

MEDICAL POLICY

POLICY TITLE	NAVIGATED TRANSCRANIAL MAGNETIC STIMULATION (NTMS)
POLICY NUMBER	2.094

CLINICAL BENEFIT	<input type="checkbox"/> MINIMIZE SAFETY RISK OR CONCERN. <input checked="" type="checkbox"/> MINIMIZE HARMFUL OR INEFFECTIVE INTERVENTIONS. <input type="checkbox"/> ASSURE APPROPRIATE LEVEL OF CARE. <input type="checkbox"/> ASSURE APPROPRIATE DURATION OF SERVICE FOR INTERVENTIONS. <input type="checkbox"/> ASSURE THAT RECOMMENDED MEDICAL PREREQUISITES HAVE BEEN MET. <input type="checkbox"/> ASSURE APPROPRIATE SITE OF TREATMENT OR SERVICE.
Effective Date:	1/1/2025

[POLICY RATIONALE](#)
[DISCLAIMER](#)
[POLICY HISTORY](#)

[PRODUCT VARIATIONS](#)
[DEFINITIONS](#)
[CODING INFORMATION](#)

[DESCRIPTION/BACKGROUND](#)
[BENEFIT VARIATIONS](#)
[REFERENCES](#)

I. POLICY

Navigated transcranial magnetic stimulation is considered **investigational** for all purposes, including but not limited to, the preoperative evaluation of patients being considered for brain surgery when localization of eloquent areas of the brain (e.g., controlling verbal or motor function) is an important consideration in surgical planning. There is insufficient evidence to support a general conclusion concerning the health outcomes or benefits associated with this procedure.

II. PRODUCT VARIATIONS

[TOP](#)

This policy is only applicable to certain programs and products administered by Capital Blue Cross please see additional information below, and subject to benefit variations as discussed in Section VI below.

FEP PPO - Refer to FEP Medical Policy Manual. The FEP Medical Policy Manual can be found at:

<https://www.fepblue.org/benefit-plans/medical-policies-and-utilization-management-guidelines/medical-policies>

III. DESCRIPTION/BACKGROUND

[TOP](#)

Management of Brain Tumors

Surgical management of brain tumors involves resecting the brain tumor and preserving essential brain function. "Mapping" of brain functions, such as body movement and language, is most accurately achieved with direct cortical stimulation (DCS), an intraoperative procedure that lengthens operating times and requires a wide surgical opening. Even if not completely accurate compared with DCS, preoperative techniques that map brain functions may aid in planning the extent of resection and the surgical approach. Although DCS is still usually performed to confirm

MEDICAL POLICY

POLICY TITLE	NAVIGATED TRANSCRANIAL MAGNETIC STIMULATION (NTMS)
POLICY NUMBER	2.094

the brain locations associated with specific functions, preoperative mapping techniques may provide useful information that improves patient outcomes.

Noninvasive Mapping Techniques

The most commonly used tool for the noninvasive localization of brain functions is functional magnetic resonance imaging (fMRI). Functional MRI identifies regions of the brain where there are changes in localized cortical blood oxygenation, which correlate with the neuronal activity associated with a specific motor or speech task being performed as the image is obtained. The accuracy and precision of fMRI depend on the patient's ability to perform the isolated motor task, such as moving the single assigned muscle without moving others. This may be difficult in patients in whom brain tumors have caused partial or complete paresis. The reliability of fMRI in mapping language areas has been questioned. Guissani et al (2010) reviewed several studies comparing fMRI with DCS of language areas and found large variability in the sensitivity and specificity rates of fMRI. Reviewers also pointed out a major conceptual point in how fMRI and DCS "map" language areas: fMRI identifies regional oxygenation changes, which show that a particular region of the brain is involved in the capacity of interest, whereas DCS locates specific areas in which the activity of interest is disrupted. Regions of the brain involved in a certain activity may not necessarily be required for that activity and could theoretically be safely resected.

Magnetoencephalography (MEG) is also used to map brain activity. In this procedure, electromagnetic recorders are attached to the scalp. Unlike electroencephalography, MEG records magnetic fields generated by electric currents in the brain, rather than the electric currents themselves. Magnetic fields tend to be less distorted by the skull and scalp than electric currents, yielding an improved spatial resolution. MEG is conducted in a magnetically shielded room to screen out environmental electric or magnetic noises that could interfere with the MEG recording.

Navigated transcranial magnetic stimulation (nTMS) is a noninvasive imaging method for evaluating eloquent brain areas. Transcranial magnetic pulses are delivered to the patient as a navigation system calculates the strength, location, and direction of the stimulating magnetic field. The locations of these pulses are registered to a magnetic resonance image of the patient's brain. Surface electromyography electrodes are attached to various limb muscles of the patient. Moving the magnetic stimulation source to various parts of the brain causes electromyography electrodes to respond, indicating the part of the cortex involved in particular muscle movements. For evaluation of language areas, magnetic stimulation areas that disrupt specific speech tasks are thought to identify parts of the brain involved in speech function. Navigated TMS can be considered a noninvasive alternative to DCS, in which electrodes are directly applied to the surface of the cortex during craniotomy. Navigated TMS is being evaluated as an alternative to other noninvasive cortical mapping techniques (eg, fMRI, MEG) for presurgical identification of cortical areas involved in motor and language functions. Navigated TMS, used for cortical language area mapping, is also being investigated in combination with diffusion tensor imaging tractography for subcortical white matter tract mapping.

Regulatory Status

MEDICAL POLICY

POLICY TITLE	NAVIGATED TRANSCRANIAL MAGNETIC STIMULATION (NTMS)
POLICY NUMBER	2.094

The Nexstim Navigated Brain Stimulation System (NBS) 5 Motor Mapping System and NBS 5 Speech Mapping System with NexSpeech® were cleared for marketing by the FDA through the 510(k) process for noninvasive mapping of the primary motor cortex of the brain to its cortical gyrus and for localization of cortical areas that do not contain speech function for preprocedural planning.

IV. RATIONALE

[TOP](#)

Summary of Evidence

For individuals who have brain lesion(s) undergoing preoperative evaluation for localization of eloquent areas of the brain who receive navigated transcranial magnetic stimulation (nTMS), the evidence includes controlled observational studies and case series. Relevant outcomes are overall survival, test accuracy, morbid events, and functional outcomes. Several small studies have evaluated the distance between nTMS hotspots and direct cortical stimulation hotspots for the same muscle. Although the average distance in most studies is 10 mm or less, this does not take into account the error margin in this average distance or whether hotspots are missed. It is difficult to verify nTMS hotspots fully because only exposed cortical areas can be verified with direct cortical stimulation. Limited studies of nTMS evaluating language areas have shown high false-positive rates (low specificity) and sensitivity that may be insufficient for clinical use. Several controlled observational studies have compared outcomes in patients undergoing nTMS with those (generally pre-TMS historical controls) who did not undergo nTMS. Findings of the studies were mixed; outcomes were not consistently better in patients who underwent presurgical nTMS. For example, overall survival did not differ significantly between groups in two studies and one reporting postoperative language deficits found significantly fewer deficits in the group that had presurgical nTMS. The controlled observational studies had various methodologic limitations and being nonrandomized, may not have adequately controlled for differences in patient groups, which may have biased outcomes. The evidence is insufficient to determine the effects of the technology on health outcomes.

V. DEFINITIONS

[TOP](#)

NA

VI. BENEFIT VARIATIONS

[TOP](#)

The existence of this medical policy does not mean that this service is a covered benefit under the member's health benefit plan. Benefit determinations should be based in all cases on the applicable health benefit plan language. Medical policies do not constitute a description of benefits. A member's health benefit plan governs which services are covered, which are excluded, which are subject to benefit limits, and which require preauthorization. There are different benefit plan designs in each product administered by Capital Blue Cross. Members and providers should consult the member's health benefit plan for information or contact Capital Blue Cross for benefit information.

MEDICAL POLICY

POLICY TITLE	NAVIGATED TRANSCRANIAL MAGNETIC STIMULATION (NTMS)
POLICY NUMBER	2.094

VII. DISCLAIMER

[TOP](#)

Capital Blue Cross' medical policies are developed to assist in administering a member's benefits, do not constitute medical advice and are subject to change. Treating providers are solely responsible for medical advice and treatment of members. Members should discuss any medical policy related to their coverage or condition with their provider and consult their benefit information to determine if the service is covered. If there is a discrepancy between this medical policy and a member's benefit information, the benefit information will govern. If a provider or a member has a question concerning the application of this medical policy to a specific member's plan of benefits, please contact Capital Blue Cross' Provider Services or Member Services. Capital Blue Cross considers the information contained in this medical policy to be proprietary and it may only be disseminated as permitted by law.

VIII. CODING INFORMATION

[TOP](#)

Note: This list of codes may not be all-inclusive, and codes are subject to change at any time. The identification of a code in this section does not denote coverage as coverage is determined by the terms of member benefit information. In addition, not all covered services are eligible for separate reimbursement.

Investigational:

Procedure Codes							
64999							

IX. REFERENCES

[TOP](#)

1. *Giussani C, Roux FE, Ojemann J, et al. Is preoperative functional magnetic resonance imaging reliable for language areas mapping in brain tumor surgery? Review of language functional magnetic resonance imaging and direct cortical stimulation correlation studies. Neurosurgery. Jan 2010; 66(1): 113-20. PMID 19935438*
2. *Jeltema HR, Ohlerth AK, de Wit A, et al. Comparing navigated transcranial magnetic stimulation mapping and "gold standard" direct cortical stimulation mapping in neurosurgery: a systematic review. Neurosurg Rev. Aug 2021; 44(4): 1903-1920. PMID 33009990*
3. *Rizzo V, Terranova C, Conti A, et al. Preoperative functional mapping for rolandic brain tumor surgery. Neurosci Lett. Nov 07 2014; 583: 136-41. PMID 25224631*
4. *Mangraviti A, Casali C, Cordella R, et al. Practical assessment of preoperative functional mapping techniques: navigated transcranial magnetic stimulation and functional magnetic resonance imaging. Neurol Sci. Sep 2013; 34(9): 1551-7. PMID 23266868*
5. *Opitz A, Zafar N, Bockermann V, et al. Validating computationally predicted TMS stimulation areas using direct electrical stimulation in patients with brain tumors near precentral regions. Neuroimage Clin. 2014; 4: 500-7. PMID 24818076*
6. *Forster MT, Limbart M, Seifert V, et al. Test-retest reliability of navigated transcranial magnetic stimulation of the motor cortex. Neurosurgery. Mar 2014; 10 Suppl 1: 51-5; discussion 55-6. PMID 23842557*

MEDICAL POLICY

POLICY TITLE	NAVIGATED TRANSCRANIAL MAGNETIC STIMULATION (NTMS)
POLICY NUMBER	2.094

7. Kato N, Schilt S, Schneider H, et al. Functional brain mapping of patients with arteriovenous malformations using navigated transcranial magnetic stimulation: first experience in ten patients. *Acta Neurochir (Wien)*. May 2014; 156(5): 885-95. PMID 24639144
8. Baro V, Sartori L, Caliri SL, et al. Navigated Transcranial Magnetic Stimulation Motor Mapping and Diffusion Tensor Imaging Tractography for Diencephalic Tumor in Pediatric Patients. *Brain Sci*. Jan 30 2023; 13(2). PMID 36831777
9. Ille S, Kelm A, Schroeder A, et al. Navigated repetitive transcranial magnetic stimulation improves the outcome of postsurgical paresis in glioma patients - A randomized, double-blinded trial. *Brain Stimul*. 2021; 14(4): 780-787. PMID 33984536
10. Weiss C, Nettekoven C, Rehme AK, et al. Mapping the hand, foot and face representations in the primary motor cortex - retest reliability of neuronavigated TMS versus functional MRI. *Neuroimage*. Feb 01 2013; 66: 531-42. PMID 23116812
11. Schmidt S, Bathe-Peters R, Fleischmann R, et al. Nonphysiological factors in navigated TMS studies; confounding covariates and valid intracortical estimates. *Hum Brain Mapp*. Jan 2015; 36(1): 40-9. PMID 25168635
12. Sollmann N, Ille S, Boeckh-Behrens T, et al. Mapping of cortical language function by functional magnetic resonance imaging and repetitive navigated transcranial magnetic stimulation in 40 healthy subjects. *Acta Neurochir (Wien)*. Jul 2016; 158(7): 1303-16. PMID 27138329
13. Sollmann N, Tanigawa N, Tussis L, et al. Cortical regions involved in semantic processing investigated by repetitive navigated transcranial magnetic stimulation and object naming. *Neuropsychologia*. Apr 2015; 70: 185-95. PMID 25731903
14. Schramm S, Albers L, Ille S, et al. Navigated transcranial magnetic stimulation of the supplementary motor cortex disrupts fine motor skills in healthy adults. *Sci Rep*. Nov 28 2019; 9(1): 17744. PMID 31780823
15. Picht T, Schmidt S, Brandt S, et al. Preoperative functional mapping for rolandic brain tumor surgery: comparison of navigated transcranial magnetic stimulation to direct cortical stimulation. *Neurosurgery*. Sep 2011; 69(3): 581-8; discussion 588. PMID 21430587
16. Forster MT, Hattingen E, Senft C, et al. Navigated transcranial magnetic stimulation and functional magnetic resonance imaging: advanced adjuncts in preoperative planning for central region tumors. *Neurosurgery*. May 2011; 68(5): 1317-24; discussion 1324-5. PMID 21273929
17. Tarapore PE, Tate MC, Findlay AM, et al. Preoperative multimodal motor mapping: a comparison of magnetoencephalography imaging, navigated transcranial magnetic stimulation, and direct cortical stimulation. *J Neurosurg*. Aug 2012; 117(2): 354-62. PMID 22702484
18. Krieg SM, Shiban E, Buchmann N, et al. Utility of presurgical navigated transcranial magnetic brain stimulation for the resection of tumors in eloquent motor areas. *J Neurosurg*. May 2012; 116(5): 994-1001. PMID 22304452
19. Raffa G, Scibilia A, Conti A, et al. The role of navigated transcranial magnetic stimulation for surgery of motor-eloquent brain tumors: a systematic review and meta-analysis. *Clin Neurol Neurosurg*. May 2019; 180: 7-17. PMID 30870762

MEDICAL POLICY

POLICY TITLE	NAVIGATED TRANSCRANIAL MAGNETIC STIMULATION (NTMS)
POLICY NUMBER	2.094

20. Krieg SM, Sollmann N, Obermueller T, et al. Changing the clinical course of glioma patients by preoperative motor mapping with navigated transcranial magnetic brain stimulation. *BMC Cancer*. Apr 08 2015; 15: 231. PMID 25884404

21. Frey D, Schilt S, Strack V, et al. Navigated transcranial magnetic stimulation improves the treatment outcome in patients with brain tumors in motor eloquent locations. *Neuro Oncol*. Oct 2014; 16(10): 1365-72. PMID 24923875

22. Hendrix P, Senger S, Simgen A, et al. Preoperative rTMS Language Mapping in Speech-Eloquent Brain Lesions Resected Under General Anesthesia: A Pair-Matched Cohort Study. *World Neurosurg*. Apr 2017; 100: 425-433. PMID 28109861

23. Schiller K, Choudhri AF, Jones T, et al. Concordance Between Transcranial Magnetic Stimulation and Functional Magnetic Resonance Imaging (MRI) Derived Localization of Language in a Clinical Cohort. *J Child Neurol*. May 2020; 35(6): 363-379. PMID 32122221

24. Picht T, Schulz J, Hanna M, et al. Assessment of the influence of navigated transcranial magnetic stimulation on surgical planning for tumors in or near the motor cortex. *Neurosurgery*. May 2012; 70(5): 1248-56; discussion 1256-7. PMID 22127045

25. Fang X, Liu M, Lu C, Zhao Y, Liu X. Current status and potential application of navigated transcranial magnetic stimulation in neurosurgery: a literature review. *Chin Neurosurg J*. 2019;5:12. Published 2019 May 21. doi:10.1186/s41016-019-0159-6

26. Motomura K, Takeuchi H, Nojima I, et al. Navigated repetitive transcranial magnetic stimulation as preoperative assessment in patients with brain tumors. *Sci Rep*. 2020;10(1):9044. Published 2020 Jun 3. doi:10.1038/s41598-020-65944-8

27. Haddad AF, Young JS, Berger MS, Tarapore PE. Preoperative Applications of Navigated Transcranial Magnetic Stimulation. *Front Neurol*. 2021;11:628903. Published 2021 Jan 22. doi:10.3389/fneur.2020.628903

28. Umana GE, Scalia G, Graziano F, et al. Navigated Transcranial Magnetic Stimulation Motor Mapping Usefulness in the Surgical Management of Patients Affected by Brain Tumors in Eloquent Areas: A Systematic Review and Meta-Analysis. *Front Neurol*. 2021;12:644198. Published 2021 Mar 4. doi:10.3389/fneur.2021.644198

29. Blue Cross Blue Shield Association Medical Policy Reference Manual. 2.01.90 Navigated Transcranial Magnetic Stimulation. Archived July 11, 2024

X. POLICY HISTORY

[TOP](#)

MP 2.094	06/08/2020 Consensus Review. No change to policy statement. Rationale and references reviewed.
	08/04/2021 Consensus Review. No change to policy statement. References updated.
	07/15/2022 Consensus Review. No change to policy statement. References reviewed and updated.
	08/16/2023 Consensus Review. Cross-references, FEP, background, and references updated. No changes to coding.
	01/19/2024 Administrative Update. Clinical benefit added.
	09/17/2024 Consensus Review. No changes to coding. Updated references.

MEDICAL POLICY

POLICY TITLE	NAVIGATED TRANSCRANIAL MAGNETIC STIMULATION (NTMS)
POLICY NUMBER	2.094

[Top](#)

Health care benefit programs issued or administered by Capital Blue Cross and/or its subsidiaries, Capital Advantage Insurance Company[®], Capital Advantage Assurance Company[®] and Keystone Health Plan[®] Central. Independent licensees of the Blue Cross BlueShield Association. Communications issued by Capital Blue Cross in its capacity as administrator of programs and provider relations for all companies.