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Effectiveness of technologies in the treatment of post-stroke anomia: A systematic review

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ABSTRACT

Background: Technologies are becoming increasingly popular in the treatment of language disorders and offer numerous possibilities, but little is known about their effectiveness and limitations.
Aim: The aim of this systematic review was to investigate the effectiveness of treatments delivered by technology in the management of post-stroke anomia.
Methods: As a guideline for conducting this review, we used the PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions. We conducted a systematic search of publications in PubMed, PsycInfo and Current Contents. We also consulted Google Scholar. Without any limitations as to publication date, we selected studies designed to assess the effectiveness of an intervention delivered by a technology, namely computer or smart tablet, to specifically improve anomia in post-stroke participants. The main outcomes studied were improvement in naming skills and generalisation to untreated items and daily communication.
Results: We examined 23 studies in this review. To date, computers constitute the most popular technology by far; only a few studies explored the effectiveness of smart tablets. In some studies, technology was used as a therapy tool in a clinical setting, in the presence of the clinician, while in others, therapy with technology was self-administered at home, without the clinician. All studies confirmed the effectiveness of therapy provided by technology to improve naming of trained items. However, generalisation to untrained items is unclear and assessment of generalisation to daily communication is rare.
Discussion: The results of this systematic review confirm that technology is an efficient approach in the management of post-stroke anomia. In future studies, ecological tasks aimed at evaluating therapy's effectiveness with word retrieval in real-life situations should be added since the ultimate goal of improving anomia is to increase the ability to retrieve words more easily in everyday life.

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1. Introduction

The aim of this article was to review the effectiveness of technologies in the treatment of post-stroke anomia. In this introduction, we discuss the limitations of the management of aphasia in health services today, along with results of recent studies related to the potential of technologies to overcome these limitations. Then we define anomia, which is the focus of this article, and review its traditional treatment.

Aphasia is an acquired language disorder following brain injury, its most common cause being stroke. Aphasia causes difficulties in comprehension and/or production of language, thus compromising the communication skills of people with aphasia. In Canada, about 50,000 new cases of strokes are reported annually (Heart & Stroke Foundation, 2014) and approximately 315,000 people are currently living with the consequences of stroke (Public Health Agency of Canada, 2011), including aphasia. In the United States, nearly 800,000 people have a stroke every year, making it the leading cause of long-term disability (American Stroke Association, 2016). It is estimated that among people with cerebrovascular disease, one in three suffers from aphasia (Mazaux, Pélissier, & Brun, 2000; Pedersen, Jørgensen, Nakayama, Raaschou, & Olsen, 1995). Thus, aphasia affects many people and has significant repercussions, not only for the person with aphasia, but also for that person's family and society. For example, researchers have documented decreased quality of life (e.g., Hilari, Wiggins, Roy, Byng, & Smith, 2003; Ross & Wertz, 2003) and less social interactions (e.g., Cruice, Worrall, & Hickson, 2006; Parr, 2007).

The prognosis of aphasia depends on several factors, including its etiology and the impact of speech-language therapy (SLT). In post-stroke aphasia, therapy is based on a collaborative care approach that usually begins at the hospital in the acute phase, continues in intensive rehabilitation programmes, and ends at home or during weekly visits to an outpatient clinic. There is evidence of the effectiveness of SLT for people with aphasia following stroke, as determined by a review conducted by the Cochrane Collaboration (Brady, Kelly, Godwin, & Enderby, 2012). However, for many patients, getting to an outpatient clinic can be difficult or impossible because of mobility problems, the need for support from a family member, the distance between home and clinic, and so on. Home therapy could be an interesting option for these people, allowing them to reach their maximum rehabilitation potential. Moreover, although clinicians usually assume that the greatest amount of recovery from aphasia primarily takes place during a spontaneous recovery period, occurring in the immediate period after stroke and lasting as long as one year, some studies provide evidence that people with aphasia can make significant improvements in response to treatment well over one year post-onset (e.g., Basso, Capitani, & Vignolo, 1979; Kertesz and McCabe, 1977; Routhier, Bier, & Macoir, 2015). Indeed, some researchers found that time post-onset was not related to response to treatment in chronic aphasia (Allen, Mehta, McClure, & Teasell, 2012; Moss & Nicholas, 2006).

However, in many countries, SLT for people with chronic aphasia is often limited, even non-existent. For example, although increasing accessibility to rehabilitation services is a clear priority of Canada's home support policy (Council of the Federation, 2012), home services cannot currently meet demand due to personnel and financial constraints, particularly in speech-language pathology. In this context, it is essential to develop new service delivery options, without burdening professional resources. The accelerated development of new technologies offers clinicians the opportunity to propose innovative and intensive treatments in which the person with aphasia is autonomous or needs less support.

Use of technology (i.e. computer, smart tablet) in language rehabilitation has grown significantly in recent years and become a topic of interest in the aphasia literature. First, there is increasing evidence of the effectiveness of technologies in the treatment of post-stroke aphasia. Recently, Zheng, Lynch, and Taylor (2016) conducted a systematic review of the effect of computer therapy in aphasia. They found seven studies assessing the effectiveness of computer programmes targeting different areas of language (i.e. comprehension and production of complex sentence structures, word-finding, reading comprehension and production of simple, grammatical sentences) and concluded that computer therapy was effective in comparison to no therapy. Zheng et al. (2016) also found three studies to support preliminary evidence that computer-delivered therapy could be as effective as clinician-delivered therapy for individuals with chronic aphasia. However, given the small number of studies investigating this aspect, more research is needed. In a review by Allen et al. (2012), computer-assisted treatment was also cited as an effective intervention for chronic aphasia.