# RESEARCH AT PAGE 3 :)

I did begin with exploratory data analysis, including a correlation matrix to identify 63 variables with higher likelihood to produce a good model. I’ve prepared several models that include a binary classification algorithm to predict whether an individual has ADHD

* Mental Retardation - I did know we were on the spectrum with Autism, and have difficulty fitting in. Sometimes the way people interact with me is very surprising to me; I have to really study humans to understand how to behave in a way that gets the outcome I expect. This sometimes gave me that feeling of “am I secretly mentally retarded and no one is telling me?” **I don’t believe I am mentally retarded, but I am not that surprised to see it correlate.**

# Tourettes

# Fifty percent of children diagnosed with ADHD have comorbid tic disorder. ADHD related symptoms have been reported in 35% to 90% of children with TS. Since ADHD is the most prevalent comorbid condition with TS - Tics can be a symptom of Tourette syndrome (TS). Attention deficit hyperactivity disorder (ADHD) has the highest comorbidity with TS. Psychopharmacological treatment of ADHD with stimulants may cause, or exacerbate pre-existing, tics.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4737687/#:~:text=Core%20tip%3A%20Tics%20can%20be,exacerbate%20pre%2Dexisting%2C%20tics.>

* Taking my medication is risky. Researchers from the University of Utah found the risk to be 6- to 8-fold higher to develop early onset Parkinson disease or a related basal ganglia and cerebellum disease than peers who do not have ADHD.
* Just having ADHD is risky though; we are twice as likely to get Parkinson’s than peers even if we don’t take medication.

# ADHD Study

# Holly Erickson

# DSC 680 Applied Data Science

# Portfolio: <https://holly-e.github.io/>

# GitHub Portfolio URL: <https://github.com/Holly-E/ADHD_Study>

# ***Topics: - 100 words each***

# ***Any surprises from your domain from these data?* (What domain is this data going to come from?)**

**Surprises from research into domain:**

* Disability: I learned that ADHD is classified as …. I had never thought of myself as having a disability before.
* Sensitivity - both to internal feelings of rejection and external stimuli such as noise.

Rejection Sensitivity Dysphoria (RSD) interesting specifics:

*“98-99% of adolescents and adults with ADHD acknowledge experiencing RSD. For 30%, RSD is the most impairing aspect of their ADHD.”*

I relate to this but also found it shocking as it’s not what most people think of to describe ADHD (trouble sitting still, etc).

*“RSD is an intense vulnerability to the perception – not necessarily the reality – of being rejected, teased, or criticized by important people in your life. RSD causes extreme emotional pain that may also be triggered by a sense of failure, or falling short – failing to meet either your own high standards or others’ expectations. Often, people experience RSD as physical pain, like they’ve been stabbed or struck right in the center of their chest.”*

I was also shocked to learn that ADHD researchers estimate that by age 12, children with ADHD get 20,000 more negative messages about themselves than other kids their age.

* Parkinson’s: This disease also involves dopamine level problems, so it does make sense that they correlate. Taking my medication actually increases chances of Parkinson’s further, to 8% more likely … not sure this stat????.

**Surprises from EDA:**

I created a dataframe of the highest correlation variables with target column K2Q31 …???

Most of them made a lot of sense to me. There were some surprises though:

* Tourettes
* Cerebral Palsy - I have never heard this, so I did some research and sure enough:

<https://www.smarterparenting.com/specific-diagnosis/when-adhd-co-occurs-with-cerebral-palsy/>

* Mental Retardation - I did know we were on the spectrum with Autism, and have difficulty fitting in. Sometimes the way people interact with me is very surprising to me, I have to really study humans to understand how to behave in a way that gets the outcome I expect. This gave me that feeling of “am I secretly mentally retarded and no one is telling me?” I don’t believe I am mentally retarded, but I actually am not that surprised to see it correlate.

1. ***The dataset is what you thought it was?***

The dataset is what I thought it was. It did have some complexities that I need to be mindful of though. The big one is that a good portion of the questions are follow-up questions that are only to be answered if an answer of “Yes” was given for a different question. This means that there would be data leakages if I included the following up questions for K2Q31…??

1. ***Have you had to adjust your approach or research questions?* (How are you proposing to analyze this dataset?)**

Previously I I will analyze the dataset by classification (subject has ADHD or does not) and by determining subgroups using unsupervised learning.

I will begin with exploratory data analysis, including a correlation matrix with other variables in the dataset. This will help us visualize potential relationships among the variables. I will prepare a model that includes a binary classification algorithm to predict whether an individual has ADHD. I will also use an unsupervised clustering technique to find similarities in the data points that do have ADHD and group similar data points together.

More targeted in what I have decided to approach the question.

1. *Is your method working?*

Yes. My model has the following statistics:

1. *What challenges are you having?* (What challenges do you anticipate having? What could cause this project to go off schedule?)

Well I am already far off schedule, potentially due to my ADHD. However I am finding success in this project and looking forward to the presentation.

Resampling (using an algorithm like SMOTE to augment the dataset with artificial data - from the central cluster - most between men and women - visualize

TUTORIAL: <https://machinelearningmastery.com/smote-oversampling-for-imbalanced-classification/>

A survey in 2016, from the Williams Institute, estimated that 0.6% of U.S. adults identify as transgender.[2]

The term transgender is used in this paper as an umbrella term for individuals who self-label differently than their birthassigned category (for a list of terms concerning gender that are transgender inclusive, see American Psychological Association, 2015), and cisgender is used to refer to individuals whose self-labeling is the same as their birth-assigned category. Finally, the term nonbinary is used here for individuals who self-identify in ways outside the two categories of female and male (e.g., agender, genderfluid, bigender) (Bornstein, 1994; Brooks, 2017; Tate et al., 2014)

There are indeed average differences between women and men in brain structure and function (Lenroot & Giedd, 2010; Ruigrok et al., 2014). These differences are, however, often misinterpreted as innate or preprogrammed, context-independent, and stable over time (e.g., Joel & McCarthy, 2016). Furthermore, it is often implicitly assumed that these differences add up to create two types of brains, one typical of females and the other typical of males. For this assumption to be accurate, differences between females and males in the structure of specific brain regions should be both highly dimorphic in the population and internally consistent in the individual. It turns out that they are neither.

Consider, for example, sex differences in the density of cannabinoid receptors in the rat hippocampus. Under typical laboratory conditions, the density of these receptors is higher in male than female rats. However, following three weeks of mild stress, the sex difference in the **dorsal part\*** of the hippocampus is reversed; the density of receptors in females is the same as that seen in non-stressed males, and the density of receptors in stressed males is the same as that seen in non-stressed females (Reich et al., 2009). In other words, the brain sex difference is context-dependent. The experience of stress did not, however, reverse sex differences in the density of cannabinoid 7 receptors in the entire brain. Different patterns were found, for example, in the ventral hippocampus. This example demonstrates that complex sex-by-environment interactions produce a brain structure that is multi-morphic rather than dimorphic.

\*Dorsal regions of the midbrain are involved in sensory information circuits. The substantia nigra, a part of the brain that plays a role in reward, addiction, and movement (due to its high levels of dopaminergic neurons) is located in the midbrain. In Parkinson’s disease, which is characterized by a deficit of dopamine, death of the substantia nigra is evident.

Researchers from the University of Utah explain that patients with attention-deficit/hyperactivity disorder (ADHD) were more than twice as likely to develop early-onset Parkinson disease or a related basal ganglia and cerebellum disease than peers who do not have ADHD. Among patients with more severe disease who are prescribed stimulant medications to control their ADHD, the risk was 6- to 8-fold higher.

Adults with attention-deficit hyperactivity disorder (ADHD) have been shown to have **damaged dopamine neurons in the basil ganglia**\*, and, commonly have **cerebellar abnormalities**, much like people with Parkinson’s disease (PD).

The cerebellum coordinates skeletal muscles to produce smooth, graceful motions. It is in the hindbrain. Evolutionarily speaking, the hindbrain contains the oldest parts of the brain, which all vertebrates possess, though they may look different from species to species. The cerebellum receives information from our eyes, ears, muscles, and joints about the body’s current positioning (referred to as proprioception). It also receives output from the cerebral cortex about where these body parts should be. After processing this information, the cerebellum sends motor impulses from the brain stem to the skeletal muscles so that they can move. The main function of the cerebellum is this muscle coordination. However, it is also responsible for balance and posture, and it assists us when we are learning a new motor skill, such as playing a sport or musical instrument. Recent research shows that apart from motor functions the cerebellum also has some role in emotional sensitivity.

\*The primary structures within the limbic system include the amygdala, hippocampus, thalamus, hypothalamus, **basal ganglia,** and cingulate gyrus.

The limbic system, located just beneath the cerebrum on both sides of the thalamus, is not only responsible for our emotional lives but also many higher mental functions, such as learning and formation of memories.

The basal ganglia is a group of nuclei lying deep in the subcortical white matter of the frontal lobes; its functions include organizing motor behavior and coordinating rule-based, habit learning.

Basal ganglia appears to serve as a gating mechanism for physical movements, inhibiting potential movements until they are fully appropriate for the circumstances in which they are to be executed. The basal ganglia is also involved with:

* rule-based habit learning (e.g., initiating, stopping, monitoring, temporal sequencing, and maintaining the appropriate movement);
* inhibiting undesired movements and permitting desired ones;
* choosing from potential actions;
* motor planning;
* sequencing;
* predictive control;
* working memory;
* attention.

The (ADHD) brain requires dopamine for individuals to avoid unpleasant feelings/feel pleasant feelings. This high-risk genetic trait leads to multiple drug-seeking behaviors, because the drugs activate release of dopamine, which can diminish abnormal cravings.

Brain-imaging studies have shown that children with this disorder have an underlying neurological dysfunction. In the simplest terms, the brains of these children have yet to come fully “on-line.” It is conjectured that while certain important brain pathways are working normally, cortical regions involved in attention, impulse control, and stimulus integration abilities, have yet to become fully active.

People with ADHD suffer from overload ([Miller and Blum 2008](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2626918/#b72-ndt-4-893)). That is, they have heightened awareness of incoming stimuli, particularly sight, sound, and touch. They are so bombarded by the normal stimuli in their environment that they cannot filter out the background noise, and they have trouble focusing or concentrating on a problem or a task.

ADHD afflicted people (may) live under stress so severe they cannot tolerate frustration, and when they are frustrated, they are likely to become angry. The anger tends to come suddenly and explosively.

It’s a complex subtype of a general condition or umbrella disorder known as reward deficiency syndrome (RDS). RDS refers to the breakdown of a cascade of neurotransmitters in the brain in which one reaction triggers another. RDS has genetic and environmental influences, and it predisposes individuals to high risk for multiple addictive, impulsive, and compulsive behaviors.

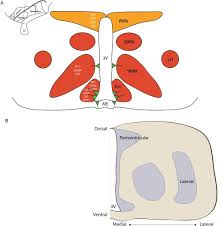
***ADHD is recognized as a disability under federal legislation (the Rehabilitation Act of 1973; the Americans with Disabilities Act; and the Individuals with Disabilities Education Act).***

I didn’t realize I had a disability. For some reason, it didn’t register to me that other people believe I have a disability, even though it is disabling to the point I have an ADHD Coach and have dropped out of college twice.

**Caused by genetics and non-genetic factors, including prenatal exposure to nicotine by mothers, anoxia in the neonatal period of infancy (newborn oxygen loss), and childhood exposure to high quantities of lead.**

Pob lacks sufficient numbers of dopamine receptor sites to use the normal amount of dopamine in reward centers so reduces the amount of dopamine produced in this area. The overall effect is an inadequate dopaminergic activity in brain reward centers. This defect drives individuals to engage in activities that will increase brain dopamine function. Consuming large quantities of alcohol or carbohydrates (carbohydrate bingeing) stimulates the brain’s production of, and utilization of, dopamine. So too does the intake of crack/cocaine and the abuse of nicotine. Also, it has been found that the genetic abnormality is associated with aggressive behavior, which also stimulates the brain’s use of dopamine

Later research on human subjects revealed that the electrical stimulation of the **medial hypothalamus** in the limbic system produced a feeling of quasi-orgasmic sexual arousal.

This is your brain but it also looks like your chest. Are parts on the chest related in some way to these parts of the brain?

In healthy people, neurotransmitters work together in a pattern of stimulation or inhibition, the effects spreading downward, like a cascade, from stimulus input to complex patterns of response leading to feelings of well-being. People with ADHD have at least one defective gene, the DRD2 gene that makes it difficult for neurons to respond to dopamine, the neurotransmitter that is involved in feelings of pleasure and the regulation of attention.

They found that three dopaminergic genes, DRD2, DAT1, and DBH, differentially associated with ADHD probands. Their results showed that these three genes were additive in their effect. Thus, individuals who had three out of three markers had the highest ADHD score; those with two of three had the next highest score; then one of three; and those with none of the three markers had the lowest ADHD score. A number of studies have shown that fathers and/or mothers of ADHD children tend to have antisocial personality.

**Up to 99% of teens and adults with ADHD are more sensitive than usual to rejection. And nearly 1 in 3 say it's the hardest part of living with ADHD.**

RSD can affect relationships with family, friends, or a romantic partner. The belief that you're being rejected can turn into a self-fulfilling prophecy. When you act differently toward the person you think has rejected you, they may begin to do so for real.

When you have ADHD, your nervous system overreacts to things from the outside world. Any sense of rejection can set off your stress response and cause an emotional reaction that's much more extreme than usual. RSD episodes happen suddenly and without warning.

Sometimes the criticism or rejection is imagined, but not always. ADHD researchers estimate that by age 12, children with ADHD get 20,000 more negative messages about themselves than other kids their age. All that criticism can take a real toll on their self-esteem.

Reddit

* The researchers found that adults with ADHD who had been prescribed the drug methylphenidate for a period of 12 months had a 24% increase in the density of the dopamine transporter in some brain regions, which after treatment was significantly higher than in adults without ADHD who had not been treated with the drug.
* This would be a good point with a safer drug like armodafinil\modafinil but adderall\mdma\meth all have a metabolite called alpha methyl dopamine which reacts with the natural antioxidant glucathione to make a huge molecule filled with sugars and free radicals which rapidily destablizes and damages dendrites in your neurons. Simple upregulation and downregulation isnt necessarilly bad but neurotoxcity is.

**References:**

* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2626918/>
* <https://en.wikipedia.org/wiki/LGBT_demographics_of_the_United_States>
* <https://doi.apa.org/manuscript/2018-32185-001.pdf>
* <https://courses.lumenlearning.com/boundless-psychology/chapter/structure-and-function-of-the-brain/#:~:text=Dorsal%20regions%20of%20the%20midbrain,is%20located%20in%20the%20midbrain.>
* <https://www.ajmc.com/focus-of-the-week/new-research-finds-link-between-adhd-and-parkinson-disease#:~:text=Researchers%20from%20the%20University%20of,who%20do%20not%20have%20ADHD.>

**Completed Projects:**

1. Semester 4 - Expedia Hotel Recommendations > Predictions - including preprocessing and R code.

Predict which hotel cluster the user is likely to book, given his (or her) search details.

Read Me:

file:///C:/Master/Semester%204/expedia-hotel-recommendations/DSC630\_7.3.pdf

1. Semester 3 - Pizza Restaurant Names

Read Me:

file:///C:/Master/Semester%203/Pizza%20projects/DSC550\_9.2.pdf

file:///C:/Master/Semester%203/Pizza%20projects/DSC550\_11.2.pdf

1. Southwest Airlines Folder - Presentations that I created for different audiences (Can I upload tableau code?)
2. Baseball presentation - youtube video + code
3. Kaggle - Astrophysics competition
4. DSC 650 Big Data - 10: Predict the sex of a person based on their age, name, and state

Resampling (using an algorithm like SMOTE to augment the dataset with artificial data - from the central cluster - most between men and women - visualize

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<https://en.wikipedia.org/wiki/LGBT_demographics_of_the_United_States>

As we move forward and transgender people are added to the data set, the algorithm could retrain the augmented data.

1. DSC 650 Big Data -11: Movie Recommendation Engine
2. SOMEDAY project = Time Series Analysis - from an ADHD perspective - an algorithm that learns as needed.
3. DSC 650 Big Data - 10: Predict the sex of a person based on their age, name, and state

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