



Clinical Policy: Transcranial Magnetic Stimulation

Reference Number: HNCA.CP.MP. 508

Last Review Date: 1/20

[Coding Implications](#)
[Revision Log](#)

See [Important Reminder](#) at the end of this policy for important regulatory and legal information.

Description

Transcranial magnetic stimulation (TMS) is a noninvasive technique that been approved as a modality for treatment resistant major depression (TRD). Brief repetitive pulses of magnetic energy are applied to the scalp via a large electromagnetic coil to generate low levels of electrical current in the underlying brain tissue. The intent is to stimulate areas of the brain involved in mood regulation to lessen the duration or severity of depressive episodes.

Policy/Criteria

- I. It is the policy of Health Net of California that transcranial magnetic stimulation is **medically necessary** when all of the following are met:
 - A. The patient is an adult with the diagnosis of Major Depressive Disorder without psychosis;
 - B. Treatment is provided by a licensed psychiatrist;
 - C. The patient has demonstrated a failure to respond to a combination of multiple trials of medication and evidence based psychotherapy treatment during the current episode of illness, with the Physician's Health Questionnaire-9 (PHQ-9) score of > 15 throughout the current course of treatment;
 - D. The Major Depressive Disorder diagnosis is not part of a presentation with multiple psychiatric comorbidities that could potentially clinically masquerade as Major Depression symptoms;
 - E. The patient has demonstrated treatment resistance or intolerance with psychopharmacologic agents as evidenced by a lack of clinically significant response to up to four trials of such agents, in the current depressive episode, from at least two different agent classes. At least two of the treatment trials must have been administered at an adequate course of mono- or poly-drug therapy with antidepressants involving standard therapeutic doses of at least 6 weeks duration; (Note: This requirement is not necessary if the patient is unable to take anti-depressants due to drug interactions with medically necessary medications or the patient has demonstrated an inability to tolerate psychopharmacologic agents as evidenced by trials of four such agents with distinct side effects in the current episode). If the patient experienced a partial therapeutic response with an antidepressant, the patient should also have at least two adequate augmentation trials with agents considered by the evidence based literature as appropriate for antidepressant augmentation.
 - F. The patient has not responded to a properly conducted episode of treatment with evidence based psychotherapy such as a formal trial of Cognitive Behavioral Therapy and/or Interpersonal Therapy;



CLINICAL POLICY

POLICY TITLE: Transcranial Magnetic Stimulation

- G. The patient has failed an adequate trial of Electroconvulsive Therapy (ECT) unless its use is contraindicated or the documented side effects were intolerable.
- H. Does not have the following contraindications:
 - 1. History of seizures
 - 2. Ferromagnetic material anywhere in the head other than the mouth (e.g. cochlear implants, brain stimulators or electrodes, aneurysm clips, plates, metallic dyes in tattoos)
 - 3. Cardiac pacemaker
 - 4. Implanted defibrillator
 - 5. Implanted medical pump, or
 - 6. Severe cardiovascular disease
 - 7. History of failure to respond to an episode of 30 TMS treatments without a 50% reduction in baseline PHQ-9 scores
- I. The acute treatment course consists up to thirty, 30 min to 60 min sessions or treatments, usually delivered as daily 5 days a week (with some recent studies advocating even longer TMS exposure for better results). Each session consists of rTMS to the left prefrontal dorso-lateral cortex area at around 120% motor threshold (10Hz, 4-second train duration, 26 second inter-train interval, between 3000 and 5000 pulses per session), using a figure-eight solid core coil. Treatment response is usually defined as at least a 50% drop from the baseline depression scores. It should be noted, however, that there is little data to support the likelihood of TMS effectiveness if the patient has not responded with at least a 25% reduction in depression symptoms as measured by validated depression severity rating scales by the 20th TMS session. The definition for remission is generally accepted as a PHQ-9 score of ≤ 9 .

Background

In the United States in a given year, major depression affects 14 to 15 million adults, or approximately 5% to 8% of the adult population. Major depression, also known as major depressive disorder (MDD), unipolar depression, or clinical depression, is a severe illness that results in significant disability and morbidity, and is the leading cause of disability in many developed countries. More than 60% of the individuals experiencing a major depressive episode (MDE) will have additional MDEs as often as once or twice a year. If untreated, the frequency and severity of depressive illness increase, often leading to suicide.

Antidepressant medications are the standard medical somatic therapy for Major Depression. Antidepressant drugs and/or evidence based psychotherapy are successful in producing remission in up to 65% of the treated patients with MDD. Each of the numerous antidepressant drugs available is categorized by class according to the neurotransmitter system with which it mostly interacts (noradrenalin, serotonin, dopamine, etc). If an antidepressant drug in one class does not relieve symptoms or causes intolerable side effects, an antidepressant drug in another class may be prescribed. The rate of remission, or complete symptom relief, is only 33% for monotherapy with the first antidepressant drug tried and diminishes with each successive antidepressant drug tried. After failing 2 antidepressant drug classes trials, plus augmentation techniques, patients are then considered drug-resistant and remission rates drop to 20%. These data and the increasing



CLINICAL POLICY

POLICY TITLE: Transcranial Magnetic Stimulation

prevalence of MDD and drug-resistant MDD suggest a need for alternative treatments for depression.

Psychotherapy is the standard non-medication treatment for Major Depression. Cognitive-Behavioral Therapy and Interpersonal Therapy have both been found to be effective in the treatment of this disorder.

ECT is the standard non-drug somatic therapy for depression. Other non-medication somatic therapies include vagus nerve stimulation (VNS), deep brain stimulation (DBS) and transcranial magnetic stimulation (TMS). All rely on electrical stimulation of neurons in regions of the brain responsible for mood. Theoretically, electrical stimulation alters mood by altering brain chemistry or metabolism and/or neurotransmitter release. VNS has not lived up to its original promise and the trials of DBS are not yet conclusive enough for wide use of this invasive procedure.

ECT delivers electrical pulses to the brain via electrode pads positioned on the scalp above mood centers. As currently practiced, ECT triggers brief ‘controlled’ seizures, requires general anesthesia and a muscle relaxant to prevent severe body convulsions, raises heart rate and blood pressure during treatment, and leads to transient confusion and anterograde memory loss after treatment. ECT induces rapid improvement in symptoms but must be repeated over several sessions (usually 6-10) to prevent relapse.

Transcranial Magnetic Stimulation consists of brief repetitive pulses of magnetic energy applied to the scalp via a large electromagnetic coil positioned on the scalp over the right or left dorsolateral prefrontal cortex (DLPFC), the mood center considered as directly associated with depression. The magnetic pulses generate low levels of electrical current in underlying brain tissue, which is postulated to ‘entrain’ local neuronal activity back to euthymia. TMS does not require anesthesia or surgery and may be performed on an out-patient basis but typically is repeated 5 times per week over the course of = 4-6 weeks to achieve maximum response. TMS may be used alone or as an adjunct to antidepressant medication.

Repeated daily left prefrontal transcranial magnetic stimulation (rTMS or TMS) was first proposed as a potential treatment for depression in 1993. Multiple studies from researchers around the world since then have repeatedly demonstrated that TMS has antidepressant effects greater than sham treatment, and that these effects are clinically meaningful. A large industry-sponsored trial, published in 2007, resulted in US FDA approval in October 2008 for the treatment of adult patients with Major Depression without psychosis (MDD) who “have not adequately responded to appropriate pharmacological treatment intervention.”

The TMS Therapy system is a computerized electromechanical instrument that delivers non-invasive magnetic stimulation to the brain in the form of brief duration, rapidly alternating, or pulsed, magnetic fields, which induce small electric fields in the cortex directly below the area where the transducer is placed on the patient’s head. These electric fields are sufficient to produce an action potential across the membranes of the neurons in the targeted region of the left



CLINICAL POLICY

POLICY TITLE: Transcranial Magnetic Stimulation

prefrontal cortex. This induced electric field, which is internal to the cortex, is the intended substrate for stimulation. The magnetic pulse is simply a conduit to transfer the electrical energy within the system to the cortex. This energy transfer system brings the unique ability to stimulate selected spatially discrete regions of the cortex, using non-invasive direct electrical stimulation. Once action potentials are created, these neurons fire, releasing naturally produced neurotransmitters. This release starts a cascade of neurochemical events typical of normal neuro-network function.

The Agency for Healthcare Research and Quality published a comparative effectiveness review entitled, “Nonpharmacologic Interventions for Treatment-Resistant Depression in Adults” (Gaynes et al., 2011). Modalities reviewed included ECT, rTMS, vagal nerve stimulation and psychotherapy. Conclusions were as follows:

“Our review suggests that comparative clinical research on nonpharmacologic interventions in a TRD population is early in its infancy, and many clinical questions about efficacy and effectiveness remain unanswered. Interpretation of the data is substantially hindered by varying definitions of TRD and the paucity of relevant studies. The greatest volume of evidence is for ECT and rTMS. However, even for the few comparisons of treatments that are supported by some evidence, the strength of evidence is low for benefits, reflecting low confidence that the evidence reflects the true effect and indicating that further research is likely to change our confidence in these findings. This finding of low strength is most notable in two cases: ECT and rTMS did not produce different clinical outcomes in TRD, and ECT produced better outcomes than pharmacotherapy. No trials directly compared the likelihood of maintaining remission for nonpharmacologic interventions. The few trials addressing adverse events, subpopulations, subtypes, and health-related outcomes provided low or insufficient evidence of differences between nonpharmacologic interventions. The most urgent next steps for research are to apply a consistent definition of TRD, to conduct more head-to-head clinical trials comparing nonpharmacologic interventions with themselves and with pharmacologic treatments, and to delineate carefully the number of treatment failures following a treatment attempt of adequate dose and duration in the current episode.”

The Institute for Clinical Systems (ICSI) published a health care guideline: Major Depression in Adults in Primary Care in 2010. They concluded, based on the review of the medical literature, that in spite of the ongoing lack of clarity about the patients population who should be targeted for rTMS, there is enough evidence to consider rTMS using a 6 week protocol as an evidence based treatment for treatment-resistance in adults, but not a first line treatment.

The American Psychiatric Association’s workgroup on the treatment for major depression published a practice guideline in October 2010 stating that for patients whose symptoms have not responded adequately to medications, ECT remains the most effective form of therapy and should be considered as well as TMS when ECT is not effective or tolerated. They cite a number of meta-analyses in the recent literature finding that individuals with treatment-resistant depression were more likely to respond to TMS than sham treatments (25% with TMS vs 17% with sham.)



CLINICAL POLICY

POLICY TITLE: Transcranial Magnetic Stimulation

George et al (2010) conducted a National Institutes of Health-sponsored, industry-independent sham controlled randomized trial using TMS therapy for major depressive disorder. The major goal of this study was to assess whether active, compared with sham, rTMS increased the remission rate during the initial phase of the study. The trial took place from 2004 – 2009 at 4 university hospital clinics with 199 study participants. The study inclusion criteria included 18 – 70 year olds with the DSM-IV diagnosis of major depressive disorder (single episode or recurrent with less than 5 year from onset) with a Hamilton Scale for depression score of 20. The study participants needed to be stable during a 2-wk medication-free lead-in period and have a moderate level of treatment resistance defined as: insufficient clinical benefit to 1-4 adequate medication trials or intolerant to 3 trials of medications. Participants were excluded if they had a history of seizure or neurologic disorder, previous treatment with TMS or vagus nerve stimulation, failure to respond to electroconvulsive treatment or currently taking medication that could lower the seizure threshold.

Patients were randomized 1:1 to either active or sham repetitive transcranial magnetic stimulation (rTMS). There was a 2-week lead-in phase, a 3 week fixed-treatment phase and a variable 3 week extension phase of clinical improvers. During the 3-week fixed treatment phase, rTMS sessions were scheduled daily in a 5 day sequence for a total of 15 sessions. Each treatment lasted about 50 minutes, including 40 minutes of the actual delivery of rTMS or the sham treatment. A certified masked clinical rate who was not involved in administering the TMS assessed patients weekly.

The primary efficacy outcome measure was the dichotomous variable of remission, defined as a Hamilton Scale for Depression (HAM-D) score of 3 or less or 2 consecutive HAM-D scores less than 10 during phase 1. Secondary outcome measures included the dichotomous variable of the responses defined as a 50% decrease in the HAM-D score from baseline at the final phase 1 visit, Montgomery-Asperg Depression Rating Scale scores, Clinical Global Impression Severity of Illness Scale scores, and patient-reported reported Inventory of Depressive Symptoms–Self-report scores

Results

Primary (Remitters)

For the primary analysis of remission in the intention to treat (ITT) sample (=190), there was a significant effect of the treatment (odds ratio, 4.2; 95% confidence interval, 1.32-13.24; P=.02). There were 18 remitters (9.5% [14.1% in the active arm and 5.1% in the sham arm]).

Secondary (Responders)

The responder analysis had similar results. All remitters were also responders, but not all responders were remitters. There were 19 responders (10.0%) (15% active and 5% sham in the ITT sample, 14 (9.1%) (14% active and 5% sham) in the complete sample and 7 (5.8%) in the fully adherent sample. Similar to the remission analyses, logistic regression detected a main effect of treatment condition for the ITT (P=.009) and completer (P=.02)



CLINICAL POLICY

POLICY TITLE: Transcranial Magnetic Stimulation

Patients, treaters and raters were effectively masked. Minimal adverse effects did not differ by treatment arm, with an 88% retention rate (90% sham and 86% active). Primary efficacy analysis revealed a significant effect of treatment on the proportion of remitters (14.1% active rTMS and 5.1% sham) ($P=.02$). The odds of attaining remission were 4.2 times greater with active rTMS than with sham (95% confidence interval, 1.32 – 13.24). The number needed to treat was 12; most remitters had low antidepressant treatment resistance. Almost 30% of the patients remitted in the open-label follow-up (30.2% originally active and 29.6% sham.)

Study limitations included failure to enroll the projected 240 suggested by the initial power analysis. It was also unclear how long patients needed to be treated. Patients who met the 30% improvement criteria continued randomized treatment for an additional 3 weeks or until the patient stopped showing meaningful response to treatment. With this rule, no one received treatment for a full 6 weeks. Despite more rigorous requirements for progression (30% improvement at 3 weeks vs 25% improvement at 4 weeks), this study showed a significant improvement in remission at 3 to 5 weeks.

The authors concluded that the treatment was relatively well tolerated, with no difference in the adverse events between the sham and the active TMS treatment arms. Adverse events included headache (active 29% vs sham 23%), discomfort at the stimulation site (active 17% vs sham 10%), Insomnia (active 10% vs sham 7%) and worsening of depression or anxiety (active 6% vs sham 8%). There were no seizures, and the retention rate was high at 88%. They also concluded that the high-intensity rTMS for at least 3 weeks is significantly more likely than sham rTMS to induce remission in antidepressant free patients with moderately treatment resistant unipolar MDD. The treatment effect seen in the primary analysis was also reflected in the secondary analyses in the remitted completer samples and in analyzing the number of responders. Similar treatment differences were found with continuous measures of symptom change, such as the Montgomery-Asberg Depression Rating Scale, the Clinical Global Impression Severity of Illness Scale, and the patient rated inventory of Depressive Symptoms self-report. Daily left prefrontal rTMS as monotherapy produced statistically significant and clinically meaningful antidepressant therapeutic effects greater than sham. The odds of attaining remission were 4.2 times greater with active rTMS than with sham (95% confidence interval, 1.21-13.24).

Janicak et al (2010) noted that transcranial magnetic stimulation (TMS) can be an effective acute antidepressant treatment, but few studies systematically examine persistence of benefit. They assessed the durability of antidepressant effect after acute response to TMS in patients with major depressive disorder (MDD) using protocol-specified maintenance antidepressant monotherapy. Three hundred one patients were randomly assigned to active or sham TMS in a 6-week, controlled trial. Nonresponders could enroll in a second, 6-week, open-label study. Patients who met criteria for partial response (i.e., >25% decrease from the baseline HAMD 17) during either the sham-controlled or open-label study ($n = 142$) were tapered off TMS over 3 weeks, while simultaneously starting maintenance antidepressant monotherapy. Patients were then followed for 24 weeks in a naturalistic follow-up study examining the long-term durability of TMS. During this durability study, TMS was re-administered if patients met pre-specified criteria for symptom worsening (i.e., a change of at least one point on the CGI-S scale for 2



CLINICAL POLICY

POLICY TITLE: Transcranial Magnetic Stimulation

consecutive weeks). Relapse was the primary outcome measure. The reported results stated that 10 of 99 (10%; Kaplan-Meier survival estimate = 12.9%) patients relapsed. Thirty-eight (38.4%) patients met criteria for symptom worsening and 32/38 (84.2%) re-achieved symptomatic benefit with adjunctive TMS. Safety and tolerability were similar to acute TMS monotherapy. They concluded that the initial data suggested that the therapeutic effects of TMS are durable and that TMS may be successfully used as an intermittent rescue strategy to preclude impending relapse.

Holtzheimer et al (2010) reported that repetitive transcranial magnetic stimulation (rTMS) has shown safety and efficacy for treatment-resistant depression, but requires daily treatment for 4-6 weeks. Accelerated TMS, with all treatments delivered over a few days, would have significant advantages in terms of access and patient acceptance. They administered open-label accelerated TMS (aTMS), consisting of 15 rTMS sessions administered over 2 days, was tested in 14 depressed patients not responding to at least one antidepressant medication. Effects on depression, anxiety, and cognition were assessed the day following treatment, then after 3 and 6 weeks. No seizure activity was observed and only one patient had a serious adverse event (increased suicidal ideation). Two patients failed to complete a full course of aTMS treatments, and 36% did not complete all study visits. Depression and anxiety significantly decreased following aTMS treatments and improvements persisted 3 and 6 weeks later. Response rates immediately following treatment and at 3 and 6 weeks were 43, 36, and 36%, respectively. Remission rates at the same timepoints were 29, 36, and 29%. The authors concluded that accelerated TMS demonstrated an excellent safety profile with efficacy comparable to that achieved in daily rTMS in other trials. Limitations primarily include open-label treatment and a small sample size.

Triggs et al (2010) conducted a prospective, randomized, sham-controlled, double blind, parallel group study of right or left pre-frontal rTMS in 48 subjects with medication-resistant depression. Two thousand (50x8-s trains of 5Hz) stimuli at MEP threshold were delivered each weekday for 2 weeks. They employed a sham coil and simultaneous electrical stimulation of the scalp to simulate rTMS. Mean (+/-S.D.) reductions in the HAMD-24 from baseline to 3-months were not significantly different between rTMS and sham treatment groups. However, right cranial stimulation (sham or rTMS) was significantly more effective than left cranial stimulation (sham or rTMS) ($P=0.012$). Mean (+/-S.D.) reductions in the HAMD from baseline to 3 months were: left: 28.1 (+/-5.36) to 19.2 (+/-11.2); and right 27.2 (+/-4.2) to 11.5 (+/-9.4). Left rTMS achieved a reduction in HAMD 9.5 points greater than that achieved by left sham, a benefit greater than that reported in a recent multi-center Phase III trial of rTMS (O'Reardon et al., 2007), albeit not statistically significant. These results suggest that somatosensory stimuli that repeatedly engage the left hemisphere may be important to the achievement of therapeutic effect.

Kim et al (2018) did a randomized controlled TMS trial in pregnant women with major depression ($N=22$). Response rates were 81.82% for the active and 45.45% for the sham coil ($p=0.088$). Remission rates were 27.27% for the active 18.18% for the sham coil ($p=0.613$). Late



CLINICAL POLICY

POLICY TITLE: Transcranial Magnetic Stimulation

preterm birth (PTB) occurred in three women receiving active TMS. All other maternal and delivery outcomes were normal.

In general, studies of rTMS in the medical literature show a short-term benefit for patients with a treatment resistant major depressive disorder who received active versus sham rTMS. Treatment benefit has been defined by response or remission rates using measurements made with validated depression rating scales. Most studies have short treatment periods, varying from one to six weeks and few studies have included long term outcomes. Questions remain about stimulation parameters and the length of optimal treatment but treatment is well-tolerated without significant adverse events and clinically significant results. Additional questions are raised about the comparative effectiveness of the devices used, and their use for “maintenance” or prevention of post-treatment relapse as well as the durability of the clinical effect after end of treatment.

A 2018 Hayes review finds evidence suggesting there may be a potential but unproven benefit for the use of TMS as augmentation for pharmacotherapy for depression. New forms of TMS are under investigation in general major depressive disorder (MDD) populations. Two examples are paired pulse TMS and theta burst stimulation (TBS). Standard TMS delivers single pulses of magnetic energy repetitively, whereas paired pulse TMS delivers 2 pulses of magnetic energy simultaneously. For paired pulse TMS, pulses may be delivered at the same or different intensity. As with standard TMS, stimulation parameters vary and may involve low-frequency pulses, which inhibit cortical activity, or high-frequency pulses, which stimulate cortical activity. TBS involves short bursts of 3 low-intensity pulses with inner high-frequency (within the gamma range) pulses that are delivered at 5 Hertz (within the theta range). Applying TBS continuously for 40 seconds has stimulatory effects, while applying TBS intermittently (e.g., 2-second pulses every 10 seconds) has inhibitory effects. The US Food and Drug Administration (FDA) has approved in 2018 a newer and faster treatment protocol for the *MagVita* rTMS therapy system from MagVenture. With the new treatment protocol, which uses intermittent theta-burst stimulation (iTBS), a treatment session lasts only 3 minutes with only 20-30 sessions needed in total (Blumberger DM et al, 2018).

Some investigators have considered whether neuronavigation (e.g., with magnetic resonance imaging guidance) would improve the effectiveness of TMS for treatment-resistant depression (Fitzgerald et al., 2009). A new open label study using Bilateral Neuronavigated TBS-20Hz TMS brought more than two-thirds of treatment refractory depressed patients to remission (Stubbeman WF et al., 2018).

A new line of investigation has been looking at Low Frequency TMS added to antidepressant medication in the treatment of Treatment Resistant Major Depression. According to a 2019 Hayes update, overall, a low-quality body of evidence suggests that Low Frequency Right TMS (LFrTMS) in addition to pharmacotherapy produced antidepressant effects in patients with treatment-resistant MDD. However, results were mixed suggesting no difference between LFrTMS and sham therapy as an adjuvant therapy to antidepressant treatment. Results also suggest no difference between LFrTMS and High Frequency Right TMS (HFrTMS) as add-on therapy. A very-low quality body of evidence does not allow for definitive conclusions regarding



CLINICAL POLICY

POLICY TITLE: Transcranial Magnetic Stimulation

the efficacy or comparative effectiveness of LFrTMS as monotherapy. Although the evidence suggests short-term efficacy of LFrTMS in treatment-resistant MDD, the comparative effectiveness of LFrTMS, and active comparators in this population remains uncertain. Additional studies designed to establish long-term efficacy and optimal treatment parameters for LFrTMS are needed. In addition, well-powered rigorous head-to-head evaluations comparing LFrTMS with pharmacotherapy, ECT, or HFrTMS for treatment-resistant MDD are needed. RCTs or cohort studies with well-controlled analyses are essential in determining the relationship between treatment effect and patient characteristics. Such studies, providing that they were powered to detect meaningful differences between LFrTMS and sham groups, could help identify patients most likely to benefit.

Coding Implications

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CPT® Codes	Description
90867	Therapeutic repetitive transcranial magnetic stimulation (tms) treatment; initial, including cortical mapping, motor threshold determination, delivery and management
90868	Therapeutic repetitive transcranial magnetic stimulation (tms) treatment; subsequent delivery and management, per session
90869	Therapeutic repetitive transcranial magnetic stimulation (tms) treatment; subsequent motor threshold re-determination with delivery and management

HCPCS Codes	Description

ICD-10-CM Diagnosis Codes that Support Coverage Criteria

ICD-10-CM Code	Description
F32.x*	Depressive episode
F33.x*	Recurrent depressive episode



CLINICAL POLICY

POLICY TITLE: Transcranial Magnetic Stimulation

Reviews, Revisions, and Approvals	Date	Approval Date
Policy initiated		3/12
Removed requirement for Anti-depression Treatment History Form, revised trial of psychopharmacologic agents, added that if further treatment may not be indicated if no response within in 30 treatments		4/13
A second device was FDA approved for treatment with TMS. Updated criteria to require two trials of mono- or poly-drug therapy etc... rather than one		6/14
Strengthened evidence-based guidelines, revised criteria by removing that the patient had a good response to previous TMS treatment	6/15	7/15
Removed pregnancy as a contraindication		7/16
Reviewed by MHN and Health Net, no changes	6/17	6/17
Added background information including HAYES		4/18
Reviewed by MHN QI Committee	6/18	6/18
Reviewed by MHN QI Committee Reviewed by Net Medical Advisory Council Added to I.E: last sentence regarding partial therapeutic response... Added to I.I that patient should experience a 25% reduction in depression symptoms by the 20 th TMS session to indicate effectiveness of treatment	12/19 1/20	1/20

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CLINICAL POLICY

POLICY TITLE: Transcranial Magnetic Stimulation

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CLINICAL POLICY

POLICY TITLE: Transcranial Magnetic Stimulation

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CLINICAL POLICY

POLICY TITLE: Transcranial Magnetic Stimulation

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Important Reminder

This clinical policy has been developed by appropriately experienced and licensed health care professionals based on a review and consideration of currently available generally accepted standards of medical practice; peer-reviewed medical literature; government agency/program approval status; evidence-based guidelines and positions of leading national health professional



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CLINICAL POLICY

POLICY TITLE: Transcranial Magnetic Stimulation

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CLINICAL POLICY

POLICY TITLE: **Transcranial Magnetic Stimulation**

Please refer to the state Medicaid manual for any coverage provisions pertaining to this clinical policy.

Note: For Medicare members, to ensure consistency with the Medicare National Coverage Determinations (NCD) and Local Coverage Determinations (LCD), all applicable NCDs, LCDs, and Medicare Coverage Articles should be reviewed prior to applying the criteria set forth in this clinical policy. Refer to the CMS website at <http://www.cms.gov> for additional information.

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