

Project Notes:

Project Title: Modeling T1 Resting State MRI Variants Using Convolutional Neural Networks in Diagnosis of OCD

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Knowledge Gaps:

This list provides a brief overview of the major knowledge gaps for this project, how they were resolved and where to find the information.

Knowledge Gap	Resolved By	Information is located	Date resolved
What are the different machine learning algorithms? How do I know when to use machine learning versus when simpler models will work better?	<i>A guide to the types of machine learning algorithms.</i> (n.d.). Www.sas.com. https://www.sas.com/en_gb/insights/articles/analytics/machine-learning-algorithms.html#:~:text=There%20are%20four%20types%20of	Within each section of the article, a brief overview of the type of ML algorithm as well as use cases is provided.	10/17
What are the current treatments that exist for OCD?	Kellner, M. (2010). Drug treatment of obsessive-compulsive disorder. <i>Dialogues in Clinical Neuroscience</i> , 12(2), 187–197. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3181958/	The article's abstract provides an overview of current treatments and covers them in detail throughout the article.	10/17
What are the different types/receptors for glutamate?	Brennan, B. P., Rauch, S., Jensen, E., & Pope Jr., H. G. (2012, July 24). A critical review of magnetic resonance spectroscopy studies of obsessive-compulsive disorder. <i>Biological Psychiatry</i> . Retrieved December 20, 2022, from https://www.sciencedirect.com/science/article/pii/S0006322312005586?casa_token=_d1utbwmkEQAAAAA%3A5NwfSeQST2oP2kHnnlq2NDvjgzDRIJOaBNnMcyFtoO-qDOxi8nO7rz-SOGAQDYbhVmAPThu4	The article is a review article in which the different aspects of glutamate are covered.	12/05
What is a positron emission tomography and how is it used?	Pittenger, C. (2014, October 10). What does an OCD brain look like? Yale School of Medicine. Retrieved December 19, 2022, from https://medicine.yale.edu/news-article/what-does-an-ocd-brain-look-like/	This article briefly explains what a PET scan is at surface level as well as its applications to OCD.	12/05
Which glutamate receptors are found	Brennan, B. P., Rauch, S., Jensen, E., & Pope Jr., H. G. (2012, July 24). A critical	This review article also specifies which	12/05

most commonly in OCD patients as being abnormal?	review of magnetic resonance spectroscopy studies of obsessive-compulsive disorder. Biological Psychiatry. Retrieved December 20, 2022, from https://www.sciencedirect.com/science/article/pii/S0006322312005586?casa_token=_d1utbwmkEQAAAAA%3A5NwfSeQST2oP2kHnnlq2NDvjgzDRIJOaBNnMcyFtoO-qDOxI8nO7rz-SOGAQDYbhVmAPThu4	receptors are the most commonly found in OCD patients as being abnormal. They found this by using 28 studies and analyzing all of the studies together with cross comparison methods.	
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Literature Search Parameters:

These searches were performed between 8/17/2022 and 12/31/2022.

List of keywords and databases used during this project.

Database/search engine	Keywords	Summary of search
Google scholarly	Blockchain, supply chain, uses	I was able to find article #4 which thoroughly examines the advantages, disadvantages, and future research for blockchain and supply chain. This article was highly useful as it points me in a clear direction within the field.
Google scholarly	AMPA, glutamate receptors, OCD	I was able to find article #6, which highlights a specific receptor called mGlur5 and its relation to OCD.
Google scholarly	Glutamate Genetics, OCD	From this search query, I was able to find article #7, which provides an in-depth review into the different studies and observations that have been made in the past regarding glutamate genetics and OCD.
Google scholarly	OCD, MRI, machine learning	From this search query, I was able to find article #14. Article #14 demonstrates how OCD severity can be predicted using gray matter tracts shown in MRI scan data.

Article #1 Notes: Multidimensional Approaches for A Case of Severe Adult Obsessive - Compulsive Disorder

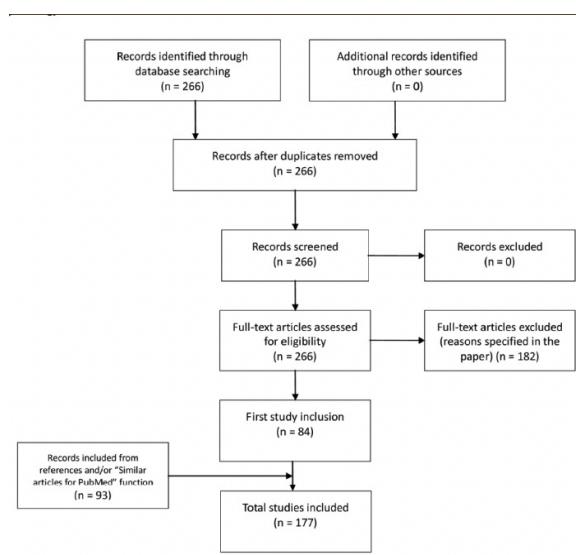
Source Title	Multidimensional Approaches for A Case of Severe Adult Obsessive - Compulsive Disorder																												
Source citation	Multidimensional Approaches for A Case of Severe Adult Obsessive - Compulsive Disorder. (n.d.). <i>Shanghai Archives of Psychiatry</i> , 29(5), 304–309. https://doi.org/10.11919/j.issn.1002-0829.217019																												
Original URL	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5738519/																												
Source type	Journal article																												
Keywords	Obsessive-compulsive disorder, Psychotherapy, Psychopharmacology																												
Summary of key points + notes (include methodology)	A 44-year-old woman named Mrs. L was suffering with a severe case of obsessive compulsive disorder(OCD) measuring a score of 28 on the Yale-Brown Obsessive-Compulsive Scale. Over 6 months, her severity of OCD went from 28 points down to 5 as a result of cognitive behavioral therapy, medications (sertraline), and support from significant others. However, these treatments take several weeks to fully work and are not effective in nearly half of suffering patients.																												
Research Question/Problem/Need	How did a treatment of OCD prove to be successful in one specific case?																												
Important Figures	<p>Table 1.</p> <p>Changes in medication dosage and Y-BOCS scores at different phases of treatment</p> <table border="1"> <thead> <tr> <th>Measures</th> <th>Pretreatment (Baseline)</th> <th>Follow-up (1st week)</th> <th>Follow-up (1st month)</th> <th>Follow-up (2nd month)</th> <th>Follow-up (4th month)</th> <th>Follow-up (6th month)</th> </tr> </thead> <tbody> <tr> <td>Sertraline (mg)</td> <td>100</td> <td>150</td> <td>150</td> <td>150</td> <td>150</td> <td>150</td> </tr> <tr> <td>Aripiprazole (mg)</td> <td>5</td> <td>5</td> <td>10</td> <td>10</td> <td>10</td> <td>5</td> </tr> <tr> <td>Y-BOCS (score)</td> <td>28</td> <td>—</td> <td>—</td> <td>17</td> <td>12</td> <td>5</td> </tr> </tbody> </table>	Measures	Pretreatment (Baseline)	Follow-up (1 st week)	Follow-up (1 st month)	Follow-up (2 nd month)	Follow-up (4 th month)	Follow-up (6 th month)	Sertraline (mg)	100	150	150	150	150	150	Aripiprazole (mg)	5	5	10	10	10	5	Y-BOCS (score)	28	—	—	17	12	5
Measures	Pretreatment (Baseline)	Follow-up (1 st week)	Follow-up (1 st month)	Follow-up (2 nd month)	Follow-up (4 th month)	Follow-up (6 th month)																							
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Aripiprazole (mg)	5	5	10	10	10	5																							
Y-BOCS (score)	28	—	—	17	12	5																							
VOCAB: (w/definition)	<ol style="list-style-type: none"> Pharmacological - relating to the branch of medicine concerned with the uses, effects, and modes of action of drugs. Efficacious - (of something inanimate or abstract) successful in producing a desired or intended result; effective. 																												
Cited references to follow up on	<ol style="list-style-type: none"> https://go.gale.com/ps/i.do?id=GALE%7CA144563720&sid=googleScholar&v=2.1&it=r&linkaccess=abs&issn=00943509&p=AONE&sw=w&userGroupName=mlin_oweb&isGeoAuthType=true 																												

Follow up Questions	<ol style="list-style-type: none">1. Why do these treatments in cognitive behavioral therapy only work in half of patients and not the other half?2. How can this treatment—3 stages—be condensed into a process that is much more simple and efficient?3. Are there specific chemicals that need to be taken into account when analyzing the levels of OCD within a person? If so, which ones?
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Article #2 Notes: Psychopharmacological Treatment of Obsessive-Compulsive Disorder (OCD)

Source Title	Psychopharmacological Treatment of Obsessive-Compulsive Disorder (OCD)
Source citation (APA Format)	Del Casale, A., Sorice, S., Padovano, A., Simmaco, M., Ferracuti, S., Lamis, D. A., Rapinesi, C., Sani, G., Girardi, P., Kotzalidis, G. D., & Pompili, M. (2019). Psychopharmacological Treatment of Obsessive-Compulsive Disorder (OCD). <i>Current Neuropharmacology</i> , 17(8), 710–736. https://doi.org/10.2174/1570159x16666180813155017
Original URL	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7059159/
Source type	Journal article
Keywords	Obsessive compulsive disorder, psychopharmacology, pharmacogenomics, selective serotonin reuptake inhibitors, atypical antipsychotics, off-label treatments
Summary of key points + notes (include methodology)	After studying antidepressants, antipsychotic treatments, and other pharmacological treatments, it was found that usage of selective serotonin reuptake inhibitors (SSRI) were the most effective in treating OCD. When combined with cognitive behavioral therapy, a larger target group can be treated due to an increase in effectiveness. Anything that falls outside of these treatment groups is known as refractory OCD and requires further study. Other SSRIs can be tried but this outlier case tends to be more difficult to treat.
Research Question/Problem/ Need	What is the efficacy of pharmacological interventions in obsessive compulsive disorder (OCD)?

Important Figures



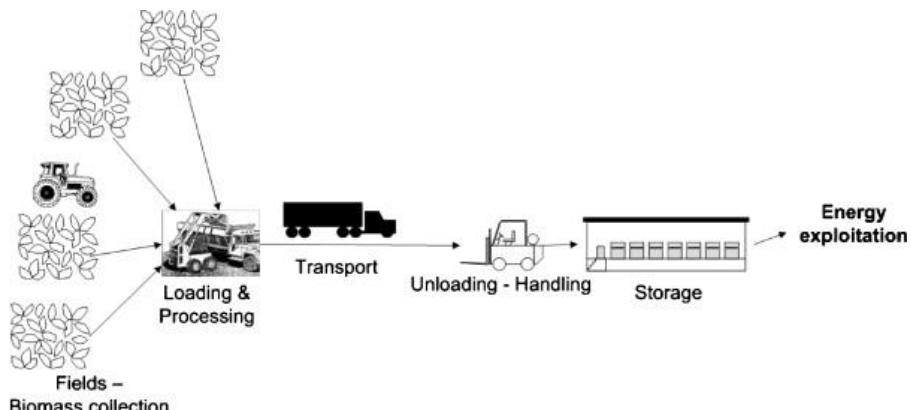
The above figure demonstrates the flow of the search parameters used in the study.

VOCAB: (w/definition)	<ol style="list-style-type: none"> Etiology - the cause, set of causes, or manner of causation of a disease or condition. Hypometabolism - when there is an abnormally low metabolic rate
Cited references to follow up on	<ol style="list-style-type: none"> https://www.deepdyve.com/lp/karger/obsessive-compulsive-symptom-dimensions-as-predictors-of-compliance-r9asAqQogH?key=KARGER
Follow up Questions	<ol style="list-style-type: none"> The article mainly covers the results of experiments involving SSRI, but why specifically does SSRI work more effectively? What exactly is SSRI performing? Is there a clear pattern in the differences from treatable OCD patients and the refractory OCD patients? Are these treatments attacking a specific neurotransmitter such as glutamate which is often known as a leading cause (when seen at higher levels) to OCD?

Article #3 Notes: Logistics issues of biomass: The storage problem and the multi-biomass supply chain

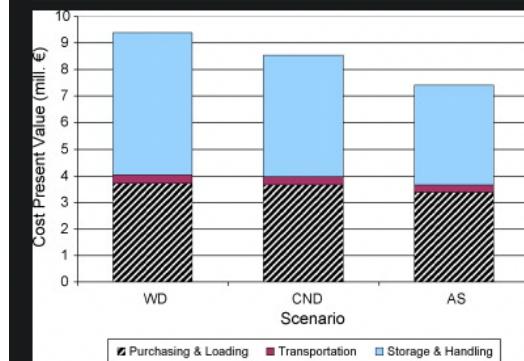
Source Title	Logistics issues of biomass: The storage problem and the multi-biomass supply chain
Source citation (APA Format)	Rentzelas, A. A., Tolis, A. J., & Tatsiopoulos, I. P. (2009). Logistics issues of biomass: The storage problem and the multi-biomass supply chain. <i>Renewable and Sustainable Energy Reviews</i> , 13(4), 887–894. https://doi.org/10.1016/j.rser.2008.01.003
Original URL	https://www.sciencedirect.com/science/article/pii/S1364032108000142?cas_a_token=5wJ9t3PYUI0AAAAA:J32ORIeHiD-Aj_OQXkyLGtETTwdW8CwNj7MR5KC7BuMKu2mBLsr3DWQDQENptFyGN18EKsU0
Source type	Journal Article
Keywords	Biomass storage, Multi-biomass, Biomass supply chain, Energy exploitation, Agricultural biomass
Summary of key points + notes (include methodology)	The author of this study noticed a key issue involving previous studies in biomass storage. All of the previous pieces of literature assume the cheapest solution for storage in their supply chain model, and the author sought to find the most optimal solution with supporting evidence. To do so, three of the most used storage methods were compared against each other to reach a conclusion. The author provides context on previous methods and ideas such as placing the storage houses next to biomass power plants. The author concluded that the most optimal method involves a shift to a greater use of cotton stalks and a reduction of almond trees. Though, future areas of studies may involve looking into fire and health risks that come with this conclusion.
Research Question/Problem/ Need	How can biomass be stored in the most efficient manner in regards to different storage solutions and different costs?

Important Figures



The above diagram demonstrates the processes used in the typical supply chain of biomass.

	WD	CND	AS
Purchasing and loading	100.0%	98.2%	90.9%
Transportation	100.0%	96.2%	87.5%
Storage and handling	100.0%	85.6%	70.2%



The distribution of transportation, purchasing and loading, and storage and handling are demonstrated by the percentages in the table above as well as the histograms.

Table 1. Characteristics of two prevailing biomass types in the case study region		
	Cotton stalks	Almond tree prunings
Residue yield (t/ha) ^a	5.47	6.21
Residue availability factor (%) ^{a,b}	70	90
Biomass remaining for energy exploitation (t/ha)	3.83	5.59
Moisture wet (%) ^a	30	40
HHV (MJ/dry kg) ^{a,b}	18.1	18.4
Density (kg/m ³)	200	300
Availability of biomass	October–November	December–February
Purchasing price (€/t wet) ^c	20	30

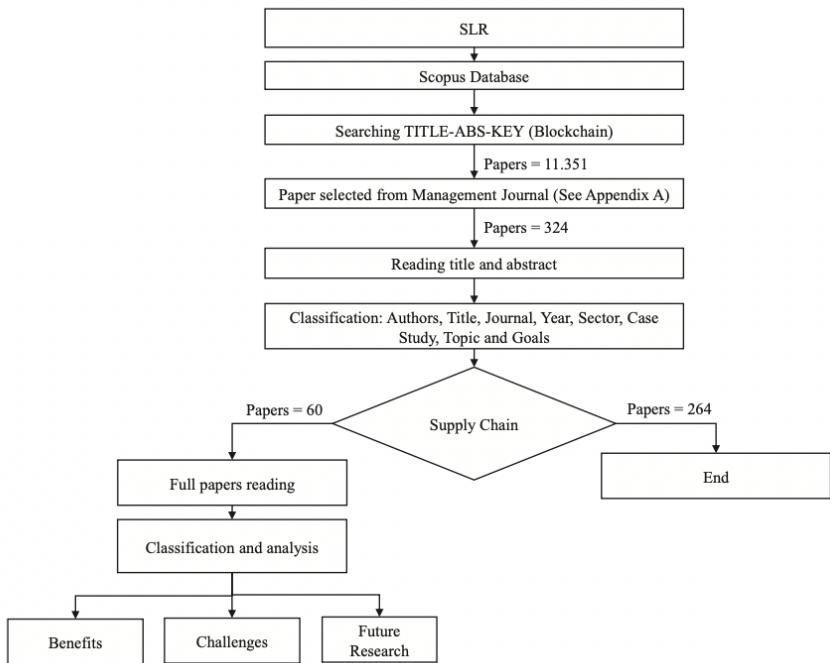
The specific characteristics of the cotton stalks and almond tree prunings used in this study are notes as above.

VOCAB: (w/definition)	1. **Biomass** - material coming from living organisms 2. **GIS** - geographic information system 3. **Ambient Storage** - storage at room temperature
Cited references to follow up on	1. S. Sokhansanj, A. Kumar, A.F. Turhollow Development and implementation of integrated biomass supply analysis and logistics model (IBSAL) 2. D. Nilsson SHAM—a simulation model for designing straw fuel delivery systems. Part 1: model description
Follow up Questions	1. Why were the consequences of low-cost storage overlooked in previous studies? 2. In the overall supply chain, does the efficiency of individual storage facilities make a difference? 3. Does efficiency in the biomass supply chain have an impact on overall global warming?

Article #4 Notes: New organizational changes with blockchain: a focus on the supply chain

Source Title	New organizational changes with blockchain: a focus on the supply chain
Source citation (APA Format)	<i>Varriale, V., Cammarano, A., Michelino, F., & Caputo, M. (n.d.). New organizational changes with Blockchain: A focus on the supply chain. Journal of Organizational Change Management.</i> Retrieved December 20, 2022, from https://www.emerald.com/insight/content/doi/10.1108/JOCM-08-2020-0249/full/html
Original URL	https://www.emerald.com/insight/content/doi/10.1108/JOCM-08-2020-0249/full/html
Source type	Journal Article
Keywords	Blockchain, Supply chain, Systematic literature review, Benefits, Challenges, Future research
Summary of key points + notes (include methodology)	The journal article aims to provide the benefits, challenges, and future research for blockchain and supply chain in relation to each other. Previously, literature reviews focused on specific aspects of supply chain in relation to blockchain, but did not provide overall use cases for the technology. Therefore, this article provides a cumulative overview. In order to do so, the Scopus database was used to filter publications and then arrive at the benefits, challenges, and future research for these two intertwined studies. These papers were analyzed to find the most popular areas for blockchain use as well as to create a comprehensive list of the advantages and disadvantages for blockchain. It was found that blockchain application primarily concerns authentication and certification of goods and has benefits in terms of monitoring and automating supply chain processes. However, challenges arose with performance of the technology as well as with energy consumption.
Research Question/Problem/ Need	What are the current trends of blockchain technology? Where will it be used in the future and what are the advantages and disadvantages that will ensue?

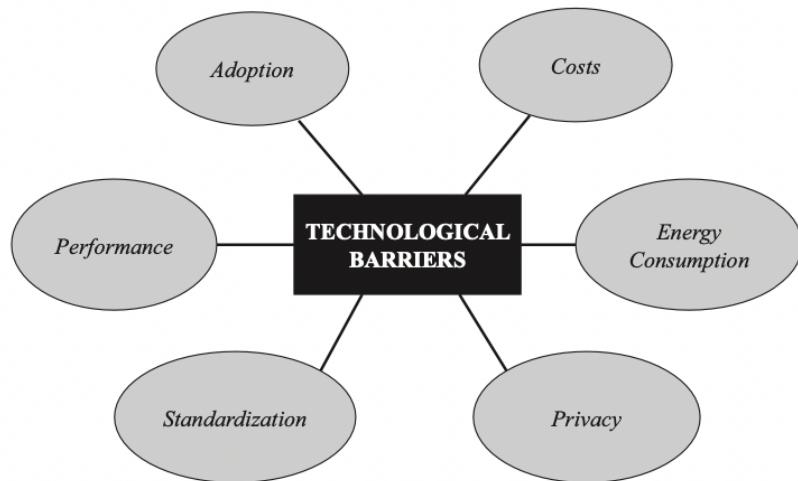
Important Figures



Area of application	#	%
Business and industry	38	12
Energy sector	29	9
Financial	75	23
Health sector	4	1
Informatic sector	47	15
Innovation management	7	2
New technologies	23	7
Public sector	12	4
Social issues	9	3
Supply chain	60	19
Tourism	4	1
Others	16	5

Research method	#	%
Adoptions and limits	44	14
Case study	18	6
Conceptual studies	85	26
IT solutions	20	6
Literature review	43	13
Mathematical solutions	20	6
Statistical approach	32	10
Technical implementation	52	16
Editorial	10	3

The diagrams above demonstrate a few different aspects of this study. The top most diagram demonstrates the search parameters used in the review article in order to analyze past work. The next two tables demonstrate the areas of application mentioned for blockchain as well as the research method involved using blockchain.



Authors	Research method	Area	Years analyzed	Selected articles
Queiroz <i>et al.</i> (2019)	SLR	SC management and BT	2008–2018	27
Wang <i>et al.</i> (2019)	SLR	SC and BT	2017–2018	29
Bavassano <i>et al.</i> (2020)	SLR	Logistics and BT	2017–2019	37
Pournader <i>et al.</i> (2020)	SLR	SC, logistics, transportation and BT	2016–2018	48
Kamble <i>et al.</i> (2020)	SLR	Food SC with other emerging technologies	2000–2017	84

The figure above demonstrates the barriers that come in the way of using blockchain in the present day. The figure below demonstrates past research done in blockchain in specific areas as well as their corresponding authors and years in which the analysis was conducted.

VOCAB: (w/definition)	<ol style="list-style-type: none"> Smart contract - programs on the blockchain that run when a set of conditions are met Distributed ledger - independent computers used to record, share and sync transactions to respective ledgers. Disintermediation - reduction in the use of intermediaries between producers and consumers Intrinsic - essential/naturally
Cited references to follow up on	<ol style="list-style-type: none"> https://fis.uni-bamberg.de/handle/uniba/49465 https://ideas.repec.org/a/eee/bushor/v62y2019i1p35-45.html
Follow up Questions	<ol style="list-style-type: none"> Blockchain technology (BT) only provides the ledger transactions so how is user privacy considered a roadblock to the adoption of BT? Does performance or energy consumption outweigh the benefits of BT? Does the size of the supply chain system matter or is there a certain point where BT becomes beneficial? There is mention of BT being beneficial in CO2 reduction but no

	<p>methodology into this concept. Is this a claim that requires further research? If there are existing methods to prove this claim, what are they?</p> <ol style="list-style-type: none">4. Does removing trust from the supply chain benefit or disadvantage the industrial sector?5. How can BT use the same characteristics that create benefits in the privacy sector for ransomware attacks?
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Article #5 Notes: Glutamate: What It Is and Function

Source Title	Glutamate: What It Is and Function
Source citation (APA Format)	Cleveland Clinic. (2022, April 25). <i>Glutamate: What it is & function.</i> Cleveland Clinic. https://my.clevelandclinic.org/health/articles/22839-glutamate
Original URL	https://my.clevelandclinic.org/health/articles/22839-glutamate
Source type	General Article
Keywords	Glutamate, Illnesses, Functions, Applications
Summary of key points	The following article further provides an explanation on the function of glutamate. Glutamate is known to be an excitatory neurotransmitter, which means it stimulates a nerve cell that sends a chemical message from a nerve cell to another nerve cell. Glutamate itself is made from glial cells in the brain and is recycled as the older glutamate is simply refreshed with new glutamate naturally. Beyond serving the different trigger actions, glutamate also helps to process gamma-aminobutyric acid, which is another neurotransmitter to calm the brain. In the body, glutamate serves to enhance learning and memory, energy sources for brain cells, chemical messengers, sleep-wake cycles, and pain signaling.
Notes (include methodology)	<ul style="list-style-type: none"> - Functions of glutamate <ul style="list-style-type: none"> - Learning and memory - Energy source for brain cells - Chemical messenger - sleep/wake cycle manager - Pain signaler - How can you end up with too much glutamate? <ul style="list-style-type: none"> - Too much release - Nerves cell receptors become over sensitive to glutamate - Conditions from too much glutamate <ul style="list-style-type: none"> - Lou gehrig's diseases - Multiple sclerosis - Stroke - etc.
Research Question/Problem/ Need	What is the purpose of the neurotransmitter glutamate?

Important Figures	None.
VOCAB: (w/definition)	<ol style="list-style-type: none"> 1. GABA - (gamma-aminobutyric acid) a calming neurotransmitter involved in sleep and relaxation 2. Synaptic vesicles - storage for neurotransmitters 3. MSG - (monosodium glutamate) a food additive
Cited references to follow up on	<ol style="list-style-type: none"> 1. https://my.clevelandclinic.org/health/diseases/9490-obsessive-compulsive-disorder 2. https://my.clevelandclinic.org/health/diseases/9290-depression
Follow up Questions	<ol style="list-style-type: none"> 1. Is glutamate the only commonality in the conditions listed as consequence for too much glutamate? 2. Why can a person end up with too little glutamate? The consequences are explained but not the reasoning for how this situation is created. 3. Are the receptors of glutamate or glutamic itself responsible for the conditions listed?

Article #6 Notes: Metabotropic glutamate receptor 5 binding in patients with obsessive-compulsive disorder

Source Title	Metabotropic glutamate receptor 5 binding in patients with obsessive-compulsive disorder
Source citation (APA Format)	Akkus, F., Terbeck, S., Ametamey, S. M., Rufer, M., Treyer, V., Burger, C., Johayem, A., Mancilla, B. G., Sovago, J., Buck, A., & Hasler, G. (2014). Metabotropic glutamate receptor 5 binding in patients with obsessive-compulsive disorder. <i>The International Journal of Neuropsychopharmacology</i> , 17(12), 1915–1922. https://doi.org/10.1017/s1461145714000716
Original URL	https://academic.oup.com/ijnp/article/17/12/1915/2910007
Source type	Journal Article
Keywords	Anxiety, glutamate, neuroimaging, obsession
Summary of key points	From previous studies, it has become clear that interventions that currently exist for OCD do not work. Instead, recent animal studies and magnetic resonance spectroscopy research point to glutamate dysfunction being a primary factor in OCD – something that the current interventions do not consider. Based on past research, metabotropic glutamate receptor 5 or mGluR5 was investigated. The distribution volume ratio of the receptor was measured as a response on a group of 10 individuals put through a PET scan. From this experiment, it resulted that there was no significant difference between receptors in healthy versus OCD diagnosed patients. However, this experiment was most likely invalidated based on the fact that many of the OCD patients had depression in the past which reduces their distribution volume ratio, making it seem like there is no difference.
Notes (include methodology)	<ul style="list-style-type: none"> - Role of glutamate is demonstrated by the effects that pharmaceuticals have on glutamate receptors - Methodology <ul style="list-style-type: none"> - Using positron emission tomography the researchers were able to measure availability of the receptor in health/OCD patients - Imaging technique using tracers to measure the change of metabolic processes - Predicted to see changes in the orbitofrontal cortex per previous research - Got people from Zurich university hospital - Evaluated the people to see if they could even be used for

	<p>the PET scan as they need to be in good shape etc.</p> <p>additionally people with structural brain pathologies or other illnesses in general were excluded via tests performed before the PET</p> <ul style="list-style-type: none"> - Subjects joined study after giving consent - Collected data from the PET scan - Used PMOD software which is peripheral module interface that allows external boards to connect to a PC - Data was normalized based on regions of interest (ROIS) that were expected to have activity based on previous studies 																																																																																				
Research Question/Problem/ Need	What is the impact of the DVR of the glutamatergic receptor mGluR5 on obsessive compulsive disorder?																																																																																				
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VOCAB: (w/definition)	<ol style="list-style-type: none"> 1. Metabotropic - action controlled by metabolic function 2. Distribution volume ratio - linear function of receptor availability 3. Anxiolytic - a drug used to reduce anxiety 4. PMOD - (peripheral module interface) allows for external boards to connect to a PC 																																																																																				
Cited references to follow up on	<ol style="list-style-type: none"> 1. Spooren WP, Vassout A, Neijt HC, Kuhn R, Gasparini F, Roux S, Porsolt RD, Gentsch C (2000) Anxiolytic-like effects of the prototypical metabotropic glutamate receptor 5 antagonist 2-methyl-6-(phenylethynyl)pyridine in rodents. J Pharmacol Exp Ther 295:1267–1275. 2. Nestadt G, Grados M, Samuels JF (2010) Genetics of obsessive-compulsive disorder. Psychiatr Clin North Am 33:141–158. 																																																																																				
Follow up Questions	<ol style="list-style-type: none"> 1. Why are healthy subjects also not placed on the Y-BOCS compulsion scale? 																																																																																				

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|--|---|
| | <ol style="list-style-type: none">2. Will the lower sample size have an effect on the overall study?3. Why was depression not blocked during the stages prior to the PET scan? |
|--|---|

Article #7 Notes: Glutamate Genetics in Obsessive-Compulsive Disorder: A Review

Source Title	Glutamate Genetics in Obsessive-Compulsive Disorder: A Review
Source citation (APA Format)	Rajendram, R., Kronenberg, S., Burton, C. L., & Arnold, P. D. (2017). Glutamate Genetics in Obsessive-Compulsive Disorder: A Review. <i>Journal of the Canadian Academy of Child and Adolescent Psychiatry</i> , 26(3), 205–213. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5642460/
Original URL	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5642460/
Source type	Review Article
Keywords	OCD, glutamate, genetics
Summary of key points	Over the course of the past few years, there have been many studies conducted in the realm of Obsessive Compulsive Disorder (OCD) and glutamic genes. This study condenses those previous works into one, comprehensive piece that summarizes the current progress.
Notes (include methodology)	<ul style="list-style-type: none"> - Starts off with context of OCD, touching on the risk factors/gene factors being unknown - Lifetime prevalence of 1-3% - Glutamate signaling dysfunction in cortico-striatal-thalamo-cortical circuit has growing evidence for being involved with OCD - The study serves to look at the role of glutamic genes in the cases of OCD - Methodology <ul style="list-style-type: none"> - Recent papers of the role of glutamate genes in OCD were observed - SAPAP family in Mouse Models <ul style="list-style-type: none"> - Per mouse models, the gene family of SAPAP is believed to have the strongest relation to OCD based on mouse models - It regulates the trafficking/targeting of neurotransmitters - May also be altering glutamate signals - When the gene was taken out, OCD symptoms were observed in the mice (excessive grooming, anxiety, etc) - When the gene is removed, abnormalities in the cortico-striatal circuit were observed - AMPAR is a glutamate receptor that mediates effects caused by SAPAP3 <ul style="list-style-type: none"> - Transmissions of this receptor were reduced in the

	<ul style="list-style-type: none"> - mice without SAPAP3 - mGluR also was affected by the SAPAP3 change as they were more active on the striatal inhibitory medium spiny neurons - Because two different receptors are impacted by SAPAP, there is a strong sign that SAPAP is an important indicator for OCD - Human Genetics Findings in the DLGAP family <ul style="list-style-type: none"> - Human homolog of the SAPAP gene - Associated with schizophrenia and tourette's syndrome - Findings for DBGAP have mixed results - There is no single nucleotide or haplotype within DLGAP3 that has a role in OCD - Instead of DLGAP3, DLGAP1 has been provided as a potential link - Human Genetic Findings in a Glutamate Transporter Gene <ul style="list-style-type: none"> - The 9p24 region showed links to OCD - Two genes code that interact with glutamate are SLC1A1 and PTPRD - Fives different studies confirm SLC1A1 as a postsynaptic glutamate transporter - OCD patients also have SLC1A1 variants - Functional Role of SLC1A1 <ul style="list-style-type: none"> - Regulation of isoform expression has the potential to disrupt SLC1A1 - Results <ul style="list-style-type: none"> - The SAPP family, SLC1A1, and GRIN/GRIK families of proteins have demonstrated that they have the greatest relation to OCD
Research Question/Problem/ Need	What is the current status for knowledge of obsessive compulsive disorder in relation to glutamic genes? What is our past knowledge?
Important Figures	<p>The diagram illustrates the synaptic transmission process. On the left, a presynaptic neuron releases Glutamate from synaptic vesicles. The Glutamate binds to AMPAR (Alpha-amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid receptor) on the post-synaptic neuron. SAPAP3 (SAPAP3) is shown associated with the AMPAR. On the right, mGluR5 (metabotropic glutamate receptor 5) is shown on the post-synaptic neuron, which is activated by Glutamate. Arrows indicate the signal flow from the AMPAR to the mGluR5.</p>

	The SAPAP3 gene was removed from mice in the image above, resulting in OCD symptoms for the mice. After removal, there was a higher rate of transmission from glutamate.
VOCAB: (w/definition)	<ol style="list-style-type: none">1. striatal inhibitory medium spiny neurons - a special inhibitory cell, accounting for a major portion of neurons in the striatum2. Endocytosis - process where cells absorb material through the process of engulfing the material with the cell membrane3. human homolog - a related gene
Cited references to follow up on	<ol style="list-style-type: none">1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5642460/#b30-cca_p26_p02052. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5642460/#b20-cca_p26_p0205
Follow up Questions	<ol style="list-style-type: none">1. Several genes are listed as having correspondence with OCD, but which have the most correspondence?2. Are larger studies required in order to prove the correlation between specific genes and OCD?

Article #8 Notes: An experimental analysis of obsessive-compulsive checking as avoidance behavior

Source Title	An experimental analysis of obsessive-compulsive checking as avoidance behaviour
Source citation (APA Format)	Aguayo, L., Melero, F., Lázaro, A. (2014). An experimental analysis of obsessive-compulsive checking ... - <i>PSICOThemes</i> . An experimental analysis of obsessive-compulsive checking as avoidance behaviour. Retrieved October 11, 2022, from https://www.psicothema.com/pdf/4153.pdf
Original URL	https://www.psicothema.com/pdf/4153.pdf
Source type	Journal Article
Keywords	OCD, checking, experimental analogue, avoidance, negative reinforcement.
Summary of key points	Researchers conducted an experiment on 48 healthy individuals from a local university. They were attempting to determine if the behaviors that occurred as a result of different aversion leveled activities had an impact on checking behavior. By recognizing the checking behavior in response to aversion in healthy patients, they would be able to draw conclusions from negative emotions to OCD-like behavior. Thus, they wanted to see if this type of behavior could be expanded beyond the population of OCD individuals (using YBOCS).
Notes (include methodology)	<ul style="list-style-type: none"> - The study attempted to use repetitive behaviors to group/characterize similar OCD cases <ul style="list-style-type: none"> - METHOD <ul style="list-style-type: none"> - Inter group design - When subjects are tested by a different factor at the same time - 3 levels of aversion - 48 healthy patients were distributed in groups of 16 each - During tasks, a checking frequency was measured - Questionnaires for compulsivity were used <ul style="list-style-type: none"> - TONI-2 - STAI - MOCI - YBOCS-SR - RESULTS

	<ul style="list-style-type: none"> - Participants with minimal or maximum aversion levels tended to have the worst checking behaviors in comparison to others - CONCLUSION <ul style="list-style-type: none"> - The checking behavior allows an individual to have a sense of escape, even if short - Could be extended to avoidance function 																																																																																				
Research Question/Problem/ Need	The objective was to create an experimental signal to stimulate checking behavior to see if the participants had higher OCD levels.																																																																																				
Important Figures	<p style="text-align: center;"><i>Table 1</i> Mean scores for groups</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2"></th> <th colspan="2">Minimal</th> <th colspan="2">Progressive</th> <th colspan="2">Maximum</th> </tr> <tr> <th>M</th> <th>SD</th> <th>M</th> <th>SD</th> <th>M</th> <th>SD</th> </tr> </thead> <tbody> <tr> <td>STAI-State</td> <td>16.44</td> <td>7.35</td> <td>13.50</td> <td>7.63</td> <td>12.88</td> <td>7.91</td> </tr> <tr> <td>STAI-Trait</td> <td>17.31</td> <td>11.11</td> <td>16.50</td> <td>8.95</td> <td>14.19</td> <td>6.39</td> </tr> <tr> <td>MOCI</td> <td>5.63</td> <td>3.59</td> <td>4.56</td> <td>3.14</td> <td>5.31</td> <td>2.77</td> </tr> <tr> <td>YBOCS</td> <td>4.74</td> <td>4.96</td> <td>5.88</td> <td>5.97</td> <td>4.25</td> <td>5.22</td> </tr> <tr> <td>Toni-2</td> <td>36.19</td> <td>5.19</td> <td>36.44</td> <td>4.66</td> <td>38.44</td> <td>6.32</td> </tr> <tr> <td>Checking (**)</td> <td>9.36</td> <td>3.09</td> <td>5.75</td> <td>4.35</td> <td>6.88</td> <td>3.63</td> </tr> <tr> <td>Time in minutes</td> <td>44.96</td> <td>1.43</td> <td>46.39</td> <td>1.24</td> <td>45.92</td> <td>1.12</td> </tr> <tr> <td>Percentage of CR</td> <td>59.37</td> <td>21.51</td> <td>68.31</td> <td>16.39</td> <td>55.28</td> <td>26.42</td> </tr> <tr> <td>Essays / Time (**)</td> <td>3.74</td> <td>1.33</td> <td>3.03</td> <td>1.06</td> <td>1.85</td> <td>0.77</td> </tr> </tbody> </table> <p>(**) Checking responses and rate essays/time were significant (SC= 127.12, gl= 2, F= 4.56, p<.01)</p> <p>Mean scores for the different questionnaires that were given (i.e. YBOCS, MOCI, etc). These scores allowed them to observe statistically significant differences at the conclusion of the experiments.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <caption>Data for Bar Chart</caption> <thead> <tr> <th>Aversion Group</th> <th>Number of Checks</th> </tr> </thead> <tbody> <tr> <td>Minimal</td> <td>9.63</td> </tr> <tr> <td>Progressive</td> <td>5.75</td> </tr> <tr> <td>Maximum</td> <td>6.88</td> </tr> </tbody> </table> <p>The number of recorded checks against the three different aversion groups are demonstrated above.</p>		Minimal		Progressive		Maximum		M	SD	M	SD	M	SD	STAI-State	16.44	7.35	13.50	7.63	12.88	7.91	STAI-Trait	17.31	11.11	16.50	8.95	14.19	6.39	MOCI	5.63	3.59	4.56	3.14	5.31	2.77	YBOCS	4.74	4.96	5.88	5.97	4.25	5.22	Toni-2	36.19	5.19	36.44	4.66	38.44	6.32	Checking (**)	9.36	3.09	5.75	4.35	6.88	3.63	Time in minutes	44.96	1.43	46.39	1.24	45.92	1.12	Percentage of CR	59.37	21.51	68.31	16.39	55.28	26.42	Essays / Time (**)	3.74	1.33	3.03	1.06	1.85	0.77	Aversion Group	Number of Checks	Minimal	9.63	Progressive	5.75	Maximum	6.88
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VOCAB: (w/definition)	1. Analogue - relating/using signals																																																																																				

	<ol style="list-style-type: none"> 2. Aversion - a disliking 3. Visuo-spatial reasoning - one's ability to identify visual and spatial relations
Cited references to follow up on	<ol style="list-style-type: none"> 1. Arntz, A., Voncken, M., & Goosen, C.A. (2007). Responsibility and obsessive-compulsive disorder: An experimental test. <i>Behaviour Research and Therapy</i>, 45(3), 425-435. 2. Rachman, S. (1997). A cognitive theory of obsessions. <i>Behavior Research and Therapy</i>, 35, 793-802.
Follow up Questions	<ol style="list-style-type: none"> 1. What do reinforcements for OCD refer to when stating that there are less reinforcements after anxiety levels are reduced? 2. Why was there no OCD test group involved? 3. If checking was observed within these individuals, does that mean it's non-unique to OCD cases?

Article #9 Notes: Drug treatment of obsessive-compulsive disorder

Source Title	Drug treatment of obsessive-compulsive disorder
Source citation (APA Format)	Kellner, M. (2010). Drug treatment of obsessive-compulsive disorder. <i>Dialogues in Clinical Neuroscience</i> , 12(2), 187–197. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3181958/
Original URL	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3181958/
Source type	Review Article
Keywords	obsessive-compulsive disorder , OCD, pharmacotherapy, drug, treatment, SSRI, antipsychotic, psychotherapy, glutamate
Summary of key points	Obsessive compulsive disorder has several treatments, and this article serves to demonstrate some of the current ways that exist. Treatments from the most common such as SSRIs to cognitive behavioral treatments are presented alongside the resulting consequences of each. Research has found SSRIS to have the most benefit as of yet, though, newer areas of study are being formed in order to find more effective solutions to OCD. An important area in the future will be being able to determine the yield of a certain treatment before it is implemented to be more effective and provide faster results.
Notes (include methodology)	<ol style="list-style-type: none"> 1. Obsessive compulsive disorder has progressed in terms of searching for a treatment over the past 40 years; however, the current treatments are not effective, such as: <ul style="list-style-type: none"> - Serotonergic antidepressants (ex. SSRIS) - Clomipramine - Intravenous serotonergic antidepressants 2. The orbitofrontal cortex is believed to have some influence on OCD 3. Glutamate dysfunction and dopamine established as areas of study 4. Most sufferers do not receive adequate treatment (more than one in 3 do not receive pharmacotherapy) 5. SSRIS <ul style="list-style-type: none"> - SSRIS have a higher recommendation grade in comparison to citalopram and clomipramine - Higher doses are provided with OCD to create greater efficacy - Treatment involving SSRIS should be with one of the following <ul style="list-style-type: none"> - Fluoxetine - Fluvoxamine

	<ul style="list-style-type: none"> - Paroxetin - Sertraline - Citalopram <p>- Further studies needed for efficacy between specific SSRIS</p> <p>6. 40 to 60% of patients do not respond to SSRIS leading to a need for a second-line of treatments</p> <p>7. Solutions with antipsychotics and cognitive behavioral psychotherapy are being developed</p> <ul style="list-style-type: none"> - Only 25% of symptoms appeared to be reduced <p>8. Cognitive behavior therapy (CBT)</p> <ul style="list-style-type: none"> - Use of (CBT) allowed for a reduction in OCD symptoms for over 6 months <p>9. Several issues still need to be understood for OCD</p> <p>10. Prediction of response to approaches to OCD is a new area of research</p>
Research Question/Problem/ Need	What are the current pharmacotherapeutic treatments for OCD, and how do they work?
Important Figures	<p>Table I</p> <p>Algorithm for drug treatment of patients with obsessive-compulsive disorder</p> <hr/> <p>First-line pharmacological treatment:</p> <ul style="list-style-type: none"> • Selective serotonin reuptake inhibitors (eg, escitalopram, fluvoxamine, fluoxetine, paroxetine or sertraline) or clomipramine • Administration of medium to high doses • Acute treatment of at least 3 months • If efficacious, maintenance treatment of at least 1 year <p>Treatment options for patients refractory to first-line pharmacological treatment:</p> <ul style="list-style-type: none"> • Modification of first-line treatment (eg, intravenous clomipramine, further dose increase, switch to other or combination of first-line drugs) • Augmentation with antipsychotics (eg, risperidone, haloperidol, quetiapine, olanzapine, or aripiprazole) • Augmentation with (or switch to) cognitive-behavior therapy • Trials with other drugs (please see text) <p style="text-align: right;">Open in a separate window</p>
	The findings of the review article of the different treatments are condensed into the table above.
VOCAB: (w/definition)	<p>11. Pharmacotherapy - treatment of a disorder with medication</p> <p>12. Morbidity - the condition of suffering from a disorder</p> <p>13. Amelioration - improvement</p>
Cited references to follow up on	<p>1. https://pubmed.ncbi.nlm.nih.gov/11981351/</p>

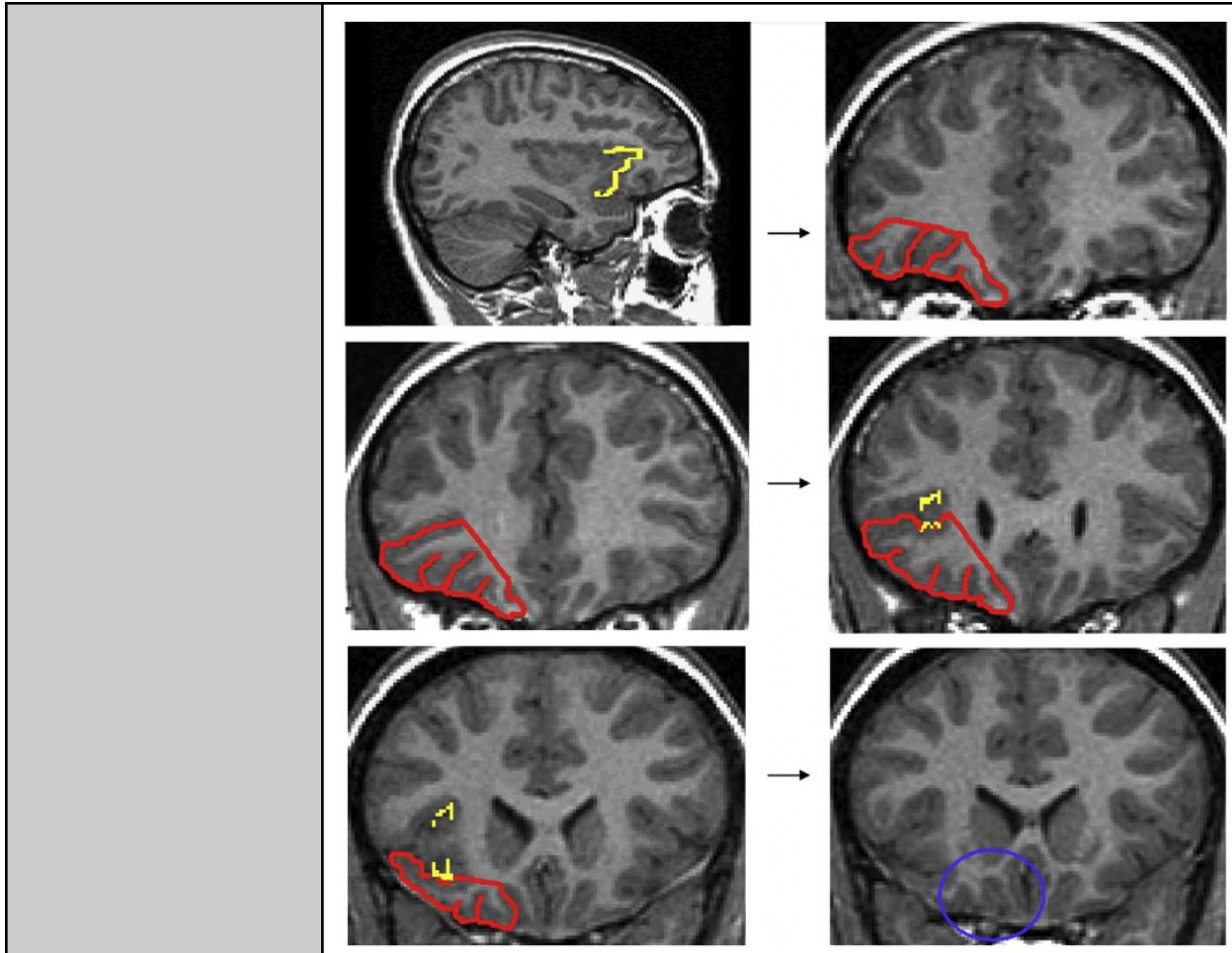
Follow up Questions

1. Can different approaches be combined to create different results?
2. Are OCD solutions applicable to other disorders?
3. Future research involves trying to determine which approaches will yield better results than others, but how can this be done without studies?

Article #10 Notes: Orbital frontal cortex in treatment-naïve pediatric obsessive-compulsive disorder

Source Title	Orbital frontal cortex in treatment-naïve pediatric obsessive-compulsive disorder
Source citation (APA Format)	MacMaster, F., Vora, A., Easter, P., Rix, C., & Rosenberg, D. (2010). Orbital frontal cortex in treatment-naïve pediatric obsessive-compulsive disorder. <i>Psychiatry Research: Neuroimaging</i> , 181(2), 97–100. https://doi.org/10.1016/j.psychresns.2009.08.005
Original URL	https://www.sciencedirect.com/science/article/pii/S0925492709001978?cas_a_token=90YbAcxTJysAAAAA:utsZSob5TJavV8pwYF_IY7aCUETrbHgOZscYVoJIRbeFg78_mfQ3z0sOocsDGpnRK9zfBZcW
Source type	Journal Article
Keywords	Magnetic resonance imaging, Obsessive-compulsive disorder, Orbital prefrontal cortex
Summary of key points	Researchers observed the consistency of the orientation frontal cortex (OFC) region of the brain being impacted in OCD cases and therefore performed imaging to find an association. In order to do so, they took 28 OCD patients and a random sample of healthy patients in order to observe differences. They took MRI scans of both groups and analyzed the brains in order to reach the conclusion that white matter in the right OFC was greater for OCD patients. This result contradicts previous studies, but it is noted that the previous studies may have been impacted by confounding variables.
Notes (include methodology)	<ul style="list-style-type: none"> - Orientation frontal cortex region (OFC) has been noted to have implicated in relation to the observance of obsessive compulsive disorder (OCD) <ul style="list-style-type: none"> - Neuropsychological studies demonstrated this - Imaging studies found lower OFC volumes in OCD sufferers than in healthy patients - OFC in relation to OCD is the most consistent finding of yet in comparison to the results of treatments and drugs - The purpose of this study was to link genetic and neuroimaging data to associations with certain genes involved with OCD - The researchers hypothesized that smaller OFC volumes would be observed in the OCD patients - Method <ul style="list-style-type: none"> - Used 28 patients diagnosed with OCD

	<ul style="list-style-type: none"> - Healthy control patients were taken at random - Patients were excluded on basis of bipolar disorder, psychosis, eating disorders, substances abuses, Sydenham's chorea, tic-related conditions, conduct disorder, medical conditions, pervasive developmental disorder and more - Healthy patients did not have any previous illnesses - OCD was assessed on the Yale-Brown Obsessive-Compulsive Scale (YBOCS) - Hamilton Anxiety Rating Scale used for anxiety measurement - MRI scans were taken - Analysis of covariance compared the groups - Right OFC white matter for OCD patients were significantly higher than that of the healthy patients with no other abnormalities being noted 																																																
Research Question/Problem/ Need	What is the relation between genetic and neuroimaging data with OCD?																																																
Important Figures	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Item</th> <th style="text-align: center;">OCD patients</th> <th style="text-align: center;">Healthy controls</th> <th style="text-align: center;">Statistic</th> </tr> </thead> <tbody> <tr> <td>Age (years)</td> <td style="text-align: center;">12.78 ± 2.92</td> <td style="text-align: center;">13.56 ± 2.88</td> <td style="text-align: center;">$t = 0.93, P = 0.36$</td> </tr> <tr> <td>Sex</td> <td style="text-align: center;">14 males 14 females</td> <td style="text-align: center;">9 males 12 females</td> <td style="text-align: center;">$\chi^2 = 0.18, P = 0.67$</td> </tr> <tr> <td>CY-BOCS</td> <td style="text-align: center;">24.61 ± 5.74</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> </tr> <tr> <td>Duration of illness (months)</td> <td style="text-align: center;">47.14 ± 38.10</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> </tr> <tr> <td>Hamilton Depression Scale</td> <td style="text-align: center;">8.07 ± 5.35</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> </tr> <tr> <td>Hamilton Anxiety Scale</td> <td style="text-align: center;">8.39 ± 4.64</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> </tr> <tr> <td>OFC right gray (cc)</td> <td style="text-align: center;">5.67 ± 1.49</td> <td style="text-align: center;">5.45 ± 1.57</td> <td style="text-align: center;">$F = 0.52, df = 4,47, P = 0.85$</td> </tr> <tr> <td>OFC right white (cc)</td> <td style="text-align: center;">3.86 ± 0.73</td> <td style="text-align: center;">3.17 ± 0.83</td> <td style="text-align: center;">$F = 5.50, df = 4,47, P = 0.024$</td> </tr> <tr> <td>OFC left gray (cc)</td> <td style="text-align: center;">5.92 ± 1.30</td> <td style="text-align: center;">5.75 ± 1.93</td> <td style="text-align: center;">$F = 0.92, df = 4,47, P = 0.34$</td> </tr> <tr> <td>OFC left white (cc)</td> <td style="text-align: center;">3.83 ± 0.83</td> <td style="text-align: center;">3.75 ± 1.27</td> <td style="text-align: center;">$F = 0.90, df = 4,47, P = 0.35$</td> </tr> <tr> <td>Intracranial volume (cc)</td> <td style="text-align: center;">1235.79 ± 108.27</td> <td style="text-align: center;">1142.75 ± 114.93</td> <td style="text-align: center;">$t = 2.90, df = 4,47, P = 0.006$</td> </tr> </tbody> </table> <p>Data of the subjects in the sample</p>	Item	OCD patients	Healthy controls	Statistic	Age (years)	12.78 ± 2.92	13.56 ± 2.88	$t = 0.93, P = 0.36$	Sex	14 males 14 females	9 males 12 females	$\chi^2 = 0.18, P = 0.67$	CY-BOCS	24.61 ± 5.74	-	-	Duration of illness (months)	47.14 ± 38.10	-	-	Hamilton Depression Scale	8.07 ± 5.35	-	-	Hamilton Anxiety Scale	8.39 ± 4.64	-	-	OFC right gray (cc)	5.67 ± 1.49	5.45 ± 1.57	$F = 0.52, df = 4,47, P = 0.85$	OFC right white (cc)	3.86 ± 0.73	3.17 ± 0.83	$F = 5.50, df = 4,47, P = 0.024$	OFC left gray (cc)	5.92 ± 1.30	5.75 ± 1.93	$F = 0.92, df = 4,47, P = 0.34$	OFC left white (cc)	3.83 ± 0.83	3.75 ± 1.27	$F = 0.90, df = 4,47, P = 0.35$	Intracranial volume (cc)	1235.79 ± 108.27	1142.75 ± 114.93	$t = 2.90, df = 4,47, P = 0.006$
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Images from the MRI scans of the health and OCD patients with regions being highlighted to demonstrate the inherent changes occurring.

VOCAB: (w/definition)	<ol style="list-style-type: none"> 1. White matter - areas of brain with axons covered in myelin 2. Coronal plane - imaginary plan that divides body into the front and back region vertically 3. Insular cortex - a structure of the brain allowing functionality in emotional/social behaviors and other aspects
Cited references to follow up on	<ol style="list-style-type: none"> 1. https://www.sciencedirect.com/science/article/pii/S0925492709001978?via=ihub#bbib2 2. https://www.sciencedirect.com/science/article/pii/S0925492709001978?via=ihub#bbib4
Follow up Questions	<ol style="list-style-type: none"> 1. What are the differing confounding variables in the past study and this one that led to the opposing results? 2. How can concentration of white matter observed in the study be narrowed down to find a more specific cause for the disorder? 3. Did any of the animals tested on share a commonality when exhibiting OCD symptoms?

Article #11 Notes: Orbitofrontal Cortex

Source Title	Orbitofrontal Cortex
Source citation (APA Format)	<i>Orbitofrontal cortex.</i> (n.d.). Kenhub. Retrieved October 18, 2022, from https://www.kenhub.com/en/library/anatomy/orbitofrontal-cortex
Original URL	https://www.kenhub.com/en/library/anatomy/orbitofrontal-cortex
Source type	General Article
Keywords	Orbitofrontal cortex, functionality, brain circuitry
Summary of key points	The orbitofrontal cortex is located on the frontal lobe – which is the front half of the brain – and on the ventral side – underneath. This part of the brain serves to process rewards and punishments as well as regulate behaviors. Furthermore, the orbitofrontal cortex serves as a function to connect various other regions of the brain such as the temporal lobe and hippocampus. In the scope of obsessive compulsive disorder (OCD), understanding the function of this part of the brain in relation to other variables is required in order to analyze why different changes are noticed.
Notes (include methodology)	<ul style="list-style-type: none"> - The orbitofrontal cortex is the part forming the prefrontal cortex with the frontal lobe - Related to olfactory bulb and tract - Primary function comes with processing rewards and punishments <ul style="list-style-type: none"> - Takes in all the sensory information and outputs an according reward or punishment feeling - Part of the brain's network of connections <ul style="list-style-type: none"> - Connects to the temporal lobe and hippocampus - Also is involved in regulating emotional/social behavior
Research Question/Problem/ Need	What is the orbitofrontal cortex, and what is its function?
Important Figures	None.
VOCAB: (w/definition)	<ol style="list-style-type: none"> 1. Brodmann areas - system to divide the cerebral cortex based on cytoarchitectural organization 2. Magnocellular medial nuclear - major synaptic for reaching

	<p>auditory areas of cerebral cortex</p> <p>3. Carotid - two main arteries which carry blood to the head and neck</p>
Cited references to follow up on	<ol style="list-style-type: none"> 1. Krangelbach, M. L., & Rolls, E. T. (2004). The functional neuroanatomy of the human orbitofrontal cortex: evidence from neuroimaging and neuropsychology. <i>Progress in neurobiology</i>, 72(5), 341-372. 2. Rolls, E. T. (2004). The functions of the orbitofrontal cortex. <i>Brain and cognition</i>, 55(1), 11-29.
Follow up Questions	<ol style="list-style-type: none"> 1. Which pieces of sensory information have a greater impact on the function of the orbitofrontal cortex? 2. Does the orbitofrontal cortex serve as an indicator of disorders? If so, which ones? 3. What are common irregularities noticed in this region of the brain?

Article #12 Notes: Reliability and Validity of the Yale-Brown Obsessive-Compulsive Scale

Source Title	Reliability and Validity of the Yale-Brown Obsessive-Compulsive Scale
Source citation (APA Format)	Woody, S. R., Steketee, G., & Chambless, D. L. (1995). Reliability and validity of the Yale-Brown Obsessive-Compulsive Scale. <i>Behaviour Research and Therapy</i> , 33(5), 597–605. https://doi.org/10.1016/0005-7967(94)00076-v
Original URL	https://pubmed.ncbi.nlm.nih.gov/7598684/
Source type	Journal Article
Keywords	YBOCS, validity, comparison
Summary of key points	Obsessive compulsive disorder (OCD) relies on Y-BOCS for diagnosis. However, the Y-BOCS lacks a proper form of validation. Prior to this study, only 1 other study provided positive results in tying the test to OCD. Therefore, this paper serves to validate the test by using OCD patients requiring treatment at a local hospital. They used a series of steps in order to collect data on the test scores for different patients and then conducted an analysis using Chronback's alpha levels.
Notes (include methodology)	<ul style="list-style-type: none"> - Validity and reliability of YBOCS needs to be tested - Scale broken into two subsections: obsessively and compulsions <ul style="list-style-type: none"> - Each side has 5 factor levels ranging from scores 0 to 4, giving the test a total max score of 40 - Scale is not dependent on specific symptoms but instead aspects of those symptoms - Method <ul style="list-style-type: none"> - Participants = 54 - Measures <ul style="list-style-type: none"> - Clinical expert - Self report - Collect BAT
Research Question/Problem/ Need	Is the Y-BOCS a reliable test for assessing and diagnosing OCD patients?

Important Figures

Table 1. Previous reports on psychometric properties of the Yale-Brown obsessive compulsive scale

Sample	Goodman <i>et al.</i> (1989a)	Goodman <i>et al.</i> (1989b)	Kim <i>et al.</i> (1990)	Kim <i>et al.</i> (1992)	Frost <i>et al.</i> (1994)
	40 OCD patients	81 OCD patients from 3 separate studies	23 nondepressed OCD patients	28 nondepressed OCD patients	43 non-clinical students
<i>Reliability</i>					
Alpha	0.88 to 0.91	—	—	—	0.88
Item-total correlation	$r = 0.36$ (item 4) to 0.77	—	—	—	$r = 0.43$ to 0.75
Inter-rater ICCs	YBOCS Total $r = 0.98$ Obsessions $r = 0.97$ Compulsions $r = 0.96$ items 0.86–0.97	—	—	—	94% agreement ($n = 10$ cases)
Test-retest ICCs	—	—	$r = 0.90$	$r = 0.97$	—
<i>Convergent validity</i>					
Physical global	—	$r = 0.74$	$\rho = -0.73^{*†}$	$\rho = 0.82^{*}$	—
Patient global	—	—	$\rho = 0.54^{*†}$	$\rho = 0.72^{*}$	—
NIMH-OC	—	$r = 0.67$ ($n = 20$)	—	$\rho = 0.80^{*}$ baseline, $\rho = 0.77$	—
MOCI	—	$r = 0.53$ ($n = 66$)	—	—	$r = 0.58$
LOI	—	—	Total $\rho = 0.3$ Symptom $\rho = 0.38$	—	—
SCL-90-R OC	—	—	—	$\rho = 0.41^{*}$ baseline, $\rho = 0.17$	—
CAC-R	—	—	—	—	$r = 0.55$
OTC	—	—	—	—	$r = 0.64$
<i>Divergent validity</i>					
Hamilton-Depression	—	$r = 0.60$ ($n = 80$)	—	—	—
Hamilton-Anxiety	—	$r = 0.47$ ($n = 79$)	—	—	—

The study summarizes knowledge from previous studies via this table, utilizing r values and other statistical analysis.

Table 2. Yale-Brown obsessive compulsive scale: internal consistency

	Item-remainder correlation ($n = 51$) (Subscale)	Item-remainder correlation ($n = 51$) (YBOCS Total)
<i>Obsessions Subscale</i>	<i>alpha = 0.77</i>	
1. Time spent	0.62	0.48
2. Interference	0.53	0.53
3. Distress	0.63	0.51
4. Resistance	0.34	0.30
5. Control	0.60	0.51
<i>Compulsions subscale</i>	<i>alpha = 0.51</i>	
6. Time spent	0.27	0.34
7. Interference	0.43	0.38
8. Distress	0.21	0.38
9. Resistance	0.09	-0.10
10. Control	0.45	0.21
<i>YBOCS total</i>	<i>alpha = 0.69^a</i>	

^a Alpha for a 9-item YBOCS excluding both Resistance items and including Avoidance (item 12) is 0.78.

The results of the study, relating the within-section and cross-section scores using Chronbach alpha levels

Table 3. Inter-rater and test-retest reliability for YBOCS items and scale scores

	Inter-rater ICCs (n = 30)	Test-retest ICCs (n = 24)
<i>Obsessions subscale</i>	0.94	0.64
1. Time spent	0.91	0.55
2. Interference	0.84	0.54
3. Distress	0.85	0.62
4. Resistance	0.81	-0.09
5. Control	0.90	0.56
<i>Compulsions subscale</i>	0.89	0.56
6. Time spent	0.89	0.43
7. Interference	0.76	0.60
8. Distress	0.80	0.37
9. Resistance	0.78	0.55
10. Control	0.82	0.42
<i>YBOCS total (1-10)</i>	0.93	0.61
12. Avoidance	0.70	0.51

Note: ICC = Intra-class correlation.

Intraclass correlation used to determine test retest ability

Table 4. Pearson correlations between the YBOCS and measures of OC symptoms and moodstate at pre- and post-treatment

	Pretest				Posttest			
	n	Obs.	Com.	Total	n	Obs.	Com.	Total
<i>MOCI</i>	50	0.33*	0.35*	0.43**	30	0.53**	0.48*	0.55**
<i>SCL-90</i>								
Anxiety	46	0.33*	0.00	0.23	28	0.43*	0.24	0.37
Depression	46	0.33*	0.35*	0.42**	28	0.48*	0.46*	0.51*
<i>Target ratings</i>								
Fear/Avoid	44	0.18	—	—	29	0.31	—	—
Rituals	44	—	0.30*	—	29	—	0.72***	—
Composite	44	—	—	0.26	29	—	—	0.64***
<i>BAT</i>								
Avg. SUDS	34	0.36*	0.30	0.43*	27	0.35	0.06	0.23
Avoidance/ Rituals	42	0.27	0.32*	0.38*	27	0.32	0.36	0.37

***P < 0.0005; **P < 0.005; *P < 0.05 (all two-tailed).

Correlations with the YBOCS and similar tests analyzed with P-values

VOCAB: (w/definition)	<ol style="list-style-type: none"> Intraclass correlation - units from 0 to 1 that determine how strongly different groups resemble another Divergent validity - when opposite questions result in opposite results Psychometrically - branch of psychology that involves design, administration, or interpretation
Cited references to follow up on	<ol style="list-style-type: none"> Fleiss, J. L. (1986). The design and analysis of clinical experiments. New York: Wiley. Kim, S. W., Dysken, M. W. & Kuskowski, M. (1990). The Yale-Brown Obsessive-Compulsive Scale: A reliability and validity

	study. Psychiatry Research, 34, 99-106.
Follow up Questions	<ol style="list-style-type: none">1. How can the authors be sure that the test does not require a change in design?2. Can modeling methods be applied to these sets of data to expand results to greater populations?

Article #13 Notes: An MRI Study of the Metabolic and Structural Abnormalities in Obsessive-Compulsive Disorder

Source Title	An MRI Study of the Metabolic and Structural Abnormalities in Obsessive-Compulsive Disorder
Source citation (APA Format)	Salles Andrade, J. B. de, Ferreira, F. M., Suo, C., Yücel, M., Frydman, I., Monteiro, M., Vigne, P., Fontenelle, L. F., & Tovar-Moll, F. (2019, May 21). <i>An MRI study of the metabolic and structural abnormalities in obsessive-compulsive disorder</i> . Frontiers. Retrieved December 10, 2022, from https://www.frontiersin.org/articles/10.3389/fnhum.2019.00186/full
Original URL	https://www.frontiersin.org/articles/10.3389/fnhum.2019.00186/full
Source type	Journal Article
Keywords	obsessive-compulsive disorder, HMRS, DTI, anterior cingulate cortex, cingulate bundle
Summary of key points	Through a study done of patients with OCD using DTI and MRS, no correlation between glutamate and severity of the symptoms or duration of OCD was found. However, higher levels of glutamate were found specifically in the anterior cingulate cortex in OCD vs healthy. This correlation provides evidence for therapeutic usage of glutamate modulating drugs. However, Whole brain analysis yields no significant results for FA measure but specific ROI with the cingulate bundle does. More severe the obsessive symptoms, the lower the FA of the bundle. Finally, contradictory to the initial hypothesis, glutamate levels did not correlate with FA in CB.
Notes (include methodology)	<p>Background</p> <ul style="list-style-type: none"> • OCD is a neuropsychiatric illness • Currently, treatments are ineffective because exposure and response prevention as well as serotonin reuptake inhibitors only partially treat patients • More understanding of the etiology and pathophysiology are needed • Hypothesis that the cortico-striatal-thalamic-cortical (CSTC) circuits of OCD patients are altered in some way as they control regulation • Include cortical and subcortical regions as well as white matter tracts • Implicated in other disorders studied in the past

- Diffusion tensor imaging (DTI) - measures the diffusion characteristics of water molecules within living organisms
- Used to observe white matter in psychiatric disorders
- Expected to see decreased fractional anisotropy – a measure of connectivity in the brain (FA)
- Current literature demonstrates that the cingulate bundle is more affected as shown by 10 out of 17 studies
- Main takeaway: DTI is being hypothesized as a method to determine the integrity of white matter levels in OCD patients depending on the region of the brain
- Further hypothesizes that glutamate is a primary neurotransmitter of the CSTC
- Past literature has heavily emphasized glutamate playing a critical role in the development of OCD
- Specific SNPs point to genes related to/associated with OCD
- H1-MRS has the ability to quantify glutamate levels in OCD
- Glutamate and glutamine levels can be measured by this method of MR
- Past research has highly contradictory results in terms of the glutamate and glutamine levels in the brain
- This study is attempting to use H1-MRS and DTI to determine the metabolic and white matter changes in OCD vs. healthy
- White matter and biochemistry in OCD is understudied/underfunded
- Main Hypothesis
- OCD patients will exhibit decreased FA (DTI return value) in the cingulate bundle and increased glutamate/glutamine in the anterior cingulate cortex
- Findings would correlate with OCD symptoms (leveling)
- Findings would be indep. from medication status (no confounding)
- Glutamate/glutamine levels in anterior cingulate cortex will negatively correlate with FA and cingulate bundle

Method

- Patients under treatment for OCD in the Federal University of Rio de Janeiro were used
 - Met the DSM-IV-TR (Diagnostic and Statistical Manual of Mental Disorders)
 - Y-BOCS of 16 or more
 - Patients with other disorders were removed from the study
 - Control patients with past experiences of OCD were also removed
 - All participants older than 18

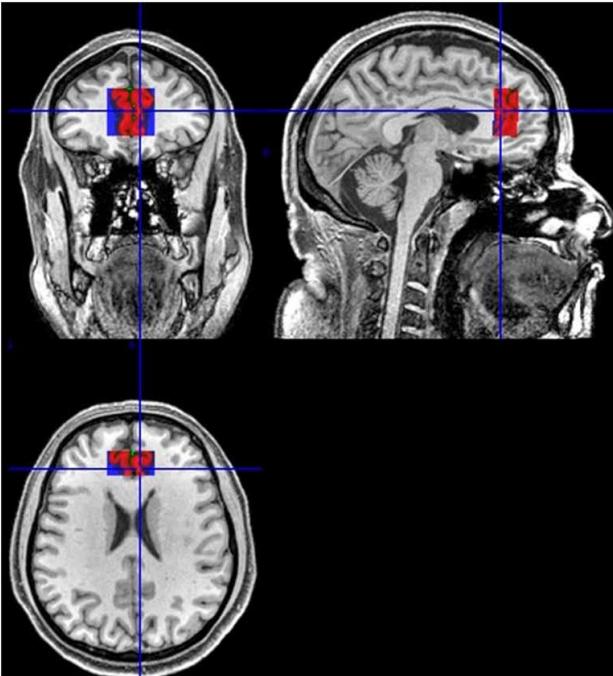
Procedure

- All participants given YBOCS to evaluate OCD symptoms at the start

- Patients were given scores of 0 to 2 based on their current SRI/antidepressant usage for OCD
- DTI applied in 32 non-collinear directions applied to the patients and levels of glutamate/glutamine, choline, and creatine/phosphocreatine were measured
- DTI parameters used to observe white matter included FA
- Color maps were created for FA values to depict the white matter tracts
- Whole brain and regions of interest were then analyzed to further explore white matter
- Whole Brain:
 - Tract based Spatial Statistics were used to assess differences in the tracts across the whole brains in OCD vs healthy
- ROIs:
 - Specified ROI were analyzed using DTI-MRI atlas to determine specific changes of white matter in these ROIs
- Preformed only at the anterior cingulate cortex to determine the differences of glutamate/glutamine in this region
- LCModel utilized for spectrum quantification
- Cr was previously measured so that Cr could be used in here as a reference signal to minimize magnetic field homogeneity

Results

- Demographic data
 - OCD patients scored higher on the Beck Depression Inventory and lower on the Assessment for Function compared to control, both were statistically significant at P-values of sub 0.001
- H1-MRS results
 - Statistically significant level of glutamate and glutamine found in OCD vs non-OCD patients at P-value of 0.016
- DTI results
 - No differences in the FA between OCD patients and healthy volunteers
 - Lower FA in healthy vs OCD for ROI tests (left cingulate bundle)
 - The left cingulate bundle, where differences of FA were observed shown on the right
 - Negative correlation between Y-BOCS and FA (integrity of white matter) in left CB and right CB
 - No correlation when adjusted for depression and treatment score
 - Negative correlation between YBOCS observed Subscore and FA in left CB specifically
 - FA and Glutamate/glutamine levels had no significant results when looking at association in anterior cingulate

	cortex																
Research Question/Problem/ Need	Are the cortico-striatal-thalamic-cortical (CSTC) circuits of OCD patients altered in some way?																
Important Figures	 <p>Sample of a DTI scan used in the study.</p> <table border="1"> <thead> <tr> <th>Metabolite</th> <th>OCD (n = 23)</th> <th>Controls (n = 21)</th> <th>Sig.</th> </tr> </thead> <tbody> <tr> <td>NAA/Cr</td> <td>1.18 (0.16)</td> <td>1.11 (0.16)</td> <td>0.191</td> </tr> <tr> <td>Cho/Cr</td> <td>0.29 (0.05)</td> <td>0.28 (0.04)</td> <td>0.454</td> </tr> <tr> <td>Glx/Cr</td> <td>1.51 (0.27)</td> <td>1.32 (0.23)</td> <td>0.016*</td> </tr> </tbody> </table> <p><i>NAA</i>, N-acetyl-aspartate total; Cho, choline; Glx, glutamate–glutamine; Cr, creatine + phosphocreatine. t-test *<i>p</i> < 0.05.</p> <p>Statistically significant level of glutamate and glutamine found in OCD vs non-OCD patients at P-value of 0.016</p>	Metabolite	OCD (n = 23)	Controls (n = 21)	Sig.	NAA/Cr	1.18 (0.16)	1.11 (0.16)	0.191	Cho/Cr	0.29 (0.05)	0.28 (0.04)	0.454	Glx/Cr	1.51 (0.27)	1.32 (0.23)	0.016*
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Metabolite	OCD	Controls											
NAA/Cr	~1.2	~1.15											
Cho/Cr	~0.2	~0.18											
Glx/Cr	~1.5	~1.35*											
VOCAB: (w/definition)	<ol style="list-style-type: none"> Cingulate bundle - white matter fiber tract in the brain, connecting the frontal lobe to the parietal lobe and temporal lobe Fractional anisotropy - value from 0 to 1 which describes degree of anisotropy for diffusion process (i.e. DTI) Beck Depression inventory - 21 question multiple choice self report test to measure the severity of depression in a patient 												
Cited references to follow up on	<ol style="list-style-type: none"> Smith, S. M. (2002). Fast robust automated brain extraction. <i>Hum. Brain Mapp.</i> 17, 143–155. doi: 10.1002/hbm.10062 Sun, Z., Wang, F., Cui, L., Breeze, J., Du, X., Wang, X., et al. (2003). Abnormal anterior cingulum in patients with schizophrenia: a diffusion tensor imaging study. <i>Neuroreport</i> 14, 1833–1836. doi: 10.1097/01.wnr.0000094529.75712.48 Thomason, M. E., and Thompson, P. M. (2011). Diffusion imaging, white matter, and psychopathology. <i>Annu. Rev. Clin. Psychol.</i> 7, 63–85. doi: 10.1146/annurev-clinpsy-032210-104507 												
Follow up Questions	<ol style="list-style-type: none"> How does DTI differ from MRS? Do they provide different results? Are there comorbidities with the results noted? Why is Cr used as a regulatory? Does this impact results? 												

Article #14 Notes: Predicting obsessive-compulsive disorder severity combining neuroimaging and machine learning methods

Source Title	Predicting obsessive-compulsive disorder severity combining neuroimaging and machine learning methods
Source citation (APA Format)	Hoexter, M. Q., Miguel, E. C., Diniz, J. B., Shavitt, R. G., Busatto, G. F., & Sato, J. R. (2013). Predicting obsessive-compulsive disorder severity combining neuroimaging and machine learning methods. <i>Journal of affective disorders</i> , 150(3), 1213–1216. https://doi.org/10.1016/j.jad.2013.05.041
Original URL	https://pubmed.ncbi.nlm.nih.gov/23769292/
Source type	Journal Article
Keywords	Machine learning, Magnetic resonance imaging, Neuroimaging, Obsessive-compulsive disorder, Support vector regression, Symptom severity
Summary of key points	This study aimed to create a machine learning model using support vectors to determine if gray matter found in MRI scans correlates with OCD symptoms. They used 37 adult OCD patients from a nearby clinic. Using their MRI scans, they created a model to determine severity of patients using YBOCS in comparison to gray matter. To conclude, they found that gray matter volumes of the cortical subcortical circuits contain the most useful information to help determine an OCD vs healthy patient.
Notes (include methodology)	<ul style="list-style-type: none"> - Application of MRI to determine severity of symptoms is uncommon - Structural MRI previously used in image classification with a 76.6% accuracy rate. - Past neuroimaging studies have noted correlated between gray matter and severity - Using GM and support vector is a new approach to correlation - Support vector regression was used to determine if gray matter could be used to determine severity of OCD patient symptoms - Found that the medial orbitofrontal cortex and left putamen had the most vital information for determining symptoms based on gray matter - Future work: sample used was small and should be tested on larger populations - SVR may be able to predict OCD symptom severity

	<ul style="list-style-type: none"> - Methods <ul style="list-style-type: none"> - Used 37 adults with OCD in the study - Recruited from Institute of Psychiatry in Sao Paulo Medical School in Brazil - Written consent - Patients between 18 and 65 years old and given YBOCS test - Excluded based on past medications - Pearson correlation coefficient for medial orbitofrontal cortex and left putamen were 0.002 - Method to predict OCD severity based on MRI successfully constructed - GM volume of the cortical subcortical circuits contain info to help determine OCD vs. non-OCD patients 																						
Research Question/Problem/ Need	Can gray matter from MRI scans be used to predict the severity of symptoms in an OCD patient?																						
Important Figures	<table border="1"> <thead> <tr> <th>Variable</th><th>Mean±SD (range)</th></tr> </thead> <tbody> <tr> <td>Age, years</td><td>31.9±10.1 (18–60)</td></tr> <tr> <td>Age of onset of OCS, years</td><td>13.4±7.5 (5–35)</td></tr> <tr> <td>Illness duration, years</td><td>18.3±10.5 (0–42)</td></tr> <tr> <td>Y-BOCS scores (total)</td><td>25.0±5.2 (15–36)</td></tr> <tr> <td>DY-BOCS (total)</td><td>20.5±4.5 (8–30)</td></tr> <tr> <td>Aggression/checking</td><td>5.6±4.7 (0–12)</td></tr> <tr> <td>Sexual/religious</td><td>3.2±4.7 (0–14)</td></tr> <tr> <td>Symmetry/ordering</td><td>7.6±3.8 (0–14)</td></tr> <tr> <td>Contamination/washing</td><td>5.7±5.1 (0–13)</td></tr> <tr> <td>Hoarding</td><td>2.9±3.3 (0–10)</td></tr> </tbody> </table> <p>Figure demonstrating Y-BOCS and DY-BOCS scores of the patients with summary stats.</p>	Variable	Mean±SD (range)	Age, years	31.9±10.1 (18–60)	Age of onset of OCS, years	13.4±7.5 (5–35)	Illness duration, years	18.3±10.5 (0–42)	Y-BOCS scores (total)	25.0±5.2 (15–36)	DY-BOCS (total)	20.5±4.5 (8–30)	Aggression/checking	5.6±4.7 (0–12)	Sexual/religious	3.2±4.7 (0–14)	Symmetry/ordering	7.6±3.8 (0–14)	Contamination/washing	5.7±5.1 (0–13)	Hoarding	2.9±3.3 (0–10)
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	<p>The charts on the left demonstrate the observed vs predicted YBOCS based on the machine learning techniques used in the study. On the right, the brain regions used to predict the YBOCS score are outputted.</p>
VOCAB: (w/definition)	<ol style="list-style-type: none"> 1. Putamen - round structure at the base of the forebrain. A structure that composes the basal nuclei 2. Medial - situated in the middle of something. 3. Antipsychotics - a drug class of psychotropic medication used to manage psychosis, mostly with schizophrenia
Cited references to follow up on	<ol style="list-style-type: none"> 1. https://www.frontiersin.org/articles/10.3389/fninf.2021.676491/full 2. https://pubmed.ncbi.nlm.nih.gov/20592442/ 3. https://www.nature.com/articles/npp2011250
Follow up Questions	<ol style="list-style-type: none"> 1. How does SVR provide different results as compared to CNNs? 2. The model was stated to be a working method, has it been tested on the general public? 3. If this model were used on healthy patients, what would be yielded as output?

Article #15 Notes: Prediction of Obsessive-Compulsive Disorder: Importance of Neurobiology-Aided Feature Design and Cross-Diagnosis Transfer Learning

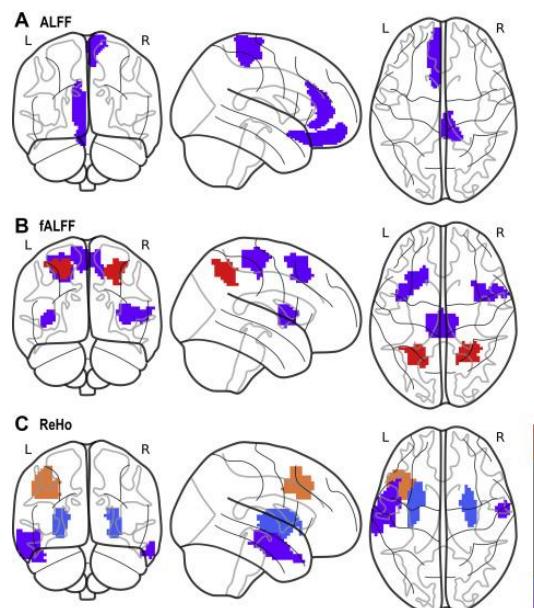
Source Title	Prediction of Obsessive-Compulsive Disorder: Importance of Neurobiology-Aided Feature Design and Cross-Diagnosis Transfer Learning
Source citation (APA Format)	Kalmadyab, S., Paula, A., Narayanaswamyde, J., Agrawale, Shivakumarde, Greenshawc, A., Dursunc, S., Greinerac, VenkatasubramaniandePersonEnvelope, & Reddyde, Y. C. (2021, December 18). <i>Prediction of obsessive-compulsive disorder: Importance of neurobiology-aided feature design and cross-diagnosis transfer learning</i> . Biological Psychiatry: Cognitive Neuroscience and Neuroimaging. Retrieved December 19, 2022, from https://www.sciencedirect.com/science/article/pii/S2451902221003451
Original URL	https://www.sciencedirect.com/science/article/pii/S2451902221003451
Source type	Journal Article
Keywords	fMRI, Machine learning, Obsessive-compulsive disorder, Schizophrenia, Transfer learning
Summary of key points	This study aimed to use a transfer learning design in order to predict OCD. A transfer learning design extrapolates an existing model to a new dataset with the given knowledge that there are comorbidities between the datasets. The authors of this study achieved this goal successfully with an accuracy rate of 80.3% for predicting OCD cases based on this transfer model. This also provides proof of concept that a similar type of extrapolation can be used on other disorders in the future. Furthermore, this model surpasses any other existing models based on accuracy rates as well as size of data sample used.
Notes (include methodology)	<ul style="list-style-type: none"> - Incorporating prior neurobiological knowledge into models has the possibility to improve production in models - OCD is a highly debilitating condition however comorbidity with other psychiatric disorders creates difficulty in diagnosis - In the recent years, there has been increased use of machine learning to try and predict the state of subjects - fMRI may have sufficient information to establish models that identify unique disorders - Current limitation in the field is that past work done with machine

	<p>learning used small datasets and therefore could not achieve validation</p> <ul style="list-style-type: none"> - Studies with more than 100 patients have seen accuracy levels of around 72 to 79 percent - A transfer learning model with schizophrenia was used because OCD and schizophrenia have shown shared features and symptoms in the past - In this study, a learning network called EMPaSchiz is used to try and predict OCD and provide empirical evidence for diagnosis of other disorders - EMPaSchiz is an algorithm for schizophrenia prediction and this study attempts to apply a concept known as transfer learning to predict cases of OCD - Methods <ul style="list-style-type: none"> - 188 patients attending the OCD clinic of the National institute of Mental Health and Neuroscience in India - Used if DSM-IV criteria for OCD was met - Healthy control subjects taken from local area of same age and gender of those OCD OCD patients (sex-matched control subjects) - OCD and HC subjects were also used from a previous dataset of patients - 8 patients and 7 control images were removed from the study due to excessive head movements - 350 total subjects, 175 healthy, 175 OCD - EMPaSchiz takes out 6 resting-state fMRI features and then uses the pearson correlation, FC-partial correlation, or FC-precision - Analysis performed with 3D data - Cross diagnosis transfer learning used - Model ran based on 175 patients with OCD and 88 control, some control were dropped out due to potential bias - 25 epochs at 80% train, 20% test - Patients with OCD ranged in symptoms and were measured using the YBOCS - Compared the model to another that focused on features specifically implicated in OCD such as the cortico-striato-thalamo-cortical circuit. - This knowledge based approach to OCD prediction via schizophrenia leads to an 80.3% success rate - Decreased functional connectivity between anterior prefrontal cortex and left angular gyrus, occipital gyrus and posterior occipital gyrus - Increased functional connectivity found between interhemispheric occipital gyri, dorsal anterior cingulate cortex, and basal ganglia, and posterior parietal cortex - EMPaSize model outperforms other neural network models
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	<ul style="list-style-type: none"> - Takeaways <ul style="list-style-type: none"> - Model can predict OCD with 80.3% accuracy - Feature based design with past knowledge allows for better performance - Single source feature sets can be converted from schizophrenia to OCD without loss in prediction performance - EMPaSchiz is generalization and interpretable for model structure
Research Question/Problem/ Need	Can knowledge-driven methods for predicting OCD be comparable to more precise existing neural networks?
Important Figures	<p>A NN-1</p> <p>B NN-2</p> <p>C NN-3</p> <p>The above figure depicts the different methods to conduct machine learning based on the available data, parameters, kernel size, and strides. Each provides a slightly different but similar approach in order to complete a neural network.</p>

Models	Accuracy,	Precision,	Sensitivity,	Specificity,	True	True	False
	%	%	%	%	Positive	Negative	Positive
EMPaSchiz	80.3 (0.7)	79.2 (1.0)	82.7 (0.9)	77.8 (1.4)	144.8 (1.5)	136.2 (1.0)	38.8 (1.0)
Stacked-ALFF	70.5 (1.2)	70.3 (1.2)	71.2 (1.7)	69.7 (1.6)	124.6 (2.8)	122.0 (2.8)	53.0 (2.8)
Stacked-ReHo	62.9 (1.0)	63.6 (1.2)	61.7 (1.3)	64.0 (1.9)	108.0 (1.5)	112.0 (0.9)	63.0 (0.9)
Stacked-fALFF	61.4 (1.1)	62.2 (1.2)	59.2 (1.6)	63.5 (1.8)	103.6 (2.0)	111.2 (2.2)	63.8 (2.2)
Stacked-FC-Corr.	73.5 (0.8)	72.4 (1.0)	76.6 (1.1)	70.4 (1.4)	134.0 (1.4)	123.2 (1.3)	51.8 (1.3)
Stacked-FC-Part.	75.9 (1.0)	74.4 (1.2)	80.2 (1.3)	71.5 (1.9)	140.4 (1.6)	125.2 (1.6)	49.8 (1.6)
Stacked-FC-Prec.	77.9 (1.0)	75.0 (1.1)	84.2 (1.5)	71.5 (1.5)	147.4 (1.3)	125.2 (0.4)	49.8 (0.4)
Baseline	50.00						

The table above demonstrates the accuracy rates specifically for the model used in this study (EMPaSchiz) as well as other single-source models in similar use cases.



Key regions of impact in OCD were generated as shown above from the model. These areas had excessive activity.

	<p style="text-align: center;">Comparison across EMPaSchiz and NN based methods 5 fold cross-validation - 5 shuffled iterations</p> <table border="1"> <thead> <tr> <th>Model</th> <th>Average (SEM) Test Accuracy (%)</th> </tr> </thead> <tbody> <tr> <td>NN-1</td> <td>68%</td> </tr> <tr> <td>NN-2 fALFF</td> <td>72%</td> </tr> <tr> <td>NN-3</td> <td>75%</td> </tr> <tr> <td>NN-2 Reho</td> <td>76%</td> </tr> <tr> <td>NN-2 ALFF</td> <td>77%</td> </tr> <tr> <td>EMPaSchiz</td> <td>80%</td> </tr> </tbody> </table> <p>EMPaSchiz model versus other existing neural networks. At an accuracy of 80%, this value outperforms the average levels of accuracy for other models.</p>	Model	Average (SEM) Test Accuracy (%)	NN-1	68%	NN-2 fALFF	72%	NN-3	75%	NN-2 Reho	76%	NN-2 ALFF	77%	EMPaSchiz	80%
Model	Average (SEM) Test Accuracy (%)														
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EMPaSchiz	80%														
VOCAB: (w/definition)	<ol style="list-style-type: none"> 1. Kernel - method of using a linear classifier to solve a nonlinear problem 2. Functional connectivity - statistical relationship between specific psychological signals in time 3. Comorbidity - when two or more diseases are present within a patient at a given time 														
Cited references to follow up on	<ol style="list-style-type: none"> 1. Y. Takagi, Y. Sakai, G. Lisi, N. Yahata, Y. Abe, S. Nishida, et al. A neural marker of obsessive-compulsive disorder from whole-brain functional connectivity Sci Rep, 7 (2017), p. 7538 														
Follow up Questions	<ol style="list-style-type: none"> 1. Does using a transfer model mean that there will be confounding factors when schizophrenia data is also inputted? 2. How does this model provide a method of consistent prediction at a rate of 80.3? 3. By generalization, does this imply that the model can be used on other disorders in the future? 														

Article #16 Notes: What does an OCD brain look like?

Source Title	What does an OCD brain look like?
Source citation (APA Format)	Pittenger, C. (2014, October 10). <i>What does an OCD brain look like?</i> Yale School of Medicine. Retrieved December 19, 2022, from https://medicine.yale.edu/news-article/what-does-an-ocd-brain-look-like/
Original URL	https://medicine.yale.edu/news-article/what-does-an-ocd-brain-look-like/
Source type	General Article
Keywords	Obsessive-compulsive disorder, functional magnetic resonance imaging, PET scans, signaling
Summary of key points	This general article from Yale School of Medicine tried to answer the simple question “can we diagnose OCD cases based on MRI data?” They started off by explaining the differences in signaling shown by PET scans and the implications these may provide. They then further into the idea that different and specific regions of the brain are implicated in OCD cases such as the anterior cingulate cortex. However, in the end, they reach the definite answer of “no” in stating that currently, we cannot simply use a single MRI scan to diagnose a patient as OCD or healthy though in the future it may be possible. There is not enough information at the individual level to be making these predictions.
Notes (include methodology)	<ul style="list-style-type: none"> - OCD was one of the first disorders to show abnormal activity in regions of interest as early as the 1980s - OCD brains have a feedback loop from the cortex to the striatum - The anterior cingulate cortex, anterior thalamus, and insula have been defined as areas of hyperactivity based on previous studies <ul style="list-style-type: none"> - Activity in these areas are worse when symptoms are provoked - Similar patterns shown in fMRI - New ways of utilizing fMRI to measure connectivity in the brain have also shown these abnormal patterns - Abnormalities in the frontal cortex and basal ganglia recently found - Other symptoms may be involved but it depends on the brain region being activated in individual cases as well as the specific symptoms an individual has - At the current day, we technically cannot simply run a scan to determine an OCD patient because even if we are highly sure of structural difference in the brain, we cannot make predictions based off that

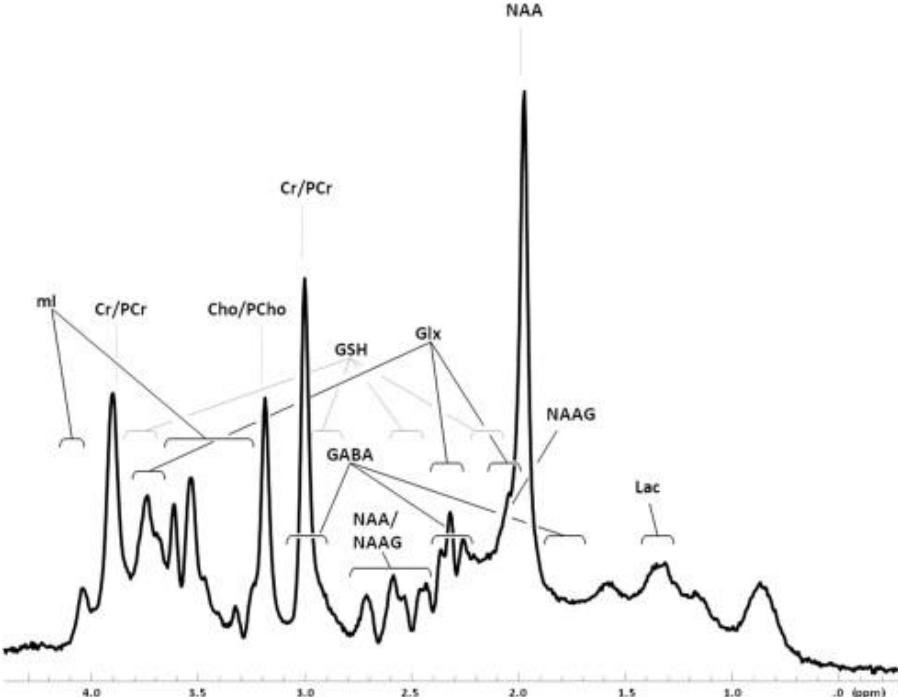
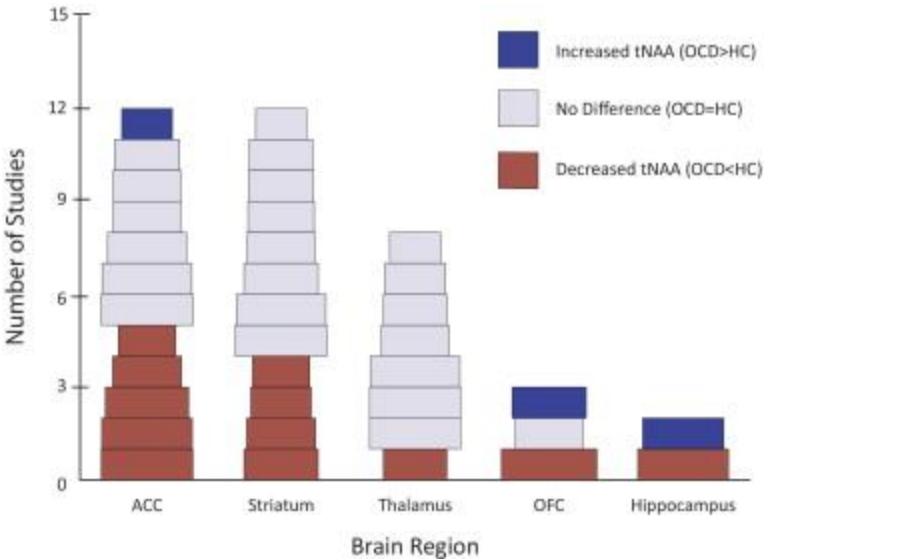
	<ul style="list-style-type: none"> - Analogy provided by article: giving the height of someone doesn't help you determine if they are male or female even if, on average, males are taller than women - There's empirical evidence with height/gender but there's more at the individual level that cannot be predicted - Most of the time, brain scans for an OCD patient looks completely normal
Research Question/Problem/ Need	How does the brain of an obsessive-compulsive disorder patient differ from a healthy control subject, and why does this occur?
Important Figures	<p>PET scan data demonstrates the differences in regions of signaling between a normal control and an OCD patient. The warmer colors mean that there is higher activity in those brain regions whereas the cooler colors like the blues and greens correspond to less activity. Regions of the OCD MRI are clearly more active defined by the warmer colors as compared to the normal control.</p>
VOCAB: (w/definition)	<ol style="list-style-type: none"> 1. Basal ganglia - group of structures near the center of brain that form connections 2. Psychotherapy - use of psychological methods to help a person change their behavior
Cited references to follow up on	<ol style="list-style-type: none"> 1. https://pubmed.ncbi.nlm.nih.gov/3493749/
Follow up Questions	<ol style="list-style-type: none"> 1. This study claims that you cannot make predictions at the individual level; however, using a neural network, could predictions then be made?

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| | <ol style="list-style-type: none">2. Even if predictions cannot be made, can probabilities be provided to OCD patients instead?3. The article claims that some OCD patients may have no differences in MRI at all. How does this occur based on the fact that OCD brains have hyperactivity in certain regions as well as hyperactivity in other regions. |
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Article #17 Notes: A Critical Review of Magnetic Resonance Spectroscopy Studies of Obsessive-Compulsive Disorder

Source Title	A Critical Review of Magnetic Resonance Spectroscopy Studies of Obsessive-Compulsive Disorder
Source citation (APA Format)	Brennan, B. P., Rauch, S., Jensen, E., & Pope Jr., H. G. (2012, July 24). A critical review of magnetic resonance spectroscopy studies of obsessive-compulsive disorder. <i>Biological Psychiatry</i> . Retrieved December 20, 2022, from https://www.sciencedirect.com/science/article/pii/S0006322312005586?cas_a_token=_d1utbwmkEQAAAAA%3A5NwfSeQST2oP2kHnnlq2NDvjgzDRIJOaBNnMcyFtoO-qDOxI8nO7rz-SOGAQDYbhVmAPThu4
Original URL	https://www.sciencedirect.com/science/article/pii/S0006322312005586?cas_a_token=_d1utbwmkEQAAAAA%3A5NwfSeQST2oP2kHnnlq2NDvjgzDRIJOaBNnMcyFtoO-qDOxI8nO7rz-SOGAQDYbhVmAPThu4
Source type	Journal Article
Keywords	Cholinemagnetic, magnetic resonance spectroscopy, N-acetylaspartate, glutamate, obsessive-compulsive disorder, OCD
Summary of key points	A review article was conducted in order to summarize previous findings of OCD in relation to proton magnetic resonance spectroscopy in oOCD patients. As a result, 28 articles were compiled and the different results of each were noted in this article. The results were then specifically classified into the biomarkers in the studies such as Glx, tCho and more. The specific differences and observations across all articles were then noted.
Notes (include methodology)	<ul style="list-style-type: none"> - Functional neuroimaging studies have begun to suggest that the cortico-striatal-thalamo-cortical circuit (CSTC) dysfunction is the main alteration occurring in obsessive-compulsive disorder (OCD) - New approaches to examining neurochemistry are leading to similar insight into the CSTC <ul style="list-style-type: none"> - Proton magnetic resonance spectroscopy allows for quantification of neurochemicals in CSTC - OCD has a lifetime prevalence of 2.3# in the US - SSRIs often do not work as patients remain resistant to their effect - 30-50% of patients develop OCD in their childhood - In OCD, the orbitofrontal cortex, anterior cingulate cortex, and striatum have hyperactivity as compared to other structures as well as in comparison to resting states - New data points to other regions of interest for OCD such as the amygdala, hippocampus and others

	<ul style="list-style-type: none"> - Proton magnetic resonance spectroscopy (H-MRS) shows potential for a new way of quantifying neurochemicals in brain regions - N-acetylaspartate appears to be highly involved in glutamate synthesis and glutamate has been an area of prevalence in terms of OCD - Methods <ul style="list-style-type: none"> - The study used keywords: <ul style="list-style-type: none"> - Magnetic resonance spectroscopy - obsessive -compulsive disorder - OCD - Found studies using H-MRS to compare the results of OCD vs healthy patients - Accepted pediatric and adult OCD studies (no limits on sample size or regions studies) - 28 studies were found - 20 compared neurochemical levels in OCD vs healthy patients - 8 looked at changes in levels using SSRIs or CBT - 26 looked at regions within the CSTC - 21 used single-voxel H-MRS - GLX <ul style="list-style-type: none"> - 14 studies compared Glx in healthy vs OCD - 2 out of 8 reported significant decrease of Glx in the anterior cingulate cortex - 1 out of 3 reported increase of Glx in orbitofrontal cortex - One lab found Glx levels to be positively correlated with symptom severity of OCD patients - tCho <ul style="list-style-type: none"> - 5 out of 24 studies found increase of tCho in OCD vs healthy - 1 out of 8 treatment studies found an increase of tCho after therapy - tCr <ul style="list-style-type: none"> - Increased tCr found in OCD based on one study - Another study found decreased tCr specifically in the right orbitofrontal cortex in OCD - mI <ul style="list-style-type: none"> - Only 1 study found significant increase of mI in right rostral and dorsal anterior cingulate cortex - Others did not find any significance - H-MRS findings remain inconsistent but open new pathways for examining OCD - Larger samples can help mitigate the current inconsistencies - Future work: <ul style="list-style-type: none"> - Need for homogeneous samples in specific subpopulations - Need for more advancing spectral editing methods - Multiple H-MRS techniques - Multimodal imaging
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Research Question/Problem/ Need	What are the approaches that have been used to determine neurochemicals in the CSTC? What are the inconsistencies in past work, and what should be looked into in the future?																								
Important Figures	 <p>The output of a H-MRS scan which yields a spectroscopy graph of different featured chemicals in the brain.</p>  <table border="1"> <thead> <tr> <th>Brain Region</th> <th>Decreased tNAA (OCD<HC)</th> <th>No Difference (OCD=HC)</th> <th>Increased tNAA (OCD>HC)</th> </tr> </thead> <tbody> <tr> <td>ACC</td> <td>5</td> <td>6</td> <td>1</td> </tr> <tr> <td>Striatum</td> <td>4</td> <td>6</td> <td>0</td> </tr> <tr> <td>Thalamus</td> <td>2</td> <td>4</td> <td>0</td> </tr> <tr> <td>OFC</td> <td>1</td> <td>1</td> <td>1</td> </tr> <tr> <td>Hippocampus</td> <td>1</td> <td>1</td> <td>1</td> </tr> </tbody> </table> <p>The authors of the review article formed the graph above, which demonstrates the patterns noticed in correspondence with the number of studies they observed these patterns in. ACC corresponds to the anterior cingulate cortex, and the OFC corresponds with the orbitofrontal cortex.</p>	Brain Region	Decreased tNAA (OCD<HC)	No Difference (OCD=HC)	Increased tNAA (OCD>HC)	ACC	5	6	1	Striatum	4	6	0	Thalamus	2	4	0	OFC	1	1	1	Hippocampus	1	1	1
Brain Region	Decreased tNAA (OCD<HC)	No Difference (OCD=HC)	Increased tNAA (OCD>HC)																						
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OFC	1	1	1																						
Hippocampus	1	1	1																						

VOCAB: (w/definition)	<ol style="list-style-type: none"> 1. Choline - nutrient for humans and other animals. It is a cation forming in salts 2. N-acetylaspartate - an acid in the brain with high concentrations of glutamate 3. Ferrous - containing/consisting iron
Cited references to follow up on	<ol style="list-style-type: none"> 1. H.C. Breiter, S.L. Rauch, K.K. Kwong, J.R. Baker, R.M. Weisskoff, D.N. Kennedy, et al. Functional magnetic resonance imaging of symptom provocation in obsessive-compulsive disorder 2. D. Ebert, O. Speck, A. Konig, M. Berger, J. Hennig, F. Hohagen 1H-magnetic resonance spectroscopy in obsessive-compulsive disorder: Evidence for neuronal loss in the cingulate gyrus and the right striatum 3. L. Besiroglu, M. Sozen, O. Ozbebit, S. Avcu, Y. Selvi, A. Bora, et al. The involvement of distinct neural systems in patients with obsessive-compulsive disorder with autogenous and reactive obsessions
Follow up Questions	<ol style="list-style-type: none"> 1. Can H-MRS findings be connected with findings from machine learning studies done with standard MRI data? 2. Are 28 studies enough to compare trends across the studies or will more research need to be done before trends can be taken from these works?

Patent #1 Notes: Method for treating obsessive-compulsive disorder with electrical stimulation of the brain internal capsule

Source Title	Method for treating obsessive-compulsive disorder with electrical stimulation of the brain internal capsule
Source citation (APA Format)	Nuttin, B., Gielen, F. L. H., Cosyns, P. B., Gybels, J., Meyerson, B., & Mindus, P. (2005, March 22). <i>US6871098B2 - method for treating obsessive-compulsive disorder with electrical stimulation of the brain internal capsule</i> . Google Patents. Retrieved December 20, 2022, from https://patents.google.com/patent/US6871098B2/en
Original URL	https://patents.google.com/patent/US6871098B2/en
Source type	Official Patent
Keywords	Treatment, obsessive-compulsive disorder, electrical stimulation, anterior limb
Summary of key points	The purpose of this patent was to provide patients suffering with obsessive-compulsive disorder (OCD) with a means of temporary relief via electrical stimulation. Their method involves applying this stimulation to the anterior limb—an area with known implications for OCD patients. They used a signal generator and an electrode that was implanted in the region of interest (ROI) in order to create this stimulation/
Notes (include methodology)	<ul style="list-style-type: none"> - Device was aimed at solving obsessions and compulsions in OCD - Obsessions/compulsions are time consuming and occurring often for patients - Currently we rely on SSRIs and they are not effective so this device serves to create an effective means to preventing OCD patients from experiencing further suffering - Significant amounts of OCD patients are resistant to current methods of treatment - Surgery cannot be done because of the lack of knowledge in the field with studies involving randomization - Previous work has used electrical stimulation in order to solve anxiety disorder; however, the same concepts have yet to be applied on OCD - This device provides an electrical stimulation via a generator to the anterior limb of the internal capsule of the brain in order to provide

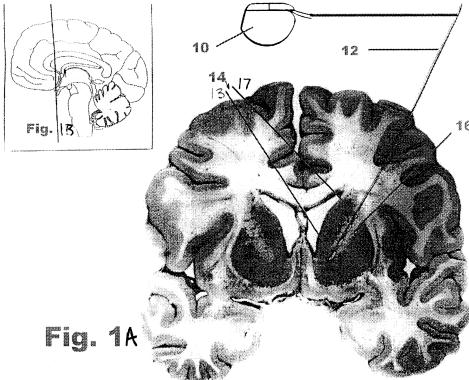
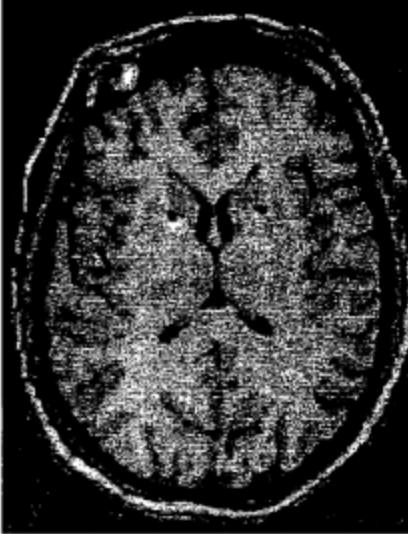
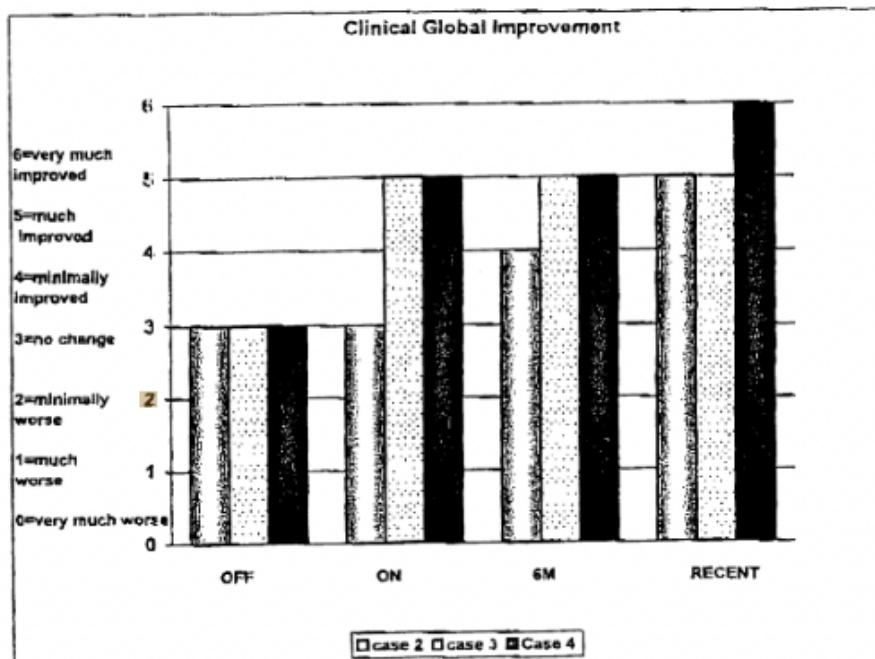
	<p>relief</p> <ul style="list-style-type: none"> - This device makes use of neurological stimulators via electrodes
Research Question/Problem/ Need	What novel methods can be implemented to help alleviate the symptoms of an OCD patient?
Important Figures	 <p>Fig. 1A</p> <p>The above diagram demonstrates the device described in the patent in use. In the diagram, it is delivering the electrical current described.</p> <p>Fig. 2A</p>  <p>This diagram is an MRI scan after stimulation of the electrodes has been performed on the internal capsules.</p>

FIG. 10D



The device was compared against other methods for relief in the scope of the YBOCS as shown above.

VOCAB: (w/definition)	<ol style="list-style-type: none"> Electrode - conductor in which electricity both enters or leaves Internal capsule - two way tract for transmission of information Postoperatively - relates to the period of time after a surgical operation
Cited references to follow up on	None
Follow up Questions	<ol style="list-style-type: none"> Do electrical stimulations have an implication on the future health of the patients? Can this method be implemented to be more widely used such that it replaces SSRIs and other therapies? Do the electrical doses happen in one session or over multiple?

Patent #2 Notes: Novel treatment for obsessive-compulsive disorder (OCD) and OCD-related disorders using GVG

Source Title	Novel treatment for obsessive-compulsive disorder (OCD) and OCD-related disorders using GVG
Source citation	Dewey, S., Brodie, J., & Ashby, C. (2004, November 14). <i>US20020169103A1 - novel treatment for obsessive-compulsive disorder (OCD) and OCD-related disorders using GVG</i> . Google Patents. Retrieved December 20, 2022, from https://patents.google.com/patent/US20020169103?oq=ocd
Original URL	https://patents.google.com/patent/US20020169103?oq=ocd
Source type	Official Patent
Keywords	Gamma vinyl-GABA, obsessive-compulsive disorder,
Summary of key points	This patent covers a device that ties gamma vinyl-GABA agents to alleviate the symptoms experienced by an OCD patient. The method in question provides gamma vinylGABA composition to a patient that reduces or eliminates symptoms. This treatment is claimed to be tolerated and more effective than current existing SSRIs.
Notes	<ul style="list-style-type: none"> - OCD has a debilitating disorder that includes obsessions, compulsions, gambling, overeating, and more - Symptoms occur due to chemical imbalances in the brain and current drug therapies have poor responses - Previously, OCD has been treated with SSRIs including fluoxetine that are supposed to increase serotonin in the brain - Less than 20% of patients with OCD that use SSRIs have their symptoms eliminated - Research has suggested that serotonin levels may not be the primary target and rather a secondary issue - NEED: a treatment for OCD to reduce/eliminate symptoms
Research Question/Problem/ Need	What is a more effective method to treating obsessive-compulsive disorder?
Important Figures	No figures in the patent.
VOCAB: (w/definition)	<ol style="list-style-type: none"> 1. Transaminase - type of enzyme that causes transfer of chemical substance

	<ol style="list-style-type: none">2. Acamprosate - a type of medication most commonly used to reduce alcoholism3. Enantiomers - compounds with the exact same connectivity but opposite 3d shape – they come in pairs
Cited references to follow up on	None.
Follow up Questions	<ol style="list-style-type: none">1. What are potential side effects that may ensue as a part of using gamma vinyl-GABA in patients?2. What specific advantages does this method provide over methods such as SSRIs?

