



Geisinger Health Plan Policies and Procedure Manual

Policy: MP073

Section: Medical Benefit Policy

Subject: Deep Brain Stimulation

Applicable line of business:

Commercial	x	Medicaid	x
Medicare	x	ACA	x
CHIP	x		

I. Policy: Deep Brain Stimulation

II. Purpose/Objective:

To provide a policy of coverage regarding Deep Brain Stimulation

III. Responsibility:

- A. Medical Directors
- B. Medical Management

IV. Required Definitions

1. Attachment – a supporting document that is developed and maintained by the policy writer or department requiring/authoring the policy.
2. Exhibit – a supporting document developed and maintained in a department other than the department requiring/authoring the policy.
3. Devised – the date the policy was implemented.
4. Revised – the date of every revision to the policy, including typographical and grammatical changes.
5. Reviewed – the date documenting the annual review if the policy has no revisions necessary.

Commercial

Geisinger Health Plan may refer collectively to health care coverage sponsors Geisinger Health Plan, Geisinger Quality Options, Inc., and Geisinger Indemnity Insurance Company, unless otherwise noted. Geisinger Health Plan is part of Geisinger, an integrated health care delivery and coverage organization.

Medicare

Geisinger Gold Medicare Advantage HMO, PPO, and HMO D-SNP plans are offered by Geisinger Health Plan/Geisinger Indemnity Insurance Company, health plans with a Medicare contract. Continued enrollment in Geisinger Gold depends on contract renewal. Geisinger Health Plan/Geisinger Indemnity Insurance Company are part of Geisinger, an integrated health care delivery and coverage organization.

CHIP

Geisinger Health Plan Kids (GHP Kids) is a Children’s Health Insurance Program (CHIP) offered by Geisinger Health Plan in conjunction with the Pennsylvania Department of Human Services (DHS). Geisinger Health Plan is part of Geisinger, an integrated health care delivery and coverage organization.

Medicaid

Geisinger Health Plan Family (GHP Family) is a Medical Assistance (Medicaid) insurance program offered by Geisinger Health Plan in conjunction with the Pennsylvania Department of Human Services (DHS). Geisinger Health Plan is part of Geisinger, an integrated health care delivery and coverage organization.

V. Additional Definitions

Medical Necessity or Medically Necessary means Covered Services rendered by a Health Care Provider that the Plan determines are:

- a. appropriate for the symptoms and diagnosis or treatment of the Member's condition, illness, disease or injury;
- b. provided for the diagnosis, and the direct care and treatment of the Member's condition, illness disease or injury;
- c. in accordance with current standards of good medical treatment practiced by the general medical community.
- d. not primarily for the convenience of the Member, or the Member's Health Care Provider; and
- e. the most appropriate source or level of service that can safely be provided to the Member. When applied to hospitalization, this further means that the Member requires acute care as an inpatient due to the nature of the services rendered or the Member's condition, and the Member cannot receive safe or adequate care as an outpatient.

Medicaid Business Segment

Medically Necessary — A service, item, procedure, or level of care that is necessary for the proper treatment or management of an illness, injury, or disability is one that:

- Will, or is reasonably expected to, prevent the onset of an illness, condition, injury or disability.
- Will, or is reasonably expected to, reduce or ameliorate the physical, mental or developmental effects of an illness, condition, injury or disability.
- Will assist the Member to achieve or maintain maximum functional capacity in performing daily activities, taking into account both the functional capacity of the Member and those functional capacities that are appropriate for Members of the same age

DESCRIPTION:

Unilateral or bilateral deep brain stimulation of the thalamus, or bilateral stimulation of the globus pallidus or sub-thalamic nucleus refers to a neurosurgical procedure where a device is implanted in the brain for the control of tremors in selected members who have been diagnosed with essential tremor or Parkinsonian tremor. The device consists of a pacemaker-like chest unit that transmits mild electrical pulses through a wire to a lead that is stereotactically implanted in the thalamus or selected surrounding structures. This procedure, being reversible, is an alternative to permanent neuroablative procedures such as thalamotomy and pallidotomy in patients with significant functional disability and who are refractory to maximized pharmacological management.

INDICATIONS:

- Essential tremor
- Parkinson's disease tremor or complicated motor fluctuation
- Intractable primary dystonia, including generalized and/or segmental dystonia, hemidystonia and cervical dystonia when used in accordance with the Humanitarian Device Exemption specifications of the U.S. Food and Drug Administration
- Medically refractory epilepsy

CRITERIA FOR COVERAGE: Requires Prior Authorization by a Plan Medical Director or designee

Note: This prior auth requirement only applies to initial placement, and not to revision(s) and replacement(s) after implantation.

Essential Tremor: unilateral or bilateral deep brain stimulation of the ventral intermediate (Vim) nucleus is considered medically necessary when all of the following criteria are met:

- Diagnosis of disabling essential tremor refractory to pharmacotherapy
- The tremor constitutes a significant functional disability as evidenced by a standardized scale (e.g., Fahn-Tolosa-Marin Clinical Tremor Rating Scale*, TETRAS**, or equivalent scale) or discussion of their ADL or iADL limitations with their physician.

*<https://www.yumpu.com/en/document/view/11254127/fahn-tolosa-marin-tremor-rating-scale>

** https://www.bcm.edu/neurology/pdf/poster_other_TETRAS.pdf

Parkinson's Disease: unilateral or bilateral deep brain stimulation of the ventral intermediate thalamic nucleus, internal globus pallidus (GPi) or the subthalamic nucleus (STN) is considered medically necessary when all of the following criteria are met:

- History of clearly documented Parkinson's disease, diagnosed using the UK Parkinson's disease brain bank criteria that has responded to pharmacologic therapy in the past, **and**
- Having symptoms of parkinsonism for at least four years, and
- One of the following:
 - Disabling motor fluctuations despite optimized medical/pharmacologic therapy; or
 - Disabling tremor despite optimized medical/pharmacologic therapy.

Primary Dystonia unilateral or bilateral deep brain stimulation of the internal globus pallidus (GPi) or the subthalamic nucleus (STN) is considered medically necessary when all of the following criteria are met:

- Chronic, intractable primary dystonia, including generalized and/or segmental dystonia, hemidystonia, or cervical dystonia (torticollis); and
- Member is 7 years of age or older; and
- Medical documentation that the condition is refractory to pharmacotherapy

Medically Refractory Epilepsy Deep brain stimulation of the anterior nucleus of thalamus is considered medically necessary using the Medtronic DBS System for Epilepsy when all of the following criteria are met:

- Member is 18 years of age or older; and
- Documentation of focal (partial-onset) seizures with or without secondary generalized seizures; and
- The member is currently averaging 6 or more focal (partial-onset) seizures per month with no more than 30 days between seizures with current antiepileptic drug regimen; and
- Is deemed to be medically refractory having tried and failed at least 3 antiepileptic drugs; and
- The member is not a candidate for, or has failed resective epilepsy surgery; and
- There is no evidence of a neurological disorder or condition likely to progress such as but not limited to: brain tumor, arteriovenous malformations (AVM) that are likely to progress; meningitis or abscess; or encephalitis.

NOTE: Services related to component reimplantation or replacement in members previously approved for the implantation, or members having had the implantation prior to enrollment in the Plan, and who otherwise meet criteria for coverage, do not require prior authorization.

CONTRAINDICATIONS:

- Independent diagnoses that could explain the failure to respond to medical treatment
- Mental impairment, moderate to severe cognitive impairment or uncontrolled depression
- Focal lesions of the basal ganglia (lacunae or space occupying lesion) or at the target site.
- Surgical risk is unacceptable due to comorbid conditions

RESPONSIVE NEUROSTIMULATION:

For criteria relate to responsive neurostimulation as a treatment for refractory treatment-resistant epilepsy, please see MP330 Responsive Neurostimulation

FOR MEDICARE BUSINESS SEGMENT: See also NCD 160.24 Deep Brain Stimulation for Essential Tremor and Parkinson's Disease

EXCLUSIONS:

The Plan does **NOT** provide coverage for Deep brain stimulation for control of tremor induced by any diagnosis other than those listed above because it is considered **unproven**. There is insufficient evidence in the peer-reviewed published medical literature to establish the effectiveness of this treatment on health outcomes when compared to established treatments or technologies. The list of such diagnosis includes, but is not limited to:

- | | |
|---|---|
| • Trauma | • Multiple Sclerosis |
| • Neurological Degenerative Disorders | • Metabolic Disorders |
| • Infectious Disease | • Drug Induced Movement Disorders |
| • Obsessive Compulsive Disorder (must be reviewed by a Plan Behavioral Health Medical Director or designee) | • Tourette's Syndrome |
| • Tardive dyskinesia | • Neuropsychiatric conditions (must be reviewed by a Plan Behavioral Health Medical Director or designee) |
| • Cerebral palsy | • Chronic pain |

- Chronic Intractable Cluster Headaches
- Post-traumatic tremor

Medicaid Business Segment:

Any requests for services, that do not meet criteria set in the PARP, may be evaluated on a case by case basis.

Note: A complete description of the process by which a given technology or service is evaluated and determined to be experimental, investigational or unproven services is outlined in **MP 15 - Experimental Investigational or Unproven Services or Treatment**

CODING ASSOCIATED WITH: Deep Brain Stimulation

The following codes are included below for informational purposes and may not be all inclusive. Inclusion of a procedure or device code(s) does not constitute or imply coverage nor does it imply or guarantee provider reimbursement. Coverage is determined by the member specific benefit plan document and any applicable laws regarding coverage of specific services. Please note that per Medicare coverage rules, only specific CPT/HCPCS Codes may be covered for the Medicare Business Segment. Please consult the CMS website at www.cms.gov or the local Medicare Administrative Carrier (MAC) for more information on Medicare coverage and coding requirements

- 61850 twist drill or burr hole(s) for implantation of neurostimulator electrodes, cortical
- 61860 craniectomy or craniotomy for implantation of neurostimulator electrodes, cerebral, cortical
- 61863 Twist drill, burr hole, craniotomy, or craniectomy for stereotactic implantation of neurostimulator array in subcortical site (eg, thalamus, globus pallidus, subthalamic nucleus, periventricular, periaqueductal gray) without use of intraoperative microelectrode recording; first array
- 61864 each additional array
- 61867 Twist drill, burr hole, craniotomy, or craniectomy for stereotactic implantation of neurostimulator array in subcortical site (eg, thalamus, globus pallidus, subthalamic nucleus, periventricular, periaqueductal gray) with use of intraoperative microelectrode recording; first array
- 61868 each additional array
- 61870 craniectomy for implantation of neurostimulator electrodes, cerebellar, cortical
- 61880 Revision or removal of intracranial neurostimulator electrodes
- 61885 Incision and subcutaneous placement of cranial neurostimulator pulse generator or receiver, direct or inductive coupling; with connection to a single electrode array
- 61886 with connection to two or more electrode arrays
- 61888 Revision or removal of cranial neurostimulator pulse generator or receiver
- 61889 Insertion of skull-mounted cranial neurostimulator pulse generator or receiver, including craniectomy or craniotomy, when performed, with direct or inductive coupling, with connection to depth and/or cortical strip electrode array(s)
- 61891 Revision or replacement of skull-mounted cranial neurostimulator pulse generator or receiver with connection to depth and/or cortical strip electrode array(s)
- 61892 Removal of skull-mounted cranial neurostimulator pulse generator or receiver with cranioplasty, when performed
- 95961 Functional cortical and subcortical mapping by stimulation and/or recording of electrodes on brain surface, or of depth electrodes, to provoke seizure or identify vital brain structures; initial hour of physician attendance
- 95962 each additional hour of physician attendance (List separately in addition to code for primary procedure)
- 95970 Electronic analysis of implanted neurostimulator pulse generator system (eg, rate, pulse amplitude and duration, configuration of wave form, battery status, electrode selectability, output modulation, cycling, impedance and patient compliance measurements); simple or complex brain, spinal cord, or peripheral (i.e., cranial nerve, peripheral nerve, autonomic nerve, neuromuscular) neurostimulator pulse generator/transmitter, without reprogramming
- 95971 simple brain, spinal cord, or peripheral (i.e., peripheral nerve, autonomic nerve, neuromuscular) neurostimulator pulse generator/transmitter, with intraoperative or subsequent programming
- 95972 complex brain, spinal cord, or peripheral (except cranial nerve) neurostimulator pulse generator/transmitter, with intraoperative or subsequent programming, first hour
- 95974 Electronic analysis of implanted neurostimulator pulse generator
- 95975 Electronic analysis of implanted neurostimulator pulse generator system (e.g., rate, pulse amplitude and duration, configuration of wave form, battery status, electrode selectability, output modulation, cycling, impedance and patient compliance measurements); complex cranial neurostimulator pulse generator/transmitter, with

intraoperative or subsequent programming, with or without nerve interface testing, each additional 30 minutes after first hour

- 95978 Electronic analysis of implanted neurostimulator pulse generator system (eg, rate, pulse amplitude and duration, battery status, electrode selectability and polarity, impedance and patient compliance measurements), complex deep brain neurostimulator pulse generator/transmitter, w/ initial or subsequent programming; first hour
- 95979 Electronic analysis of implanted neurostimulator pulse generator system (eg, rate, pulse amplitude and duration, battery status, electrode selectability and polarity, impedance and patient compliance measurements), complex deep brain neurostimulator pulse generator/transmitter, w/ initial or subsequent programming; each additional 30 minutes after first hour (List separately in addition to code for primary procedure)
- C1767 generator neurostimulator (implantable) non-rechargeable
- C1778 lead, neurostimulator
- C1787 patient programmer, neurostimulator
- C1816 receiver and/or transmitter neurostimulator (implantable)
- C1820 generator, neurostimulator (implantable), non high-frequency with rechargeable battery and charging system
- C1822 generator, neurostimulator (implantable), high frequency, with rechargeable battery and charging system
- C1897 lead neurostimulator test kit (implantable)
- L8679 implantable neurostimulator, pulse generator, any type
- L8680 Implantable neurostimulator electrode, each
- L8681 Patient programmer (external) for use with implantable programmable neurostimulator pulse generator
- L8682 implantable neurostimulator radiofrequency receiver
- L8683 radiofrequency transmitter (external) for use with implantable neurostimulator radiofrequency receiver
- L8685 implantable neurostimulator pulse generator, single array, rechargeable, includes extension
- L8686 implantable neurostimulator pulse generator, single array, non-rechargeable, includes extension
- L8687 implantable neurostimulator pulse generator, dual array, rechargeable, includes extension
- L8688 implantable neurostimulator pulse generator, dual array, non-rechargeable, includes extension

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LINE OF BUSINESS:

Eligibility and contract specific benefit limitations and/or exclusions will apply. Coverage statements found in the line of business specific benefit document will supersede this policy. For Medicare, applicable LCD's and NCD's will supercede this policy. For PA Medicaid Business segment, this policy applies as written.

REFERENCES:

Koller WC, et.al., "Deep brain Stimulation of the VIM Nucleus of the Thalamus for the Treatment of Tremor", *Neurology* 2000; 55(Suppl 6): S29-S33.

Technology Assessment for Deep Brain Stimulation for Parkinson's Disease, <http://www.hcfa.gov/coverage/8b3-ijj2.htm> January 2002.

Limousin P, Krack P, et.al., "Electrical Stimulation of the Subthalamic Nucleus in Advanced Parkinson's Disease", *The New England Journal of Medicine*, 339(16):1105-1111, 15 Oct 1998.

Vingerhoets FJG, Villemure JG, et.al., "Subthalamic DBS Replaces Levodopa in Parkinson's Disease", *Neurology* 2002;58:396-401.

"Deep Brain Stimulation of the Subthalamic Nucleus or the Pars Interna of the Globus Pallidus in Parkinson's Disease", The Deep Brain Stimulation for Parkinson's Disease Study Group, *New England Journal of Medicine*, 345(13):956-963, 27 Sept 2002.

Koller W, Pahwa R, et. al., "High-Frequency Unilateral Thalamic Stimulation in the Treatment of Essential and Parkinsonian Tremor", *Annals of Neurology* 42(3):292-299, Sept 1997.

Hariz GM, Lindberg M, Bergenheim AT, "Impact of Thalamic Deep brain Stimulation on Disability and Health Related Quality of Life in Patients With Essential Tremor", *Journal of Neurology, Neurosurgery & Psychiatry* 2002; 72:47-52.

Deep Brain Stimulation for Parkinson's Disease and Essential Tremor, Geisinger Clinic Technology Assessment Committee, April 10, 2002.

Technology Evaluation Center, TEC Evaluation. "Deep Brain Stimulation of the Thalamus for Tremor", Dec 1997; 12(20): 1-29.

Technology Evaluation Center, TEC Evaluation. "Bilateral DBS of the Subthalamic Nucleus or the Globus Pallidus Interna for Treatment of Advanced Parkinson's Disease", Feb 2002; 16(16):1-82.

Winifred S. Hayes, Hayes Inc. Online, Deep Brain Stimulation for Parkinson's Disease and Essential Tremor, Feb 2003.

Winifred S. Hayes, Hayes Inc. Online, Deep Brain Stimulation for Treatment of Dystonia, June 2003.

ECRI, HTAIS Target Database, Thalamic Stimulation for Tremor. Feb 2001.

ECRI, HTAIS Windows on Medical Technology, Thalamic Stimulation for Parkinson's Disease. Issue 17, Mar. 1999.

ECRI, HTAIS Target Database. Deep Brain Stimulation for Parkinson's Disease and Essential Tremor. July 2009

ECRI, HTAIS Target Database. Deep Brain Stimulation for Non-Parkinsonian Neurologic and Psychiatric Disorders. July 2009

Stover NP, Okun MS, Evatt ML, Raju DV, Bakay RAE, Vitek JL. Stimulation of the Subthalamic Nucleus in a Patient With Parkinson Disease and Essential Tremor. Arch Neurol 2005;62 141-143.

Leone M, Franzini A, Broggi G, May A, Bussone G. Long-term follow-up of bilateral hypothalamic stimulation for intractable cluster headache. Brain 2004;127:2259-2264.

Abelson JL, Curtis GC, Sagher O, Albuher RC, Harrigan M, Taylor SF, Martis B, Giordani B. Deep brain stimulation for refractory obsessive-compulsive disorder. Biol Psychiatry. 2005 Mar 1;57(5):510-6.

Schoenen J, Di Clemente L, Vandenheede M, Fumal A, De Pasqua V, Mouchamps M, Remacle JM, de Noordhout AM. Hypothalamic stimulation in chronic cluster headache: a pilot study of efficacy and mode of action. Brain. 2005 Apr;128(Pt 4):940-7.

Franzini A, Ferroli P, Leone M, Broggi G. Stimulation of the posterior hypothalamus for treatment of chronic intractable cluster headaches: first reported series. Neurosurgery. 2003 May;52(5):1095-9

Houeto JL, Karachi C, Mallet L, Pillon B, Yelnik J, Mesnage V, Welter ML, Navarro S, Pelissolo A, Damier P, Pidoux B, Dormont D, Cornu P, Agid Y. Tourette's syndrome and deep brain stimulation. J Neurol Neurosurg Psychiatry. 2005 Jul;76(7):992-5.

Centers for Medicare and Medicaid Services, Coverage Issues Manual. Section 65-19 Deep Brain Stimulation for Essential Tremor and Parkinson's Disease.

American Society of Stereotactic and Functional Neurosurgery. Deep brain stimulation: indications, techniques, and practice parameters. 2009. Accessed Aug 3, 2009. Available at URL address: http://www.assfn.org/practice/dbs_statement.asp

National Institute of Mental Health (NIMH). Obsessive-compulsive disorder. Jul 7, 2009a. Accessed Aug 4, 2009. Available at URL address: <http://www.nimh.nih.gov/health/publications/anxiety-disorders/obsessive-compulsive-disorder.shtml>

National Institute of Mental Health (NIMH). Depression. Jul 31, 2009b. Accessed Aug 4, 2009. Available at URL address: <http://www.nimh.nih.gov/health/topics/depression/index.shtml>

Nuttin BJ, Gabriëls LA, Cosyns PR, Meyerson BA, Andréewitch S, Sunaert SG, Maes AF, Dupont PJ, Gybels JM, Gielen F, Demeulemeester HG. Long-term electrical capsular stimulation in patients with obsessive-compulsive disorder. Neurosurgery. 2008 Jun;62(6 Suppl 3):966-77.

U.S. Food and Drug Administration (FDA). Medtronic Activa Dystonia Therapy-- H020007. Apr 15, 2003. Accessed Aug 4, 2009. Available at URL address: <http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cftopic/pma/pma.cfm?num=H020007>

U. S. Food and Drug Administration (FDA). Premarket approval. Medtronic® Activa Tremor Control System. Jul 31, 1997. Accessed August 4, 2009. Available at URL address:

<http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfPMA/PMA.cfm?ID=6988>

U. S. Food and Drug Administration (FDA). PMA-premarket approval. Activa® Parkinson's Control System p960009/S7. May 1, 2002. Accessed August 4, 2009. Available at URL address:

<http://www.fda.gov/MedicalDevices/ProductsandMedicalProcedures/DeviceApprovalsandClearances/Recently-ApprovedDevices/ucm083894.htm>

U. S. Food and Drug Administration (FDA). Reclaim™ DBS™ Therapy for OCD - H050003. Feb 19, 2009. Accessed August 4, 2009. Available at URL address:

<http://www.fda.gov/MedicalDevices/ProductsandMedicalProcedures/DeviceApprovalsandClearances/Recently-ApprovedDevices/ucm125520.htm>

UNIFIED PARKINSON'S DISEASE RATING SCALE (UPDRS). Accessed January 31, 2012. Available at URL address: <http://www.mdvu.org/library/ratingscales/pd/updrs.pdf>

Sarubbo S, Latini F, Quatrone R, Sensi M, Granieri E, Cavallo MA. Five-year follow-up of 10 patients treated with globus pallidus internus deep brain stimulation for segmental or multisegmental dystonia. *Stereotact Funct Neurosurg.* 2012;90(2):84-91.

Cif L, Vasques X, Gonzalez V, et al. Long-term follow-up of DYT1 dystonia patients treated by deep brain stimulation: an open-label study. *Mov Disord.* 2010 Feb 15;25(3):289-99.

Vidailhet M, Vercueil L, Houeto JL, et al. French Stimulation du Pallidum Interne dans la Dystonie (SPIDY) Study Group. Bilateral deep-brain stimulation of the globus pallidus in primary generalized dystonia. *N Engl J Med.* 2005 Feb 3;352(5):459-67.

Vidailhet M, Vercueil L, Houeto JL, et al. French SPIDY Study Group. Bilateral, pallidal, deep-brain stimulation in primary generalised dystonia: a prospective 3 year follow-up study. *Lancet Neurol.* 2007 Mar;6(3):223-9.

Hung SW, Hamani C, Lozano AM, et al. Long-term outcome of bilateral pallidal deep brain stimulation for primary cervical dystonia. *Neurology.* 2007 Feb 6;68(6):457-9.

Kiss ZH, Doig-Beyaert K, Eliasziw M, Tsui J, Haffenden A, Suchowersky O; on behalf of the Functional and Stereotactic Section of the Canadian Neurosurgical Society and the Canadian Movement Disorders Group. The Canadian multicentre study of deep brain stimulation for cervical dystonia. *Brain.* 2007 Nov;130(Pt 11):2879-86.

Kupsch A, Benecke R, Muller J, Trottenberg T, et al. Deep-Brain Stimulation for Dystonia Study Group. Pallidal deep-brain stimulation in primary generalized or segmental dystonia. *N Engl J Med.* 2006 Nov 9;355(19):1978-90.

Diamond A, Shahed J, Azher S, Dat-Vuong K, Jankovic J. Globus pallidus deep brain stimulation in dystonia. *Mov Disord.* 2006 May;21(5):692-5.

Panov F, Gologorsky Y, Connors G, et al. Deep brain stimulation in DYT1 dystonia: A 10-year experience. *Neurosurgery.* 2013;73(1):86-93; discussion 93

Bhidayasiri R, Fahn S, Weiner WJ, Gronseth GS, Sullivan KL, Zesiewicz TA. Evidence-based guideline: treatment of tardive syndromes: report of the Guideline Development Subcommittee of the American Academy of Neurology. *Neurology.* 2013;81:463-9.

Hosseini H, Mandat T, Waubant E, et al. Unilateral thalamic deep brain stimulation for disabling kinetic tremor in multiple sclerosis. *Neurosurgery.* 2012 Jan;70(1):66-9.

Alonso P, Cuadras D, Gabriels L, et al. Deep Brain Stimulation for Obsessive-Compulsive Disorder: A Meta-Analysis of Treatment Outcome and Predictors of Response. *PLoS One.* 2015;10:e0133591.

Salanova V, Witt T, Worth R, et al. Long-term efficacy and safety of thalamic stimulation for drug-resistant partial epilepsy. *Neurology.* 2015;84:1017-25.

Odekerken VJ, van Laar T, Staal MJ, et al. Subthalamic nucleus versus globus pallidus bilateral deep brain stimulation for advanced Parkinson's disease (NSTAPS study): a randomised controlled trial. *Lancet Neurol.* 2013 Jan;12(1):37-44.

Sako, W, Miyazaki, Y, Izumi, Y, Kaji, R. Which target is best for patients with Parkinson's disease? A meta-analysis of pallidal and subthalamic stimulation. *J Neurol Neurosurg Psychiatry*. 2014;85:982-6.

Perestelo-Perez, L, Rivero-Santana, A, Perez-Ramos, J, Serrano-Perez, P, Panetta, J, Hilarion, P. Deep brain stimulation in Parkinson's disease: meta-analysis of randomized controlled trials. *Journal of neurology*. 2014 Feb 2.

CMS Decision Memo for Deep Brain Stimulation for Parkinson's Disease (CAG-00124N).

Tan ZG, Zhou Q, Huang T, et. al. Efficacies of globus pallidus stimulation and subthalamic nucleus stimulation for advanced Parkinson's disease: a meta-analysis of randomized controlled trials. *Clin Interv Agin*. 2016;11:777-786.

Wang JW, Zhang YQ, Zhang XH, et. al. Cognitive and psychiatric effects of STN versus GPi deep brain stimulation in Parkinson's disease: a meta-analysis of randomized controlled trials. *PLoS One*. 2016;11(6):e0156721.

Xie CL, Shao B, Chen J, et. al. Effects of neurostimulation for advanced Parkinson's disease patients on motor symptoms: A multiple treatments meta-analysis of randomized controlled trials. *Sci Rep* May 4 2016;6:25285.

Xu F, Ma W, Huang Y, et. al. Deep brain stimulation of pallidal versus subthalamic for patients with Parkinson's disease: a meta-analysis of controlled clinical trials. *Neuropsychiatr Dis Treat*. 2016;12:1435-1444.

Moro E, LeReun C, Krauss JK, et. al. Efficacy of pallidal stimulation in isolated dystonia: a systematic review and meta-analysis. *Eur J Neurol* Apr 2017;24(4):552-560.

Baldermann JC, Schuller T, Huys D, et. al. Deep brain stimulation for Tourette syndrome: a systematic review and meta-analysis. *Brain Stimul*. Mar-Apr 2016;9(2):296-304.

Servello D, Zekaj E, Saleh C, et. al. Sixteen years of deep brain stimulation in Tourette's Syndrome: a critical review. *J Neurosurg Sci*. Jun 2016;60(2):218-229.

Bergfeld IO, Mantione M, Hoogendoorn ML, et. al. Deep brain stimulation of the ventral anterior limb of the internal capsule for treatment-resistant depression: a randomized clinical trial. *JAMA Psychiatry* May 1, 2016;73(5):456-464.

Naesstrom M, Blomstedt P, Bodlund O. A systematic review of psychiatric indications for deep brain stimulation, with focus on major depressive and obsessive-compulsive disorder. *Nord J Psychiatry*. Oct 2016;70(7):483-491.

Moro, E, LeReun, C, Krauss, JK, et al. Efficacy of pallidal stimulation in isolated dystonia: a systematic review and meta-analysis. *Eur J Neurol*. 2017 Apr;24(4):552-60.

Sprengers, M, Vonck, K, Carrette, E, Marson, AG, Boon, P. Deep brain and cortical stimulation for epilepsy. *Cochrane Database of Systematic Reviews*. 2017(7).

Troster, AI, Meador, KJ, Irwin, CP, Fisher, RS. Memory and mood outcomes after anterior thalamic stimulation for refractory partial epilepsy. *Seizure*. 2017 Feb;45:133-41.

Cukiert, A, Cukiert, CM, Burattini, JA, Mariani, PP, Bezerra, DF. Seizure outcome after hippocampal deep brain stimulation in patients with refractory temporal lobe epilepsy: A prospective, controlled, randomized, double-blind study. *Epilepsia*. 2017 Oct;58(10):1728-33.

Kim, SH, Lim, SC, Kim, J, Son, BC, Lee, KJ, Shon, YM. Long-term follow-up of anterior thalamic deep brain stimulation in epilepsy: A 11-year, single center experience. *Seizure*. 2017 Nov;52:154-61.

Peng L, Fu J, Ming Y, et. al. The long term efficacy of STN vs GPi deep brain stimulation for Parkinson disease: a meta-analysis. *Medicine* 2018 Aug;97(35):e12153.

Macerollo A, Deuschl G. Deep brain stimulation for tardive syndromes. Systematic review and meta-analysis. *J Neurol Sci* 2018 Jun 15;389:55-60.

Koeppen JA, Nahravani F, Kramer M, et. al. Electrical stimulation of the anterior thalamus for epilepsy: clinical outcome and analysis of efficient target. *Neuromodulation* 2019 Jun;22(4):465-471.

Yan H, Toyota E, Anderson M, et. al. A systematic review of deep brain stimulation for the treatment of drug-resistant epilepsy in childhood. *J Neurosurg Pediatr* 2018 Nov 30;23(3):274-284.

Lehtimäki K, Coenen VA, Goncalves Ferreira A, et. al. The surgical approach to the anterior nucleus in patients with refractory epilepsy: experience from the international multicenter registry (MORE). *Neurosurgery* 2019 Jan 1;84(1):141-150.

Jarvenpää S, Peltola J, Rainesalo S et. al. Reversible psychiatric adverse effects related to deep brain stimulation of the anterior thalamus in patients with refractory epilepsy. *Epilepsy Behav* 2018; 88:373-379

Li M, Cook M. Deep brain stimulation for drug-resistant epilepsy. *Epilepsia* 2018 Feb;59(2):273-290.

Zhou JJ, Chen T, Farber SH, et al. Open-loop deep brain stimulation for the treatment of epilepsy: A systematic review of clinical outcomes over the past decade (2008-present). *Neurosurg Focus*. 2018b;45(2):E5.

Salanova V. Deep brain stimulation for epilepsy. *Epilepsy Behav* 2018 Nov;88S:21-24.

Bouwens van der Vlis T, Schijns O, Schaper F et. al. Deep brain stimulation of the anterior nucleus of the thalamus for drug-resistant epilepsy. *Neurosurg Rev* 2019 Jun;42(2):287-296.

Herman H, Egge A, Konglund A, et. al. Anterior thalamic deep brain stimulation in refractory epilepsy: a randomized double-blinded study. *Acta Neurol Scand* 2019 Mar;139(3):294-304.

Park HR, Choi SJ, Joo EY, et. al. The role of anterior thalamic deep brain stimulation as an alternative therapy in patients with previously failed vagus nerve stimulation for refractory epilepsy. *Stereotact Funct Neurosurg* 2019;97(3):176-182.

Klinger N, Mittal S. Deep brain stimulation for seizure control in drug-resistant epilepsy. *Neurosurg Focus*. 2018;45(2):E4.

Koeppen JA, Nahravani F, Kramer M, et al. Electrical stimulation of the anterior thalamus for epilepsy: Clinical outcome and analysis of efficient target. *Neuromodulation*. 2019;22(4):465-471.

Bouwens van der Vlis TAM, Schijns OEMG, Schaper FLWVJ, et al. Deep brain stimulation of the anterior nucleus of the thalamus for drug-resistant epilepsy. *Neurosurg Rev*. 2019;42(2):287-296

Frizon LA, Yamamoto EA, Nagel SJ, et al. Deep brain stimulation for pain in the modern era: A systematic review. *Neurosurgery*. 2020;86(2):191-202.

Hewitt AL, Klassen BT, Lee KH, et al. Deep brain stimulation for orthostatic tremor: A single-center case series. *Neurol Clin Pract*. 2020;10(4):324-332

Raviv N, Staudt MD, Rock AK, et al. A systematic review of deep brain stimulation targets for obsessive compulsive disorder. *Neurosurgery*. 2020;87(6):1098-1110.

Brandmeir NJ, Murray A, Cheyuo C, et al. Deep brain stimulation for multiple sclerosis tremor: A meta-analysis. *Neuromodulation*. 2020;23(4):463-468

Bonomo R, Elia AE, Bonomo G, et al. Deep brain stimulation in Huntington's disease: A literature review. *Neurol Sci*. 2021;42(11):4447-4457.

Mosley PE, Windels F, Morris J, et al. A randomised, double-blind, sham-controlled trial of deep brain stimulation of the bed nucleus of the striaterminalis for treatment-resistant obsessive-compulsive disorder. *Transl Psychiatry*. 2021;11(1):190

Wu Y, Mo J, Sui L, et al. Deep brain stimulation in treatment-resistant depression: A systematic review and meta-analysis on efficacy and safety. *Front Neurosci*. 2021;15:655412.

Gummadavelli A, Englot DJ, Schwalb JM, et al. ASSFN Position Statement on Deep Brain Stimulation for Medication-Refractory Epilepsy. *Neurosurgery*. 2022;90(5):636-641

Paro MR, Dyrda M, Ramanan S, et al. Deep brain stimulation for movement disorders after stroke: A systematic review of the literature. *J Neurosurg*. 2023;138(6): 1688–1701.

Wang S, Fan S, Gan Y, et al. Efficacy and safety of combined deep brain stimulation with capsulotomy for comorbid motor and psychiatric symptoms in Tourette's syndrome: Experience and evidence. Asian J Psychiatr. 2024 Feb 7

This policy will be revised as necessary and reviewed no less than annually.

Devised: 12/02

Revised: 1/04 (Coding, references); 1/06 (criteria, exclusions and references); 1/07; 2/12 (added indications, contraindication), 12/12 (added indications); 12/16 (revised criteria); 11/19 (add reference for responsive neurostimulation); 11/20 (add epilepsy indication); 11/24 (add Medicare reference, BH medical director review)

Reviewed: 1/05, 1/08, 1/09, 2/10, 2/11, 12/13, 12/14, 12/15, 11/17, 11/18, 11/21, 11/22, 11/23

CMS UM Oversight Committee Approval: 12/23, 12/24

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