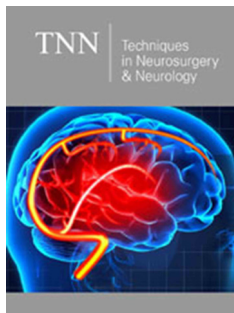


A Systematic Narrative Review of Articles on the Employment of Deep Brain Stimulation for Crime Prevention in Offenders

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Abstract

This review concerns articles on Deep Brain Stimulation (DBS) for crime prevention in offenders. Four databases were searched using “deep brain stimulation” and “criminal” or “offender” terms in “topics” or “abstract/title/keywords” parts. Articles with all dates, all types, all research designs, and sample age groups were included. The single exclusion criterion was being an animal study. PRISMA diagram left us with three philosophical/theoretical articles to be analyzed. Records obtained from Google Scholar search with prompt “deep brain stimulation in criminal offenders” led to somehow relevant articles which is presented as a table. Overall, this study shows that DBS employment as an intervention to prevent recidivism is controversial, thus the number of articles is few. The published work using the prompts above are on philosophical level, still discussing the legitimacy and expected unwavering function of the method.

Keywords: Deep Brain Stimulation; DBS; Crime prevention; Bioethics

Introduction

In recent decades, Deep Brain Stimulation (DBS) has gained recognition as a reversible and stereotaxic technique that involves the insertion of electrodes deep into the brain and use of a headset afterwards as inpatient or outpatient. Studies exhibited its favorable effects in patients suffering from neurodegenerative brain disorders such as Parkinson’s [1,2] and Alzheimer’s [3,4], as well as for treating neurological and psychiatric disorders, such as obsessive-compulsive disorder [5,6], resistant depression [7,8] or aggressive behavior [9]. DBS have some moral/ethical drawbacks such as the probability of being coercive, and a few side effects of infection, intracerebral bleeding, irreversible aberrant behavior, and structural brain change. In this narrative review, the aim is to reveal the published work in large databases about DBS use in criminal offenders as a treatment to preclude recidivism.

Method

Systematic narrative analysis method was employed. Sage, Scopus, Wiley, and Web of Science databases were searched for all dates with terms “deep brain stimulation” and “criminal” or “offender” in “topics” or “abstract/title/keywords” parts, since these locations indicate an article’s focal subject matter. All article types (narrative review, meta-analysis, empirical research, theoretical/philosophical insight, treatment protocol etc.), all research designs (correlational survey study, randomized controlled trial, quasi experimental etc.), and all possible intervention age groups were welcomed, the sole exclusion criterion being animal studies. The results yielded zero article in Sage, zero article in Scopus, four articles in Web of Science three of which were included [10-12] and the other was unrelated, four articles in Wiley two of which concerned animals and two totally irrelevant, and four articles in Taylor and Francis which were all found to be unrelated upon reading. Shortly three theoretical articles remained for review (Figure 1). The PRISMA diagram is shared below. Google scholar search with prompt “deep brain stimulation in criminal offenders” yielded 28100 potentially

relevant entries, which were scanned for corroboration. Few relevant articles (e.g., [13,14]), which did not have “deep brain stimulation”, “criminal” and “offender” words, but included “violent individuals” and “brain stimulation” in abstract or topics, which contained “psychopathic prisoners” in the body of article [15],

which used “deep brain stimulation on psychopathic detainees” statement in the abstract [16] and which used “brain stimulation” and “violent offender” words [17] in article body as examples are summarized in Table 1.

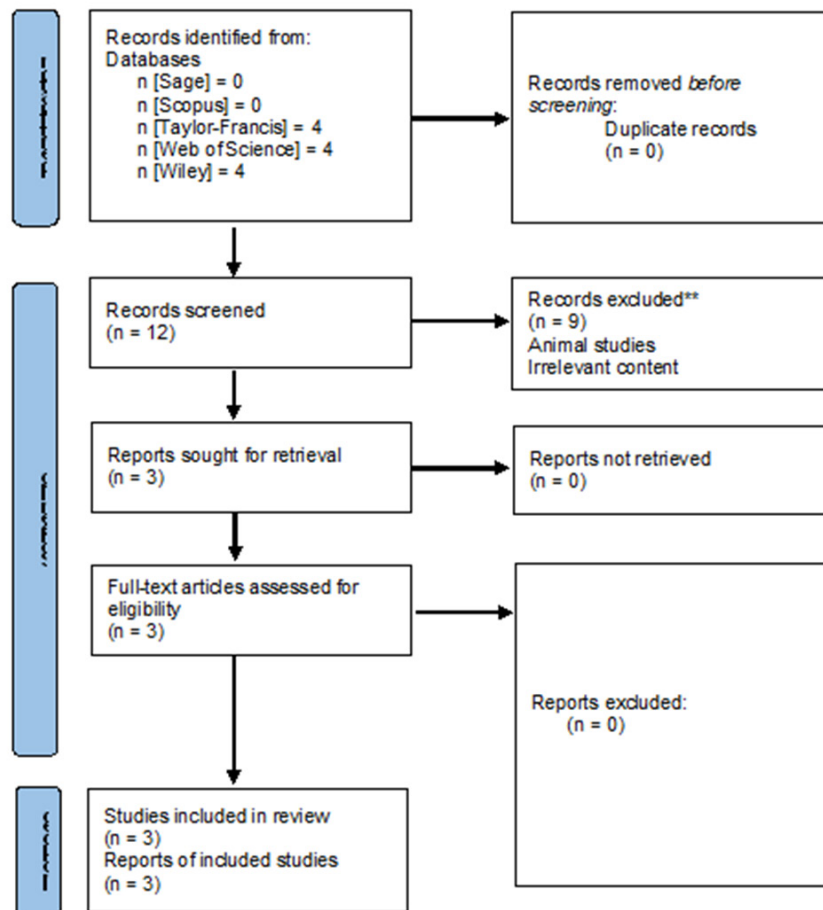


Figure 1: PRISMA 2020 flow diagram for “Deep Brain Stimulation in Criminal Offenders”.

Table 1: Google Scholar search sample findings with prompt “deep brain stimulation in criminal offenders”.

Article	Type	Problem	Intervention	Result
Faria [13,14]	Historical insight	Miscellaneous disorders	DBS and other neurosurgery techniques	No result, explanatory
Nyholm & Campbell [15]	Theoretical insight	Psychopathy	DBS	No result, only philosophical discussion
Hübner & White [16]	Theoretical insight	Psychopathy	DBS	No result, only philosophical discussion about bioethics
Denson [17]	Theoretical insight	Violent offences	Using biomedical instruments such as pharmaceuticals and brain stimulation to enhance moral behavior	No result, only philosophical discussion
Choy et al. [21]	Review comparing Omega3- vs tDCS	Antisocial behavior	Dietary Omega-3 supplementation vs. prefrontal tDCS	Both interventions are effective
Hofhansel et al. [22]	Controlled f-MRI experiment	Criminal offences due to regulation problems	Single session prefrontal tDCS	Ineffective

Molero-Caminzo et al. [23]	Single-blind sham-controlled study	Murderer vs. non-murderer violent offenders' aggression control	3-session bilateral prefrontal tDCS	Effective in both groups
Weidler et al. [24]	Double-blind sham-controlled experiment	Nicotine and alcohol addiction with aggression issues	Dorsolateral prefrontal tDCS	Effective

tDCS- Transcranial Direct Current Stimulation

f-MRI-Functional Magnetic Resonance Imaging

DBS-Deep Brain Stimulation.

Results

Müller et al. [10] this article published in International Journal of Law and Psychiatry is a philosophical essay about the ethics of use of deep brain stimulation for treatment of pedophilic Parkinsonian patients considering such nucleus sub thalamicus stimulation might both benefit the perpetrator obviating the need for dopamine treatment for movement regulation, and lead to increased impulsivity and hypersexual behavior, endangering the possible victims. Use of DBS was formerly shown to ameliorate Parkinsonian symptoms in a case and assuaged the need for dopamine intake, yet that person later attempted suicide due to depression [18]. Thus, possible use of DBS is an intricate matter which should be assessed in terms of risk for the pedophilic Parkinsonian patient and probable child victims, since currently laws do not overrule patients to get this treatment, ignoring the likelihood of their palpable misbehavior. Authors argue that if it is used, DBS should be adjusted so well to ensure that patient's moral reasoning and impulsive sexual behavior is not boosted.

Fuss et al. [11] this article published in Journal of Psychiatry and Neuroscience is a commentary on the usefulness of DBS in Ventromedial Hypothalamus (VMH) for paraphilic offenders to reduce their sexual drive. Ventromedial hypothalamotomy was previously proven to decrease sexual drive drastically in homosexuals (then seen as paraphiliacs) and pedophiles [19,20]; nevertheless, one pedophile killed a 10-year-old child in Germany 3 years after having this ablation, thereupon which the use of this procedure has been refrained from.

As opposed to ablation, DBS is lenient in effect but comparably reversible and flexible. Yet, a thorough risk-benefit appraisal would have to demonstrate that both the society and the person undergoing DBS would be better despite its side effects. The authors also raised legal responsibility concerns after DBS intervention and argued against a mandatory DBS for some reasons: For example, sexual offense after DBS could be blamed on whom, the patient or the intervention? Who is permitted to lessen or discontinue the intervention? Would post-intervention care be needed?

Meynen [12] this article published in International Journal of Law and Psychiatry concerns philosophical and legal side of biological interventions including DBS in forensic patients. As against Fuss et al., he claims DBS is considerable as a viable option for intervening with the behavioral problems of forensic patients. A good analysis of each case, mutual agreement with the offending patient, and the reversibility of DBS effects is emphasized. He claims

that autonomous cyborg DBS devices which could gauge brain changes and act accordingly might be a promising future invention that could assess rage or sexual urge escalation and do the trick to bring homeostasis to prevent re-offending. Since this device would be active in line with homeostatic changes in brain, the side-effects would be hindered.

Conclusion

The systematic survey of four large science databases yielded only three theoretical articles about the possible use of DBS in criminal offenders. Google Scholar search showed there are many more studies on non-invasive method employment in forensic intervention. Probability of compromised autonomy and latent coercion posed as ethic issues for exploiting DBS procedure in incarcerated people [21-24].

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