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Brain Disease Model of Addiction: why is it so controversial?

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The “Personal View” by Hall, Carter, and Forlini¹ questions the value of the BDMA (brain disease model of addiction) and claims that it is not supported by animal or neuroimaging evidence, that it has not helped deliver more effective treatments and that its impact on public policy have been modest. However, these claims are not supported by the evidence. First, preclinical and clinical studies have consistently delineated specific molecular and functional neuroplastic changes at the synaptic and circuitry level that are triggered by repeated drug exposure. These findings, along with ongoing research, are helping us understand the neurobiological processes associated with the loss of control, compulsive drug taking, inflexible behavior, and negative emotional states associated with addiction (Figure 1). Second, uncovering the molecular targets and circuits underlying addiction has already resulted in several effective medications (naloxone and acamprosate for alcoholism, buprenorphine-naloxone for opioid addiction; varenicline for tobacco addiction) and ongoing clinical trials are taking advantage of this knowledge to test new targets^{2, 3}. For the approved medications the effect sizes are similar to those associated with standard antidepressant pharmacotherapies. This knowledge had also provided the basis for the use of stimulation techniques such as transcranial magnetic stimulation (TMS) or transcranial direct current stimulation (tDCS) and its variants, to strengthen circuits impaired by addiction with promising results^{4, 5}. It has also provided clinicians with a framework to guide targeted interventions to strengthen the impaired circuits (i.e., behavioral interventions to enhance self-control, reduce stress reactivity, improve mood). Finally, the statement that the effects of the BDMA framework on public policy are modest negates some major achievements, such as the passage in 2008 of the parity law (the Paul Wellstone and Pete Domenici Mental Health Parity and Addiction Equity Act, driven by the BDMA model) that requires medical insurance for the first time in the USA to cover costs associated with the treatment of addiction⁶. Finally, the mere framework of BDMA has benefits in treatment as it significantly diminishes the stigma attached with addiction and gives hope for recovery to those fighting this devastating disease.

We agree that in addiction, as is the case for any other medical condition, there is a severity dimension (incorporated into the recently revised classification of substance use disorders in the diagnostic statistical manual or DSM 5;⁷), and that only a small percentage of those with a substance use disorder fall in the most severe category. However, we don't

understand the argument of why this fact should negate the value of the disease model in addiction. It is basic research that is helping us understand this severity dimension and the mechanisms underlying the transition from mild to severe addiction that one day might enable us to develop interventions to revert and/or revert those changes and to identify those who are at most risk when exposed to drugs to transition into a severe phenotype. In the meantime, research is already providing evidence that is guiding therapeutic interventions on the basis of the levels of severity⁸. Similarly, as for any other disease the largest impact at the population level is derived from interventions that prevent the emergence of the disease process in the first place. In the case of cancer this would entail, for example, the prevention of smoking, which connotes prevention of nicotine addiction. Translational research is a powerful engine of effective prevention: Understanding how genetic, developmental and environmental (including social) factors influence the vulnerability for substance use disorders helps develop better prevention strategies; particularly for those at highest risk for whom universal prevention strategies are not as effective. This can be well illustrated by the case of the very successful smoking prevention campaign that resulted in >50% reduction in smoking but has failed to prevent smoking in 18-20% of the population, presumably those who are the most vulnerable.

So why is it that despite all the scientific evidence the BDMA is so frequently singled out for criticism as in the piece by Hall, Carter, and Forlini? We think it reflects in part our expectations that science should immediately translate into transforming solutions, which have not materialized for addiction nor for most of the other brain diseases. Yet, the value of basic research in diseases such as Alzheimer's or schizophrenia has never been questioned, which leads us to ponder whether the difficulty relies in accepting as a bona fide disease one that erodes the neuronal circuits that enable us to exert free-will. Addiction is a complex disease of a complex brain; ignoring this fact will only hamper our efforts to find effective solutions through a comprehensive and systematic understanding of the underlying phenomena.

References

1. Hall W, Carter A, Forlini C. The brain disease model of addiction: is it supported by the evidence and has it delivered on its promises? *The Lancet Psychiatry*. 2015; 2(1):105–10.
2. Kalivas PW, Volkow ND. New medications for drug addiction hiding in glutamatergic neuroplasticity. *Mol Psychiatry*. 2011; 16(10):974–86. [PubMed: 21519339]
3. Koob GF, Zorrilla EP. Neurobiological mechanisms of addiction: focus on corticotropin-releasing factor. *Curr Opin Investig Drugs*. 2010; 11(1):63–71.
4. Conti CL, Moscon JA, Fregni F, Nitsche MA, Nakamura-Palacios EM. Cognitive related electrophysiological changes induced by non-invasive cortical electrical stimulation in crack-cocaine addiction. *Int J Neuropsychopharmacol*. 2014; 17(9):1465–75. [PubMed: 24776374]
5. Dinur-Klein L, Dannon P, Hadar A, et al. Smoking cessation induced by deep repetitive transcranial magnetic stimulation of the prefrontal and insular cortices: a prospective, randomized controlled trial. *Biol Psychiatry*. 2014; 76(9):742–9. [PubMed: 25038985]
6. Busch SH, Epstein AJ, Harhay MO, et al. The effects of federal parity on substance use disorder treatment. *Am J Manag Care*. 2014; 20(1):76–82. [PubMed: 24512166]
7. APA. *Diagnostic and Statistical Manual of Mental Disorders*. 5th. Washington DC: 2013.

8. McLellan AT, Woodworth AM. The affordable care act and treatment for "substance use disorders:" implications of ending segregated behavioral healthcare. *J Subst Abuse Treat*. 2014; 46(5):541–5. [PubMed: 24679908]

Figure 1.
Conceptual Framework for Neurobiological Bases of the Transition to Substance Use Disorders