



Narrative Review

Evidence for Intensive Aphasia Therapy: Consideration of Theories From Neuroscience and Cognitive Psychology

Jade K. Dignam, BSpPath, Amy D. Rodriguez, PhD, David A. Copland, PhD

Abstract

Treatment intensity is a critical component to the delivery of speech-language pathology and rehabilitation services. Within aphasia rehabilitation, however, insufficient evidence currently exists to guide clinical decision making with respect to the optimal treatment intensity. This review considers perspectives from 2 key bodies of research, the neuroscience and cognitive psychology literature, with respect to the scheduling of aphasia rehabilitation services. Neuroscience research suggests that intensive training is a key element of rehabilitation and is necessary to achieve functional and neurologic changes after a stroke occurs. In contrast, the cognitive psychology literature suggests that optimal long-term learning is achieved when training is provided in a distributed or nonintensive schedule. These perspectives are evaluated and discussed with respect to the current evidence for treatment intensity in aphasia rehabilitation. In addition, directions for future research are identified, including study design, methods of defining and measuring treatment intensity, and selection of outcome measures in aphasia rehabilitation.

Introduction

Sufficient evidence now exists to support the general efficacy of aphasia therapy [1-6]. However, limited evidence exists to guide the optimal scheduling of therapy services for people who have aphasia after a stroke. Evidence from the neurosciences literature, which is based primarily on animal models of motor recovery after stroke, suggests that intensive therapy is necessary to elicit significant neurologic and behavioral changes [7-11]. In contrast, the cognitive psychology literature, which primarily consists of studies of healthy adults, suggests that nonintensive or *distributed* learning schedules result in superior learning outcomes [12]. The neuroscience and cognitive psychology literature seemingly differ with respect to the maintenance of learning gains, rather than the acquisition of learning. Whereas neuroscience research asserts that intensive training facilitates acquisition, studies have demonstrated that treatment gains may not be consistently maintained upon the cessation of intensive training [13-15]. In contrast, the cognitive psychology literature suggests that a distributed training schedule promotes the long-term retention of learned information [12,16].

Consequently, it is important to distinguish between measures of treatment acquisition and long-term maintenance when considering rehabilitation outcomes.

Within the aphasiology literature, studies investigating the role of treatment intensity have produced conflicting results [1]. International clinical guidelines and best practice recommendations for the clinical management of stroke advocate for the provision of intensive rehabilitation services [17-21]; however, few direct recommendations are made regarding the optimal treatment intensity for aphasia rehabilitation. In clinical practice, speech-language pathologists are frequently required to make decisions regarding the scheduling of aphasia therapy, including the amount, intensity, and duration of therapy required. However, these decisions are often based on service delivery factors, such as staffing and budget constraints, and may not be informed by empirical evidence.

A recent randomized controlled trial conducted in the United Kingdom, Assessing Communication Therapy in the North West (ACT NoW) [22], has brought into question the effectiveness of current service delivery models for aphasia rehabilitation in the early stages of stroke recovery and has prompted the need for further

research. Bowen et al [22] investigated the effectiveness of communication therapy delivered in the first 4 months after stroke by comparing “best practice” speech-language pathology intervention, delivered at an average intensity of 1.4 hours per week (a mean total of 18 hours over 13 weeks), with a similar amount of social contact from an employed visitor. The study was unable to differentiate between treatment and control groups on the primary outcome measure of functional communication ability at 6 months follow-up, suggesting no additional benefit of speech-language pathology intervention, when delivered at this low intensity, over that of social contact. Although the ACT NoW study did not explicitly aim to evaluate treatment intensity, the study has initiated debate on the effectiveness of current service delivery models in aphasia rehabilitation [23,24].

Therapy intensity is a fundamental component of the delivery of speech and language services and consequently is a pertinent area of research. Furthermore, in view of the significant negative consequences of aphasia and the increasing demands on health care services, it is important that we address the efficacy of service delivery models in aphasia rehabilitation.

In this review we aim to (1) evaluate and synthesize key findings from the neurosciences literature with regard to treatment intensity and its relationship with functional and neurologic outcomes in rehabilitation, (2) analyze key findings from the cognitive psychology literature and consider the effect of training schedules on learning outcomes in healthy humans, (3) incorporate these perspectives with our knowledge and understanding of service delivery models and treatment intensity in aphasia rehabilitation, and (4) identify limitations in the current evidence base for treatment intensity in aphasia rehabilitation and propose a research agenda for future studies.

A comprehensive review of the stroke and aphasia rehabilitation literature, as well as literature pertaining to learning theory and neuroplasticity, was undertaken. Studies evaluating treatment intensity in adults with poststroke aphasia were considered. Articles were accessed via multiple databases (the Cochrane library, Web of Science, Scopus, and CINAHL), and search terms included “aphasia,” “intensity,” “neuroplasticity,” “therapy,” “rehabilitation,” “distributed practice,” “spacing effect,” and “learning theory.” In addition, the bibliographies of relevant studies were reviewed to identify further research articles. Relevant articles published in English prior to November 2014 were included in the review.

This is the first narrative style review to consider key findings from both the neurosciences and cognitive psychology literature and interpret these findings with respect to the current evidence base for treatment intensity in aphasia rehabilitation. This review has implications for clinical practice and service delivery models in aphasia rehabilitation. Furthermore, establishing

optimal treatment intensity is an important research question in the broader, multidisciplinary rehabilitation context, with implications for consumers, clinicians, service providers, and policy makers. Consequently, this review also has clinical implications for the multidisciplinary rehabilitation and management of stroke.

Definition of Intensity

Therapy intensity is a multifaceted construct that, until recently, has been difficult to define in speech-language pathology research. Within the aphasiology literature, intensity is commonly used to describe the frequency of therapy, in number of therapy hours per week. This definition is in contrast to studies of motor recovery after stroke, which may consider the amount of effort expended during a therapy session or the number of times a particular task is repeated. Hinckley and Carr [25] describe intensive therapy as “more treatment provided over a shorter amount of time.” However, there is great variability within the aphasia literature as to what constitutes intensive therapy, with studies ranging from 5 hours per week [26-28] to more than 20 hours per week [25,29,30]. Consequently, there is a need for consistent use of terminology and clear reporting of treatment variables in aphasiology research. Warren et al [31] suggest the use of a standardized model for defining intensity in which cumulative treatment intensity consists of dose form (ie, the task in which the teaching episode is delivered), dose (ie, the number of teaching episodes per session), dose frequency (ie, the number of times a dose is provided per day and per week) and total intervention duration (ie, the period over which an intervention is provided). To date, few clinical studies have provided the information required to be able to calculate cumulative treatment intensity based on this model [32,33]. For the purpose of this review, the amount of therapy provided, or therapy dosage, is defined as the total number of therapy hours, whereas intensity of treatment is defined as the number of therapy hours per unit time. The duration of therapy is defined as the total period of intervention, measured in weeks or months. It is acknowledged that, increasingly, clinical studies in aphasia and stroke rehabilitation are calling for greater control and reporting of treatment variables. This increased rigor is necessary to more accurately delineate the effects of treatment intensity on communication outcomes [32].

Neuroscience and Learning

Principles of Experience-Dependent Neuroplasticity

It has been argued that rehabilitation is in essence a learning experience [34]. Consequently, an increased

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