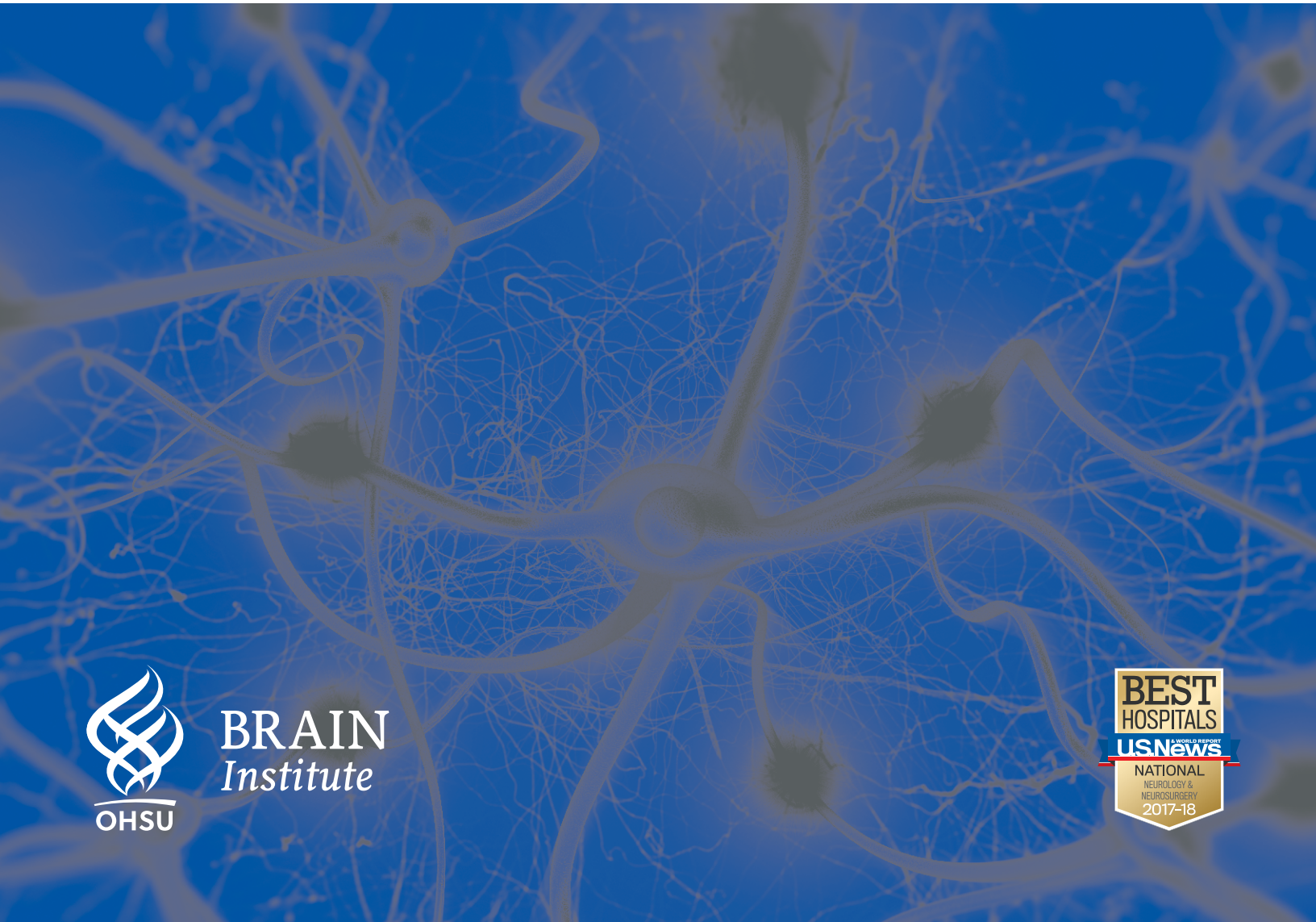
OHSU NEUROSCIENCES

Deep Brain Stimulation

Information Guide for Providers



OHSU BRAIN Institute

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Introduction

Welcome to OHSU's guide to deep brain stimulation (DBS) surgery. This guide offers referring providers a high-level overview of DBS for Parkinson's disease and essential tremor. It also outlines how OHSU's DBS program is designed to offer our unmatched expertise and resources to patients in the Portland, Oregon, area as well as outside the region. We make partnering easy by offering telemedicine for some appointments, real-time access to track care through OHSU Connect, and a streamlined appointment process with multidisciplinary team collaboration.

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DBS for Parkinson's disease or essential tremor

To refer a patient or to consult with a DBS specialist, please call the OHSU Physician Consult & Referral Service at **800-245-6478, or fax 503-346-6854** or email us at **dbs@ohsu.edu.**

For some patients with Parkinson's disease or essential tremor, deep brain stimulation surgery offers life-changing relief. Patients can regain everyday functions and dramatically reduce the need for medication. Unlike pallidotomy or thalamotomy surgical procedures, DBS does not intentionally destroy brain tissue.

Clinical DBS studies have found significant improvement in quality-of-life scores for Parkinson's disease and essential tremor patients. A cooperative VA/NIH trial also showed that DBS gave Parkinson's disease patients more than five hours of additional "on" time each day without dyskinesia.*

Deep brain stimulation benefits

- DBS can greatly enhance quality of life by improving motor function and reducing tremor.
- DBS works 24 hours a day, so patients are less dependent on medications to control symptoms. This can ease side effects. DBS can also reduce the on/off fluctuations that occur as medications take effect and wear off.
- DBS is reversible. The stimulator can be turned off, and the system left in place or removed.
- DBS is adjustable. Settings can be changed to increase effectiveness or to reduce side effects.
- DBS is renewable. The battery lasts two to five years and can be replaced.
- DBS does not interfere with regular activities such as swimming, bathing, sexual activity or sports.

Deep brain stimulation risks

Deep brain stimulation is safe and effective, but like all surgical procedures, it carries risks and possible side effects. Risks and side effects include:

- Procedural complications, such as infection, coma, intracranial hemorrhage, seizures, paralysis, cerebral spinal fluid leakage and weakness.
- Complications of the implanted device — infection, system migration, skin erosion and device failure.
- Speech and language impairments.
- Swallowing problems.
- Depression or behavior changes.
- Falls.

* Weaver FM, Follett K, Stern M, Hur K, Harris C, Marks WJ, Jr., Rothlind J, Sagher O, Reda D, Moy CS, Pahwa R, BURCHIEL K, Hogarth P, Lai EC, Duda JE, Holloway K, Samii A, Horn S, Bronstein J, Stoner G, Heemskerk J, Huang GD, for the CSPSG: Bilateral Deep Brain Stimulation vs Best Medical Therapy for Patients With Advanced Parkinson Disease: A Randomized Controlled Trial. *JAMA* 301:63-73, 2009.

DBS program at OHSU

Our team, led by Kim Burchiel, M.D., was the first in the U.S. to use DBS to treat a patient with Parkinson's disease. More than 1,000 DBS procedures have been performed at OHSU since 1991.

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With outstanding outcomes, and an experienced and dedicated research group, we are committed to partnering with you to improve the quality of life for your patients with movement disorders. As a leading DBS provider, OHSU offers:

Asleep DBS

Dr. Kim Burchiel pioneered asleep DBS at OHSU. With the patient under general anesthesia, the neurological surgeon matches a preoperative high-resolution MRI scan with intraoperative CT scans to locate the target precisely. Surgery is faster and more precise, and patients are more comfortable. Patients can also take their medication the day of surgery.

Experience

OHSU is a high-volume DBS provider. A recent three-year analysis placed OHSU in the top four DBS providers among U.S. academic medical centers. OHSU is also a leader in asleep DBS and has been performing the surgery here for 25 years.

Excellence

The OHSU Parkinson's Disease and Movement Disorders Program is a National Parkinson Foundation Center of Excellence. In addition, a study of 60 OHSU patients found unmatched precision and very low risk for asleep DBS. OHSU also has a low rate of complications: a 30-day readmission rate of 3.7 percent, according to a recent three-year analysis. That's among the lowest rates in the nation. More information on outcomes can be found at **www.ohsubrain.com/dbsoutcomes**.

Partnership

OHSU makes you a full partner in patient care. OHSU Connect allows you to track care in real time. Our secure telemedicine network gives you immediate access to the multidisciplinary team. If you are your patient's primary neurologist, you remain so throughout the DBS process.

Access

Our telemedicine program can enable you and your patient to conduct some appointments by secure video link, saving your patient the time and expense of another trip.

Education

We offer extensive DBS training and education for health care professionals.

Patient selection

A high likelihood of success is the most important factor in DBS patient selection. If your patient is a marginal candidate or your patient's multidisciplinary evaluation raises risk-versus-benefit questions, we'll talk with you about other options.

Parkinson's disease patients

Patients may be good candidates if:

- They have a clear diagnosis of idiopathic Parkinson's disease.
- There is clear evidence of motor improvement with carbidopa/levodopa. As such, we require testing of the patient's motor response in the on and off levodopa states.
- They are developing adverse effects from their medications including disabling involuntary movements called dyskinesias, frequent motor fluctuations, disabling tremor that may not respond to medication, or other side effects limiting the managing provider from increasing this dose.
- They have severe side effects from medications, need several medications to control symptoms, or need higher or more frequent doses.
- Cognitive function is intact. For example, patients score above 26 (and no lower than 24) on the Mini-Mental State Examination. Patients should be willing to undergo neuropsychological testing.
- They have had Parkinson's disease for several years and require frequent medication adjustments.
- They are healthy enough for general anesthesia.
- They can tolerate discontinuing antiplatelet medications for a set period of time for the procedure.

DBS is contraindicated to treat Parkinson's disease if the patient:

- Has Parkinson's-plus conditions such as multiple system atrophy, progressive supranuclear palsy or vascular parkinsonism. DBS may worsen symptoms for these patients.
- Has end-stage Parkinson's disease: Patients who are severely disabled despite medication will not see significant improvement.
- Has motor symptoms that do not improve with administration of carbidopa/levodopa.
- Has significant postural instability or gait dysfunction that is not responsive to medication. For example, the patient can't walk without significant assistance.

- Has poor cognitive abilities — for example, dementia, moderate to severe depression or both. These patients may become worse after DBS, and they may not be able to manage routine activities of daily living.
- Has any serious coexisting chronic illness that would prohibit anesthesia or interfere with DBS management.
- Isn't healthy enough for surgery with general anesthesia.
- Has ischemic brain disease, demyelinating brain disease, brain tumors or other brain conditions.
- Is pregnant or younger than 18.

If you are unsure if DBS is contraindicated for your patient, consider referring your patient for a comprehensive DBS evaluation with a movement-disorder-trained neurologist, neurosurgeon, physical therapist, speech pathologist and neuropsychologist to assess your patient's relative risk-to-benefit profile for this procedure.

Essential tremor patients

Patients may be good candidates if:

- They have a clear diagnosis of essential tremor. DBS is unlikely to help patients with higher-amplitude cerebellar-type tremors, specifically tremors caused by ischemic disease or demyelination.
- They can no longer effectively manage their tremor with medications, such as propranolol, gabapentin, topiramate or primidone.
- Side effects keep them from taking sufficient medication to control symptoms.
- Their tremor interferes significantly with daily activities, such as eating and dressing.
- They are healthy enough for general anesthesia.

DBS is contraindicated to treat essential tremor if the patient:

- Has ischemic brain disease or demyelinating brain disease or brain tumors.
- Has certain comorbidities, including serious cardiac disease, uncontrolled hypertension or both.
- Is not healthy enough for surgery.
- Is pregnant.

Timeline and patient flow

OHSU partners with providers and patients from all areas. We work with you and your patient to determine the best combination of face-to-face care and telemedicine for the patient's convenience, safety and comfort. We also place a high priority on your management ease and confidence in your patient's care. Some patients come to Portland only for surgery. It usually takes about three months from your patient's first appointment to surgery. The timeline chart below outlines the DBS process for Parkinson's disease and essential tremor patients.

Step 1 — Assessment and risk-benefit analysis

Parkinson's disease patients

Neurologist consultation: A fellowship-trained movement disorders neurologist obtains a thorough history and performs a neurological exam to determine DBS candidacy. In some instances, this can be done in your office. If the patient is not a surgical candidate, we will make other recommendations to optimize management of the patient's disease.

Consultation with a neurosurgeon: The neurosurgeon discusses DBS, including risks and benefits. Some patients start with this appointment if a discussion with you and a review of their medical history indicates they are DBS candidates.

Multidisciplinary surgical candidacy assessment

- Physical therapy conducts a two-day appointment to evaluate the patient's gait, balance and levodopa response. Day one is conducted with the patient stopping all PD medications 12 hours before evaluation. Day two is conducted with the patient taking all PD medications. We recommend that this testing be done at OHSU to give us the best possible information.
- Neuropsychology conducts cognitive function testing. Patients should bring a caregiver to all appointments. If your practice is outside the Portland area, you can consider the provider training we offer in evaluating patients for DBS. Please visit **www.ohsubrain.com/dbstraining** for more information.
- Speech therapy assesses speech function and counsels the patient on potential DBS side effects on speech. This evaluation is not required, but helpful in assessing DBS candidacy.

Essential tremor patients

- **Neurologist consultation:** A fellowship-trained movement disorders neurologist obtains a thorough history and performs a neurological exam to determine DBS candidacy. In some instances, this can be done in your office.

- **Neurological surgery assessment:** We see your patient to discuss the DBS procedure, outlining risks and benefits. We also assess the tremor, disease progression and response to medications. Afterward, we send you medical chart notes and discuss our recommendations with you. If the patient is not a DBS candidate, we will recommend other options.

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Step 2 — Preoperative appointments

Neurological surgery appointment: Your patient, along with the neurological surgeon and his or her team, reviews the procedure in detail, discusses medications and allergies, and receives admission and postoperative care information.

Perioperative medicine: General examination to clear the patient for surgery.

MRI: Preliminary mapping of electrode placement using OHSU's 3-Tesla MRI.

Step 3 — Surgery and programming

Electrode placement: Patients are placed under general anesthesia and five cranial fiducials are placed for surgical planning. After an intraoperative CT scan, the neurological surgeon places the electrodes and confirms correct placement with an additional CT. Patients stay in the OHSU Hospital after surgery, usually for one night.

Neurostimulator placement: The stimulator is implanted two to seven days after electrode placement, also under general anesthesia. The patient leaves OHSU that day.

Neurostimulator programming: This can be done at OHSU shortly after surgery or later in your office to allow more time for healing.

Step 4 — Follow-up

Patients have follow-up appointments at OHSU or via telemedicine at the following intervals after lead placement:

- 30 days: Neurology appointment, programming adjustments as needed.
- 60 days: Neurology appointment, programming adjustments as needed.
- 90 days: Neurology appointment, programming adjustments as needed.
- Six months: Neurology appointment, programming adjustments as needed.

After the stimulator has been programmed, we will work with you and your patient to establish a postoperative management plan that best meets your patient's needs.

Refer a patient to OHSU

Our team offers quick referrals and easy access. Contact the OHSU Physician Referral & Consult Service at 800-245-6478. You can discuss your patient with one of our specialists and decide on next steps.

Required patient information

If your patient is a potential DBS candidate, you or your referral coordinator will talk with our team. Please have the following available:

- Chart and most relevant progress notes, including from previous neurologists, from the last six months of care, documenting the need for evaluation by a neurologist or neurological surgeon.
- All available brain imaging studies (MRI, X-ray, CT, angiogram, PET), sent electronically, if possible.
- Reports of any abnormal findings on neurological examination.

Patients meet with an OHSU neurologist and neurological surgeon to evaluate DBS candidacy. If you are outside the Portland area, we'll help you with appointments at OHSU or via secure telemedicine link.

Patients are usually scheduled for a neurology consultation three to four weeks from referral. If DBS is not right for your patient, we will contact you to discuss other options.

DBS candidates then proceed to the multidisciplinary evaluation, with surgery scheduled if appropriate.

After surgery, you will receive a letter summarizing the visit. We will also call to discuss the results.

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Telemedicine for DBS

OHSU is one of the few centers to offer telemedicine for complex treatments such as DBS. Patients from outside the Portland area may be able to complete some appointments by telemedicine. You can also use telemedicine to consult with our DBS team or train to program the neurostimulator.

Telemedicine benefits include:
Secure access to the movement disorders team.
Care in a familiar setting in the patient's community, under your management.
Specialists can see the patient in real time — especially valuable for assessing movement disorders.
High-quality patient experience that replicates a face-to-face visit.
Reduced travel time, cost and effort for patients and families.

Some patients travel to Portland only for surgery, completing other visits in their communities.

Telemedicine visits may include:
Pre- and post-procedure assessments. (Some patients may require an in-person presurgery evaluation with an OHSU neurologist.)
Recovery checks, post-surgery monitoring and stimulator programming.

OHSU's DBS team

OHSU has one of the nation's leading DBS teams. Your patients will receive care from a multidisciplinary team of experts in neurology, physical therapy, speech therapy, neuropsychology and other areas.

DBS education and training

Our education and training includes:

- An overview of DBS, including history, indications, contraindications, risks and benefits.
- How to identify and evaluate patients for DBS candidacy.
- How to program the neurostimulator.
- How to manage patients after DBS surgery.
- How to train in DBS surgery.

Training can be customized to your practice. To learn more, please call the OHSU Physician Consult & Referral Service at **800-245-6478.**

Neurological surgery

Kim J. Burchiel, M.D., F.A.C.S., has performed DBS surgery more than 1,000 times. He was the first to bring DBS surgery for Parkinson's disease to the United States. In 2011, he developed asleep DBS surgery, offering comfort and optimal results.

Ahmed M.T. Raslan, M.D., is an associate professor of neurological surgery who joined OHSU's neurological surgery faculty in 2012. His interests include DBS surgery, pain surgery, functional and stereotactic neurological surgery, and epilepsy surgery.

Antonia Gragg, M.S., P.A.-C., is a physician assistant with the Department of Neurological Surgery. She works with Dr. Burchiel and Dr. Raslan to care for Parkinson's disease and essential tremor patients. She works collaboratively with the Department of Neurology's Movement Disorder Clinic to care for patients with DBS.

Neurology

Shannon Anderson, M.P.A.S., P.A.-C., is assistant professor of neurology and programs the neurostimulator following surgery.

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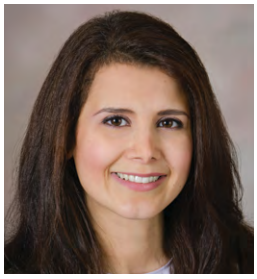
Matthew A. Brodsky, M.D., is an associate professor of neurology and the co-director of the DBS program. He gives lectures around the world on Parkinson's disease and directs annual courses on deep brain stimulation.

Kathryn A. Chung, M.D., is an assistant professor of neurology who joined the OHSU movement disorders faculty in 2004. Her research interests are focused on Parkinson's disease, including understanding dyskinesia, and gait and balance abnormalities.

Amie Hiller, M.D., combined interests in health policy and medicine by completing fellowships in the Washington, D.C., office of U.S. Sen. Jack Reed and in OHSU's Movement Disorders Program. She completed her residency in neurology at Brown University.

Jeff A. Kraakevik, M.D., is an associate professor of neurology who heads the development of medical student and resident education for OHSU's Department of Neurology and the Portland VA Medical Center. His research interests include the gait and balance problems that accompany Parkinson's disease.



Delaram Safarpour, M.D., M.S.C.E., is an assistant professor of neurology. She is interested in the clinical and epidemiological aspects of movement disorders.

Neuro Rehabilitation

Linda Bryans, M.A., C.C.C.-S.L.P., is a certified speech-language pathologist who specializes in Parkinson's disease and other movement disorders. She is a senior instructor in the Northwest Clinic for Voice and Swallowing at OHSU as well as adjunct faculty at PSU's Speech and Hearing Sciences Department.

Jenny L. Wilhelm, P.T., D.P.T., N.C.S., is a physical therapist and neurologic-certified specialist with advanced training in Parkinson's disease. She also specializes in TBI and geriatric clients.

Psychology

Haley Trontel, Ph.D., is a neuropsychologist experienced in conducting comprehensive neuropsychological assessments to facilitate diagnostic clarification and aid in treatment planning for patients, families and providers.

Aaron Vederman, Ph.D., is a neuropsychologist who focuses on the assessment and diagnosis of dysfunctions in cognitive functioning.

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