Published in final edited form as:
J Clin Psychiatry. 2014 August ; 75(8): 895–897. doi:10.4088/JCP.13l08745.

Interventional Psychiatry: Why Now?

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Introduction

> We must recollect that all of our provisional ideas in psychology will presumably one day be based on an organic substructure.
>
> Sigmund Freud, “On Narcissism”

Despite decades of research, current pharmacotherapies and psychotherapies remain ineffective or intolerable for many patients with psychiatric disorders.[1] These treatment-resistant and treatment-intolerant patients, particularly those with depression, are often referred for neuromodulatory interventions such as transcranial magnetic stimulation (TMS), electroconvulsive therapy (ECT), and deep brain stimulation (DBS).[2–6] However, unlike cardiology, radiology, and neurology, the field of psychiatry does not formally recognize or train “interventionalists” who perform specialized procedures on the spectrum between standard care and surgery.[5] The purpose of this letter is to explain why the field of interventional psychiatry should be recognized as a formal subspecialty of psychiatry and further developed.

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All authors listed have made substantial contributions to the conception or creation of this manuscript.

Disclosures:

Dr. Mark George has no equity ownership in any device or pharmaceutical company. He does occasionally consult with industry, although he has not accepted consulting fees from anyone who manufactures a TMS device, because of his role in NIH and DOD/VA studies evaluating this technology. His total industry related compensation per year over the past 20 years has always been less than 10% of his total university salary. His involvement with imaging and stimulation device companies includes: Brainsonix (TMS)-Consultant (unpaid); Brainsway (TMS)-Consultant (unpaid), Research Grant; Cephos (fMRI deception); Consultant (unpaid), MUSC owns patent rights; Mecta (ECT) Consultant (unpaid) Research Grant; Neuronetics (TMS)-Consultant (unpaid), company donated equipment for OPT-TMS trial, VA anti-suicide study; Cervel/ NeoStim (TMS)-Consultant (unpaid), Research Grant; NeoSync (TMS)-Consultant (unpaid), Research Grant; PureTech Ventures (tDCS, others)-Consultant.

Dr. E. Baron Short has no equity ownership in any device or pharmaceutical company. His involvement with imaging and stimulation device companies includes: Mecta (ECT) Consultant (unpaid) Research Grant & Neuronetics (TMS)-Consultant (unpaid).

Dr. Suzanne Kerns has partial salary support from a grant where she is performing research techniques involving new ECT technology for Mecta.

Dr. Nolan Williams has no disclosures.

Dr. Edward Kantor has no disclosures.

Dr. Joseph J. Taylor has no disclosures.

Definition

Interventional psychiatry is an emerging subspecialty that utilizes neurotechnologies to identify dysfunctional brain circuitry underlying psychiatric disorders[7,8] and apply brain stimulation techniques to modulate that circuitry.[9–11] This nascent clinical subspecialty is based on centuries of neuroscience research.[12,13] Within the last 50 years, and particularly the last decade, these classical techniques have been refined,[14,15] new treatments have been developed,[16,17] and novel therapeutic targets have been explored.[6,18] Nearly a dozen forms of brain stimulation are in development or currently US Food and Drug Administration–approved for a variety of neuropsychiatric indications (Table 1). These techniques are detailed throughout various journals, including at least 2 dedicated exclusively to brain stimulation.[19,20]

Current State

It is clear that psychiatric disorders are a product of brain circuit dysregulation,[21,22] a concept that has been slow to be accepted by the psychiatric community.[23–27] Simultaneously, there has been an explosion in noninvasive (TMS and transcranial direct current stimulation)[2,28] and invasive (vagus nerve stimulation, epidural cortical stimulation [EpCS], and DBS)[17,18,29] neuromodulation techniques for neuropsychiatric disorders. Fortunately, leaders in psychiatric research, clinical practice, and education have recognized the discrepancy between our field's direction and our current training schema and are making plans and laying groundwork to ensure that psychiatrists remain relevant in this age of brain discovery.[10,30–33]

Formalized training in interventional psychiatry will enable practitioners to adapt to an ever-evolving understanding of brain circuitry[22] and to better modulate its function.[16] Traditional training curricula offer informal, inconsistent, and limited training opportunities in neurotechnologies such as neuromodulation and diagnostic modalities, but the number of proponents for increased exposure to these advances is growing.[10,11,30,34] Clinical neuroscientists, psychiatric interventionalists, and various certifying bodies of accreditation have already begun to collaborate on improvements to the existing education model.[9,11,29,32,33] Many realize that only formal expansion of interventional psychiatric training through dedicated residency tracks and fellowships will ensure the safe and timely growth of this ever-promising area of psychiatry.[10,11]

Specialty tracks are not a new idea within psychiatric graduate medical education[35] and can be achieved with current residency resources.[10] Interventional psychiatry fellowships, training not just researchers but also clinicians, have formed across the country and include exposure to both noninvasive and invasive neuromodulation.[10,11] Both residency and fellowship options would include neuroscience didactics[34] and hands-on experience with various forms of ECT[36]/TMS[10] and infusion therapies,[34,37,38] along with specialized experiences in neurophysiology,[8,39,40] device programming,[6,10,41–43] neuroradiology,[7,44,45] and intraoperative experiences for DBS/EpCS.[29,42,46–48]

Why Now?

Perhaps the simplest way to illustrate the emergence of interventional psychiatry is to cite the timely series of recent federal and nonprofit initiatives focused on brain stimulation. In 2011, the National Institute of Mental Health proposed a new classification system, Research Domain Criteria (RDoC), that aims to develop a circuit- and biomarker-based classification system for neuropsychiatric disorders.[49] Shortly thereafter, the Accreditation Council for Graduate Medical Education launched their Psychiatry Milestone Project to increase emphasis on the importance of teaching psychiatric trainees about circuit-based neuroscience and brain stimulation.[32,34] The most recent, but likely not last, addition to this list includes the Defense Advanced Research Projects Agency's $70 million project Systems-Based Neurotechnology and Understanding for the Treatment of Neuropsychological Illnesses (SUBNETS), which is part of the BRAIN Initiative. SUBNETS seeks to develop invasive and intelligent closed-loop neuromodulation technologies that modulate dysfunctional circuits in neuropsychiatric disorders,[50] meaning that the devices developed will sense brain activity before, during, and after an event (neuropsychophysiologic) and then modify device stimulation on the basis of this "sensed" brain activity.[51–53]

The initiatives above further emphasize how the confluence of translational and clinical research[33] has launched an interventional psychiatry subspecialty despite a lack of existing formal training programs.[10,11] The field of psychiatry must be prepared to take advantage of these developments, including embracing the neuroscience behind them and adapting to the advances that arise.[33] Without more formal training programs in interventional psychiatry, the field of psychiatry will be unprepared to effectively participate in the continued expansion of neuromodulation technologies for refractory neuropsychiatric disease.[11,26] This growth can be achieved while still embracing and even enhancing our knowledge of the current treatment modalities.[7,54–56]

Summary

Interventional psychiatry offers substantial therapeutic benefits in some neuropsychiatric disorders16 and enormous potential in treating others[6] . However, as interventional diagnostics and therapeutics require specialized knowledge and skill foreign to many psychiatrists,[30] the emerging subspecialty of interventional psychiatry must be more formally integrated into the continuum of psychiatric training to ensure both safe application and continued growth. By establishing training paradigms for interventional psychiatry, academic medical centers can help fill this knowledge gap.[10,11] The cultivation of a properly trained cohort of interventional psychiatrists will better meet the challenges of treatment-resistant psychiatric illness through safe and ethical practice, while facilitating a more informed development and integration of novel neuromodulation techniques.[11,57,58]

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Table 1

Interventional Psychiatry Tools

Interventional Method	Development	FDA-Approved Uses	Currently Being Investigated
Electroconvulsive therapy	In use for over 70 years, but with significant recent advances in delivery	Grandfathered in. APA guidelines indicate MDD, bipolar disorder, schizophrenia, schizoaffective disorder, and catatonia	Newer pulse types to further limit cognitive side effects. Use in Parkinson's disease
Transcranial magnetic stimulation	Modern version developed in 1985. Multiple newer delivery mechanisms being evaluated	Acute, treatment-resistant unipolar MDD	Pain management, psychosis, mania, poststroke recovery
Vagus nerve stimulation	In use for epilepsy since 1997, for treatment-resistant depression since 2005	Partial-onset epilepsy, chronic course of treatment-resistant depression	Less invasive means currently being evaluated
Deep brain stimulation	In use for Parkinson's disease, essential tremor, and dystonia since 2002	Essential tremor, Parkinson's disease, dystonia, humanitarian device exemption for OCD	Research into use in MDD and Tourette's disorder

Abbreviations: APA = American Psychiatric Association, FDA = US Food and Drug Administration, MDD = major depressive disorder, OCD = obsessive-compulsive disorder.