



Review article

Cognitive functioning and deep transcranial magnetic stimulation (DTMS) in major psychiatric disorders: A systematic review

Karina Karolina Kedzior ^{a,*}, Lioba Gierke ^a, Helena Marie Gellersen ^b, Marcelo T. Berlim ^c^a Institute of Psychology and Transfer, University of Bremen, Bremen, Germany^b School of Engineering and Science, Jacobs University Bremen, Bremen, Germany^c Department of Psychiatry, McGill University, and Neuromodulation Research Clinic, Douglas Institute, Montreal, Canada

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ABSTRACT

Deep transcranial magnetic stimulation (DTMS) is a non-invasive brain stimulation method mostly utilised in the treatment of major depression. The aim of the current study was to systematically review the literature on the cognitive effects of DTMS applied with the H-coil system in major psychiatric disorders. Following a literature search in PsycInfo and PubMed (any time to December 2015), 13 out of 32 studies on DTMS and cognitive functioning were included in the current review. Three studies included 38 healthy participants, eight studies included 158 unipolar or bipolar depression patients and two studies included 45 schizophrenia patients. Low-frequency DTMS (1–3 sessions) had little effect on cognitive functioning in healthy participants. The most consistent cognitive and clinical improvements were reported in the short-term (after 20 daily sessions of high-frequency DTMS with H1-coil) in studies with major depression patients. There was also a trend towards a short-term cognitive and clinical improvement in studies with schizophrenia patients. High-frequency DTMS might improve cognitive functioning and alleviate clinical symptoms in the short-term, particularly in major depression. However, this conclusion is based on data from mostly uncontrolled, open-label studies with patients receiving concurrent antidepressants or antipsychotics. Randomised, sham-controlled trials are needed to investigate the magnitude of the cognitive outcomes of DTMS in the short-term and beyond the daily stimulation phase in major psychiatric disorders.

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* Corresponding author. University of Bremen, Institute of Psychology and Transfer, Grazer Str. 2c, 28359 Bremen, Germany.

E-mail address: kkedzior@graduate.uwa.edu.au (K.K. Kedzior).

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1. Introduction

Brain stimulation methods have gained popularity and acceptance as promising non-pharmacological interventions to treat various psychiatric disorders. One example of such a method is a non-invasive, repetitive transcranial magnetic stimulation (rTMS), which has consistent antidepressant properties during and beyond the daily treatment phase (Berlim et al., 2014b; Kedzior et al., 2014; Kedzior et al., 2015c). rTMS is typically administered using figure-of-eight coils, which can stimulate selective, but relatively superficial, cortical regions (Zangen et al., 2005). A novel alternative to rTMS is a non-invasive, deep transcranial magnetic stimulation (DTMS), which is delivered using the H-coil system (Roth et al., 2002). Unlike the figure-of-eight coil, the H-coil stimulates wider, and presumably deeper, brain regions (Roth et al., 2014; Zangen et al., 2005). According to a randomised-controlled trial (RCT) (Levkovitz et al., 2015) and two meta-analyses (Kedzior et al., 2015a, b), high-frequency DTMS appears to have short-term antidepressant and anxiolytic properties in the treatment of major depression. However, it remains unclear if this therapeutic intervention is also able to improve the cognitive impairments associated with major depression (Rock et al., 2014) and other psychiatric disorders. To date, only one systematic review (Minichino et al.,

2012) addressed this issue. According to this review, high-frequency DTMS is associated with small, short-term improvements in sustained attention and cognitive planning as well as larger improvements in spatial and visuospatial memory based on data from two open-label studies including patients with treatment-resistant, medication-free, unipolar depression (Minichino et al., 2012). Similar conclusions regarding the putative cognitive effects of the conventional, high-frequency rTMS have been drawn in two other systematic reviews (Guse et al., 2010; Serafini et al., 2015). Indeed, both reviews reported consistent trends towards improvement in some cognitive functions, such as visuospatial memory and verbal memory, especially in studies including patients with major depression (Guse et al., 2010; Serafini et al., 2015). Given the growing interest in the application of DTMS in psychiatry and the increasing number of published studies, it is important to assess the magnitude of its cognitive effects. Therefore, the aim of the current study was to systematically review the literature on the cognitive effects of DTMS applied with the H-coil system in major psychiatric disorders.

2. Material and methods

A systematic literature search was conducted in PsycInfo and

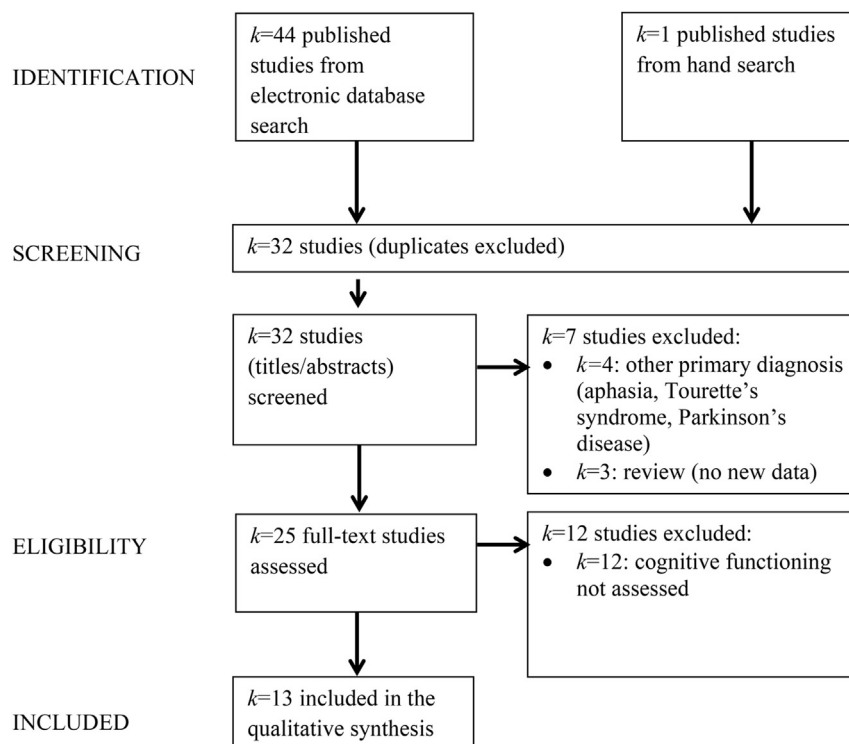


Fig. 1. PRISMA flowchart. Note. Abbreviations: DTMS, deep transcranial magnetic stimulation; k, number of studies.

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