>
<td>I</td>
<td>Personal care</td>
<td>RAP</td>
<td>?</td>
<td>Yes</td>
<td>NSS</td>
<td>FL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hand dexterity</td>
<td>ARA</td>
<td>+</td>
<td>No</td>
<td>CI = 1.3–4.8</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>UE motor control</td>
<td>FMA</td>
<td>?</td>
<td>Yes</td>
<td>NSS</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Amount of use and quality of movement</td>
<td>MAL</td>
<td>+</td>
<td>Yes</td>
<td>CI = 0.11–0.93</td>
<td>FL</td>
</tr>
<tr>
<td>Taub et al. (1993)</td>
<td>II</td>
<td>UE motor function</td>
<td>EMFT</td>
<td>+</td>
<td>Yes</td>
<td>p &lt; 0.003</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ADL skill</td>
<td>AMAT</td>
<td>+</td>
<td>Yes</td>
<td>p &lt; 0.003</td>
<td>FL</td>
</tr>
<tr>
<td>Ostendorf and Wolf</td>
<td>III</td>
<td>Time and quality of movement in 18 tasks</td>
<td>Observations</td>
<td>?</td>
<td>No</td>
<td>No statistics</td>
<td>I</td>
</tr>
<tr>
<td>Wolf et al. (1989)</td>
<td></td>
<td>Speed and force used during 21 functional tasks</td>
<td>No formal assessment</td>
<td>+</td>
<td>Yes</td>
<td>p &lt; 0.05</td>
<td>FL</td>
</tr>
<tr>
<td>Miltnner et al. (1999)</td>
<td>IV</td>
<td>UE motor function</td>
<td>WMFT</td>
<td>+</td>
<td>Yes</td>
<td>No statistics</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Amount of use and quality of movement</td>
<td>MAL</td>
<td>+</td>
<td>Yes</td>
<td>p &lt; 0.05</td>
<td>I</td>
</tr>
<tr>
<td>Kunkel et al. (1999)</td>
<td>IV</td>
<td>Amount of use and quality of movement</td>
<td>AAUT; MAL</td>
<td>+</td>
<td>Yes</td>
<td>p &lt; 0.002; p &lt; 0.049</td>
<td>FL</td>
</tr>
<tr>
<td>Blanton and Wolf (1999)</td>
<td>V</td>
<td>UE motor function</td>
<td>WMFT</td>
<td>+</td>
<td>Yes</td>
<td>p &lt; 0.049</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ADL skill</td>
<td>AMAT</td>
<td>+</td>
<td>Yes</td>
<td>p &lt; 0.049</td>
<td>FL</td>
</tr>
</tbody>
</table>

Note: CIMT = constraint-induced movement therapy; LOE = level of evidence (I = randomized controlled trial, II = nonrandomized controlled trial, III = case-control study, IV = case series without control group, V = case reports, anecdotes, and expert opinion); UE = upper extremity; ADL = activities of daily living; AAUT = Actual Amount of Use Test (Taub, Crago, & Uswatte, 1998); AMAT = Arm Motor Ability Test (Kopp et al., 1997); ARA = Action Research Arm (Lyle, 1981); EMFT = Emory Motor Function Test (Wolf, Leccraw, Barton, & Jain, 1989); FMA = Fugl-Meyer Assessment (Fugl-Meyer, Jaasko, Leyman, Olsson, & Steglin, 1975); MAL = Motor Activity Log (Morris, Crago, DeLuca, Pidikiti, & Taub, 1997); RAP = Rehabilitation Activities Profile (van Bennekom, Jelles, & Lankhorst, 1995); WMFT = Wolf Motor Function Test (Wolf et al., 1989); NSS = not statistically significant; CI = confidence interval; D = disability; FL = functional limitation; I = impairment; SL = societal limitation.
ter prepared to apply the information in their clinical decisions. Teaching students how to access and appraise systematic reviews already conducted on interventions is another reasonable strategy for supporting evidence-based practice, especially given the constraints of time in the workplace.

Conclusion
The idea of evidence-based practice is gaining support in many health care professions, including occupational therapy. Although many occupational therapists have valued research as a foundation for practice for some time, not all make use of this information to guide their clinical decision making. Clearly, certain knowledge and skills are necessary to access and use the scientific literature. The AACPDM methodology is one way programs in occupational therapy can teach and promote evidence-based practice for entry-level practitioners.

References


