International Journal of Applied Mathematics
Volume 38 No. 7s, 2025
ISSN: 1311-1728 (printed version); ISSN: 1314-8060 (on-line version)

TRANSCRANIAL MAGNETIC STIMULATION IN DEPRESSION: NURSING ROLES IN ADMINISTRATION AND MONITORING

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Abstract

Depression remains a leading cause of disability worldwide, with a significant subset of patients exhibiting treatment-resistant depression (TRD). Transcranial Magnetic Stimulation (TMS) has emerged as a non-invasive, FDA-approved alternative for treating TRD. This literature review explores the efficacy, safety, and nursing implications of TMS in depression management. Emphasizing the integral role of psychiatric nurses, the review discusses their responsibilities in patient preparation, treatment administration, monitoring, and post-treatment care. The review also addresses challenges in implementation and suggests directions for future research.

Keywords: Transcranial Magnetic Stimulation, Depression, Treatment-Resistant Depression, Psychiatric Nursing, Non-Invasive Neuromodulation, Patient Care

1. Introduction

Neuropsychiatric disorders are the third leading cause of disability worldwide, accounting for 10.4% of the total global burden measured by disability-adjusted life years (DALYs). Depression is a leading global mental health disorder, and contributes significantly to disability and disease burden worldwide (Somani & Kar, 2019). Depression is not the same as normal mood swings and sentiments about daily life. It involves a depressed mood or loss of pleasure or interest in activities for long periods of time (WHO, 2025).

Major depressive disorder (MDD) represents a significant global health crisis, accounting for 2.54% of global DALYs and impacting an estimated 264 million people worldwide with depressive disorders. The burden is particularly acute in nations like India, where roughly 1 in 20 Indians experiences depression, translating to an estimated 56 million to 60 million people suffering from various mental illnesses (WHO).

Despite the high prevalence and burden, the effectiveness of the primary treatment—antidepressants—is limited. Studies comparing antidepressants to placebo for symptom improvement typically show a drug-placebo difference corresponding to a clinical efficacy of only up to 30% over placebo. The actual rate of achieving remission, defined as the near-absence of symptoms, is even lower. This poor response defines Treatment-Resistant Depression (TRD), which is the lack of remission despite two or more trials of tolerable and evidence-based treatments.

The scale of this non-response was dramatically illustrated by the Sequenced Treatment Alternatives to Relieve Depression (STAR*D) trial. This landmark study revealed that 63.2% of patients did not achieve remission following the first treatment trial, and a staggering up to a third of patients never

International Journal of Applied Mathematics
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ISSN: 1311-1728 (printed version); ISSN: 1314-8060 (on-line version)

achieved remission across multiple sequential steps. This data underscores the critical need for more effective treatment options beyond the current standard of care.

While pharmacological and psychotherapeutic treatments remain the cornerstone of management, approximately 30% of patients exhibit treatment-resistant depression (TRD), necessitating alternative therapeutic approaches (Zamfirache et al., 2025).

A significant percentage of patients with major depression (28% to 33%) do not achieve remission after their first antidepressant treatment. Electroconvulsive therapy (ECT) and transcranial magnetic stimulation (TMS) are effective somatic treatments for major depression, with ECT being highly effective and TMS offering good tolerability and modest efficacy.

Transcranial Magnetic Stimulation is an effective, non-invasive treatment for depression, particularly for patients who do not respond to traditional therapies. It has emerged as a neuromodulation technique that delivers magnetic pulses to targeted brain regions most notably the dorsolateral prefrontal cortex to modulate neural activity associated with mood regulation. TMS has been approved by regulatory bodies such as the U.S. Food and Drug Administration (FDA) for use in treatment-resistant depression (TRD) and is increasingly recognised for its safety, efficacy, and outpatient feasibility (Trapp et al., 2025).

In this evolving landscape, nurses play a vital role in both the administration and monitoring of TMS. From preparing patients and operating the equipment to observing for side effects and providing emotional support, their presence helps to create a safe, therapeutic environment and ensures that any clinical concerns are addressed promptly and compassionately (Hamilton & Hartwig, 2011; Taylor & Bhati, 2020).

Psychiatric nurses are pivotal in TMS care, educating patients, setting realistic expectations, ensuring safety protocols, and offering continuous support (Amini & Zeighami, 2021; Wozniak & Leśniak, 2022). They assess clinical needs, ensure patient safety, and develop care policies to promote patient-centred care (McClintock et al., 2018). Through patient engagement and support, psychiatric nurses contribute significantly to treatment outcomes and therapeutic environments conducive to positive results (George et al., 2018; Dandekar et al., 2018). Specifically, this review aims to synthesise current research regarding TMS efficacy and outline the essential components of its safe and effective clinical implementation (Lefaucheur et al., 2020; Gershon et al., 2003; World Health Organization, 2023).

Specifically, this review aims to synthesize current research regarding TMS efficacy, outline the essential components of its safe and effective clinical implementation, and critically delineate the profound and multifaceted role of the psychiatric nurse in treatment planning, adherence monitoring, and holistic care within the neuro-modulation setting.

Historical Background and Mechanism of Transcranial Magnetic Stimulation (TMS)

Transcranial Magnetic Stimulation (TMS) was first developed in 1985 by Anthony Barker and colleagues as a non-invasive way to stimulate the brain using electromagnetic fields (Barker, Jalinous, & Freeston, 1985). Initially, it was used primarily in research to study brain function, particularly in the motor cortex. Over time, however, clinicians realised that TMS could have therapeutic applications, especially for depression. By the 1990s, studies began exploring its use in patients who did not respond well to standard treatments, leading to its approval by the U.S. Food and Drug Administration (FDA) for treatment-resistant depression in 2008 (George & Post, 2011).

TMS works by generating brief magnetic pulses through a coil placed on the scalp. These pulses create small electrical currents in the underlying brain tissue, which can either stimulate or inhibit neuronal activity depending on the frequency and location of the pulses (Lefaucheur et al., 2020). In depression, the most common target is the dorsolateral prefrontal cortex (DLPFC), a brain area involved in mood regulation and connected to deeper emotional centers (George et al., 2018). High-frequency stimulation to the left DLPFC tends to activate neurons, while low-frequency stimulation to the right DLPFC can dampen overactive circuits.

Received: August 09, 2025

International Journal of Applied Mathematics
Volume 38 No. 7s, 2025
ISSN: 1311-1728 (printed version); ISSN: 1314-8060 (on-line version)

Beyond these immediate effects, TMS may also promote longer-term changes in the brain. It influences neurotransmitter systems such as serotonin, dopamine, and GABA and helps strengthen connections between different brain regions involved in emotion and cognition (Dandekar et al., 2018). Over the years, newer forms of TMS—like repetitive TMS (rTMS), deep TMS, and theta-burst stimulation—have made the treatment more effective, better tolerated, and easier to deliver in clinical settings (Trapp et al., 2025).

Understanding the history and mechanism of TMS is important not just for clinicians but also for nurses. Nurses play a key role in setting up the equipment, monitoring patients during sessions, and ensuring safety. Knowing how TMS affects the brain helps nurses anticipate side effects, provide patient education, and support adherence, all of which are critical for successful treatment outcomes.

Efficacy of Transcranial Magnetic Stimulation (TMS) in Depression

Transcranial Magnetic Stimulation (TMS) has emerged as a promising non-invasive treatment for major depressive disorder (MDD), particularly for patients who have not responded to conventional therapies. Numerous studies and meta-analyses have evaluated its effectiveness, providing robust evidence for its clinical application.

A comprehensive meta-analysis by Vida et al. (2023) demonstrated that repetitive TMS (rTMS) significantly outperforms sham treatments in both response and remission rates among individuals with treatment-resistant depression (TRD). Specifically, rTMS was found to be more effective than sham rTMS in achieving clinical response and remission, with high-frequency left-sided stimulation protocols showing the most pronounced benefits. These findings underscore the potential of rTMS as a valuable adjunctive therapy for patients with MDD who have failed to achieve adequate responses to antidepressant medications.

Further supporting these findings, a network meta-analysis by Hyde et al. (2022) confirmed that rTMS is effective in treating depressive episodes, with a medium effect size, though noting high heterogeneity across studies. This variability highlights the need for personalised treatment approaches to optimise outcomes.

In addition to standard rTMS protocols, newer techniques such as theta-burst stimulation (TBS) have been explored. A study by Tao et al. (2025) found that both rTMS and TBS are similarly effective in reducing depression and anxiety symptoms, with comparable side effect profiles. Notably, TBS sessions are more time-efficient, lasting only 192 seconds, making it a cost-effective option for patients.

The efficacy of TMS is not limited to adult populations. A study by Cao et al. (2023) indicated that rTMS may also be a useful add-on therapy for children and adolescents with depression, suggesting its broader applicability across age groups.

Collectively, these studies affirm that TMS, particularly rTMS, is an effective and well-tolerated treatment option for individuals with MDD, offering hope for those who have not benefited from traditional antidepressant therapies.

Nursing Roles in TMS Administration and Monitoring

Nurses play a central role in the delivery of transcranial magnetic stimulation (TMS) for depression, ensuring that patients receive treatment safely, effectively, and comfortably. Their involvement begins even before the first session, with thorough **patient assessment and preparation**. Nurses evaluate medical history, screen for contraindications such as metal implants or seizure disorders, and provide clear explanations of the procedure to reduce anxiety and set realistic expectations (Amini & Zeighami, 2021).

During TMS sessions, nurses are responsible for **equipment setup, patient positioning, and monitoring**. Proper placement of the coil and calibration of stimulation parameters are crucial for

Volume 38 No. 7s, 2025
ISSN: 1311-1728 (printed version); ISSN: 1314-8060 (on-line version)

maximizing efficacy while minimizing discomfort. Nurses continuously observe patients for any adverse effects, including headaches, scalp discomfort, or mood changes, and intervene promptly if complications arise (McClintock et al., 2018). Their vigilance helps create a therapeutic environment where patients feel safe and supported.

Beyond technical roles, psychiatric nurses provide essential **psychological support and education**. They guide patients and families about the treatment course, expected outcomes, and potential side effects, reinforcing adherence and engagement. By offering reassurance and addressing concerns, nurses reduce anxiety and foster trust, which has been linked to improved treatment outcomes (George et al., 2018; Dandekar et al., 2018).

Nurses also contribute to **clinical documentation, quality assurance, and interprofessional collaboration**. Accurate recording of treatment parameters, patient responses, and side effects ensures continuity of care and informs treatment adjustments by the multidisciplinary team. Additionally, nurses often participate in developing protocols and policies that enhance the safety and efficiency of TMS programs.

In essence, the role of nurses in TMS extends far beyond routine observation. They are **educators, caregivers, and clinical collaborators**, integrating technical proficiency with patient-centred care. Their involvement is crucial in optimising therapeutic outcomes, minimising risks, and ensuring that TMS is delivered in a safe, supportive, and ethically responsible manner.

Challenges and Barriers in TMS Nursing Practice

Despite its benefits, several barriers exist:

- Accessibility and cost: High equipment costs and multiple sessions may limit patient access (George et al., 2018).
- Limited training and awareness: Many nurses lack formal TMS training, impacting confidence and consistency in care (Amini & Zeighami, 2021).
- Infrastructure and policy constraints: TMS requires dedicated space, equipment maintenance, and adherence to protocols (McClintock et al., 2018; Rossi et al., 2021).
- Patient-related factors: Anxiety, misconceptions, and logistical issues can affect adherence (George et al., 2018).

Nurses play an important role in addressing these barriers through education, emotional support, flexible scheduling, and interprofessional collaboration.

6. Ethical and Legal Considerations in TMS Practice

Ethical practice is central to the use of Transcranial Magnetic Stimulation (TMS) in treating depression. Upholding the principles of autonomy, beneficence, non-maleficence, and justice ensures that patient welfare remains the primary focus (Beauchamp & Childress, 2019). Before beginning therapy, nurses play an important role in obtaining informed consent, ensuring that patients fully understand the procedure, its potential risks, and available alternatives (Rossi et al., 2021).

Maintaining confidentiality, providing equal access to care, and closely monitoring for adverse effects reflect the ethical responsibility of the nursing team (George & Post, 2011). Nurses also ensure that professional competence and institutional guidelines are consistently maintained. When involved in research, they safeguard ethical standards by ensuring voluntary participation and adherence to approved protocols. In essence, nurses act as ethical advocates, ensuring TMS is delivered with compassion, transparency, and respect for human dignity.

9. Conclusion

TMS is a safe, effective, and non-invasive treatment for TRD. Psychiatric nurses are central to its successful administration, combining technical expertise with patient-centred care. Addressing barriers such as training gaps, infrastructure limitations, and patient challenges is essential to optimize outcomes. With structured education, interprofessional collaboration, and adherence to evidence-

Received: August 09, 2025

ISSN: 1311-1728 (printed version); ISSN: 1314-8060 (on-line version)

based protocols, nurses can ensure that TMS is delivered safely, effectively, and compassionately, improving the quality of care for patients with depression (Lefaucheur et al., 2020; Amini & Zeighami, 2021; McClintock et al., 2018).

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Received: August 09, 2025