

**Does Working Out Improve Mental Health:
A Research Study**

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Introduction

Growing up, I was on the overweight side because I would always ask for fast food whenever I went out with my parents. Over the years I had phases of losing weight and gaining weight, never able to consistently stay completely healthy. In 2019, I wasn't in the best state of mind, with the stress of college and parental pressure to do well. My friends convinced me to start working out at a gym, teaching me how to hit the weights and use gym equipment. From then on, attending the gym 4-5 times a week has become more of a hobby than a chore. My experience with attending the gym has convinced me that the process of exercising does in fact improve mental health, because I feel great each and every time I leave.

Overview

The topic of this research paper is to analyze whether working out improves mental health through scientific research on the topic, perhaps formulating a plan to collect data and form, and finding a general consensus of the topic. Here are some questions I wanted to ask to perform research on the topic:

1. If your mental health is affected, how do you get motivated to go to the gym?
2. Does working out improve mental health?
3. Is there a set amount of reps or amount of time that you should work out to maximize the improvement to mental health?
4. Does working out in a friend group improve mental health significantly more than working out alone?
5. In addition to working out, does having a healthy diet better mental health?

Research and Analysis

The following section details research in a variety of fields regarding the topic. The first being Google Trend analysis to gather search engine data regarding the spike in working out popularity at the start of 2020. The second explains steps people facing mental health issues should take to start working out. The third delves into the scientific reasoning why working out and eating healthy simultaneously has benefits. The last creates a quality of life survey that can be used to gather data regarding the topic and be used in a predictive model to prescribe workout routines for those with mental health issues.

Why has working out spiked in popularity?

At the start of 2020, the COVID-19 pandemic hit the United States. The start was terrifying, people scrambling to buy enough supplies to survive at home for the next few months. With no vaccine in sight and stores closing down to prevent spreading, people were stuck at home. During this time, many were frightened into looking into symptoms of COVID-19 and how they could let their loved ones know.

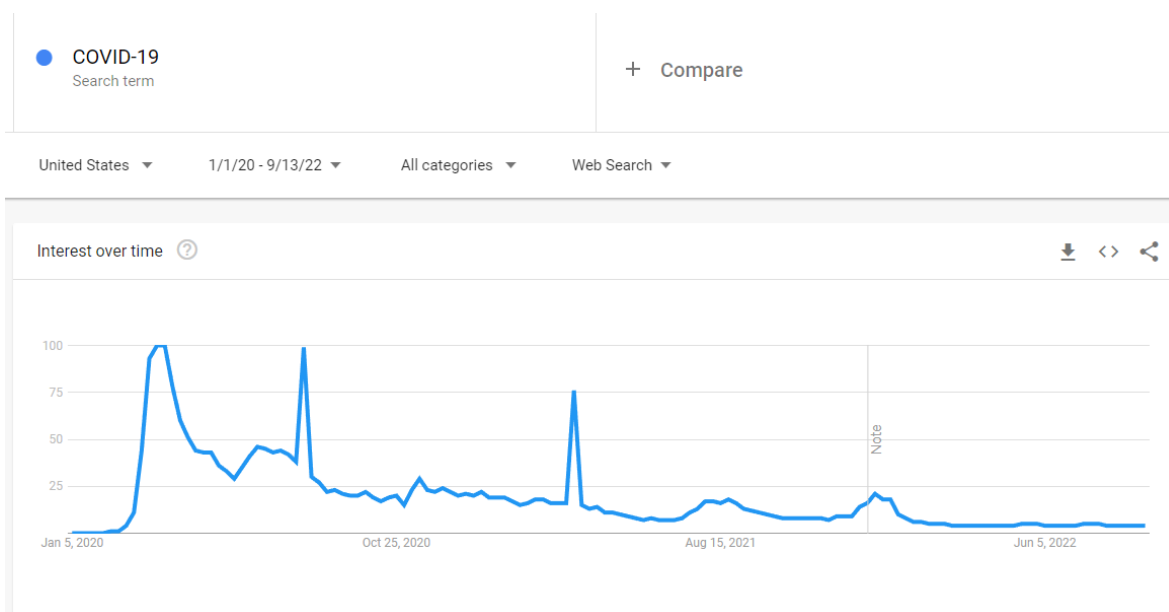


Figure 1 - COVID-19 Interest; Data Source: Google Trends

The graph above demonstrates the frequency of searches regarding COVID-19. There is a peak around March of 2020, the onset of the pandemic. The second and third peaks are probably attributed towards the different strains that were developed.

Regardless, being stuck at home lowered people's abilities to get out and socialize. Solitary confinement has a large effect on the decrease of someone's mental health. Although it felt comfortable for the first couple of weeks, the strain on people's happiness started to show. While some coped with buying pets, others started their fitness journey. The popularity of home workouts skyrocketed and the purchase of gym equipment to create a home gym in absence of going to a normal gym was quite common. While COVID-19 definitely sparked a majority of people's interests in working out, it wasn't the sole reason or cause of mental health distress.

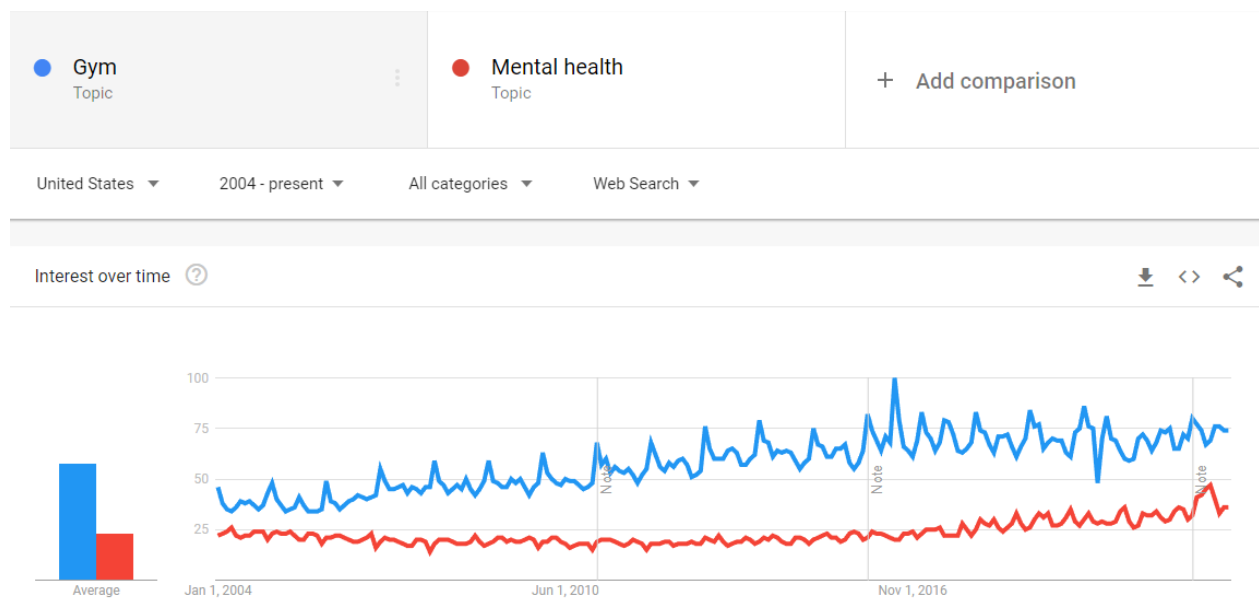


Figure 2 - Gym vs. Mental Health Searches (Google Trends, 2022)

How to get started on a fitness journey?

In order to get into the mindset of working out during the pandemic or with a lowered mental health state, most people had to start with small steps. The first small step is to set a clear plan. A depressive state is a passing thing, it may come and go (RTOR, 2020). Setting a clear workout schedule will boost confidence and restore your energy. The second step is to embrace your preferences. Depending on your mood at the time, pick a workout that fits your interests. Don't feel forced to do heavy weight lifting during severe depressive episodes. Additionally if possible, find a time to explore different fitness options such as sports, Zumba, hiking, swimming, or meditating.

The third step is to find an exercise partner. For people battling depression and mental health issues going to a crowded gym can definitely lower motivation. One way to counter this is to find an understanding workout buddy, someone who can encourage you to leave home and hit new records. Personally, I find working out with a friend much more rewarding than alone. Effects of group fitness include a statistically significant decrease in perceived stress and an increase in mental, physical, and emotional quality of life (Yorks, 2017). The final step is to give yourself some break time, when combatting depression. It's important to embrace the days you don't exercise and spend time doing other exciting hobbies like reading a book or playing video games.

The next question that arises is how long should someone dealing with depression or anxiety work out for? Doing exercise 30 minutes or more for three to five days a week may significantly improve depression or anxiety symptoms (Mayo Clinic, 2017). If 30 minutes sounds daunting at first, even just 10 to 15 minutes a day can be a game changer. The level of difficulty also comes down to the workout routine that is set and the mood of the time. The effect

that exercise has on mental health can also be scientifically proven through the release of chemicals.

Quality of Life Survey (Part 1)

While these steps are effective in their own way, I believe that most people won't just take articles for granted because a majority of them may be written by researchers of varying workout experiences. In order to convince them thoroughly, it might be a better idea to instead ask similar quality of life questions regarding working out to the general population of gym attendees. Asking these kinds of questions to a general public will allow more access to how people would normally feel about attending the gym rather than looking at the raw statistics. Hearing people's opinions can also provide further insight as to how anyone starting at the gym should proceed, especially those who are affected by mental health issues.

A plan to get this plan into motion is to start with the local gym I attend and ask if it would be possible to branch out this survey into the other locations. Once that is successful, it would probably be necessary to ask for sponsorships to get the survey across more gym companies. The survey should be asked to be completed once at the instant where the gym attendee checks in. The attendee will have an option to not take the survey, but for the most part, it should be encouraged.

Sample Questions for the Survey

These are some of the possible questions that can be asked on the survey. These are general questions that can be specified into broader questions, or can lead to branching questions depending on the response.

1. How long have you been working out for?
2. In general, do you workout by yourself?

3. If not, how many people do you work out with if working out in a group?
4. On average, how long do you workout for?
5. What type of workout do you do? (Weightlifting, Cardio, Calisthenics, or other?)
6. What was your reason to start going to the gym? (Personal, Recommended, or Other)
7. If it's not any further trouble, do you mind leaving a piece of advice for someone starting off working out?

The answers for the first few questions until the fourth question should be numerical values, then following would be qualitative. The sixth question could get a bit personal, it could ask for further input when choosing “personal” to ask about whether the attendee chose to workout due to physical health, aesthetics, or even a more sensitive question, to improve mental health. While it may seem like a very revealing question to ask, especially while attending a public gym, this could provide crucial insight and data to the predictive model. If anything, it could be used to help someone with their mental health issues who haven't worked out or attended a gym before. The seventh question will be an optional question, asking for more of an open-ended answer that could be used as a baseline for setting up workouts. For example, if one answered to start working out for a small period of time, the predictive model should take into account the user's experience, and prescribe that baseline workout time.

The Science Behind “Feeling Good”

Exercising releases a number of chemicals that form a complex cascade of health improvements. Depending on the intensity of the exercise performed, the number of neurotransmitters varies. Endorphins block pain and increase the sensation of pleasure felt. Endocannabinoids are responsible for the “runner's high”, the feeling of calmness after a rigorous workout (Preiato, 2022). Dopamine, while affecting mostly mood, is also responsible

for other processes including regulating heart rate and maintaining mood. In addition to these neurotransmitters, exercising also promotes neuroplasticity, which is the malleability of the mind to respond to internal or external stimuli. As the heart pumps faster, it increases oxygen supply and promotes improvements in working memory and self-control. With all these benefits it's not hard to see why people facing mental health issues tend to gravitate towards working out and going to the gym.









KEY NEUROTRANSMITTERS AND THEIR MAIN FUNCTIONS	
 ADRENALINE/EPINEPHRINE fight or flight Produced in stressful situations. Increases heart rate and blood flow, leading to physical boost and heightened awareness.	 GABA calming Calms firing nerves in the central nervous system. High levels improve focus, low levels cause anxiety. Also contributes to motor control and vision.
 NORADRENALINE/NOREPINEPHRINE concentration Affects attention and responding actions in the brain. Contract blood vessels, increasing blood flow.	 ACETYLCHOLINE learning Involved in thought, learning, and memory. Activates muscle action in the body. Also associated with attention and awakening.
 DOPAMINE pleasure Feelings of pleasure, also addiction, movement and motivation. People repeat behaviors that lead to dopamine release.	 GLUTAMATE memory Most common neurotransmitter. Involved in learning and memory, regulates development and creation of nerve contacts.
 SEROTONIN mood Contributes to well-being and happiness. Helps sleep cycle and digestive system regulation. Affected by exercise.	 ENDORPHINS euphoria Released during exercise, excitement and sex. Producing a sense of well-being and pain reduction.

Figure 3 - Key Neurotransmitters (Smith, 2021)

The figure above illustrates key neurotransmitters and each of their main functions. As discussed, dopamine and endorphins are two of the neurotransmitters released during exercise.

Benefits of a Healthy Diet

Exercise should also be performed in tandem to maintain a healthy diet. Oftentimes, eating the right foods and working out has better results than doing just one or the other. Together they are effective in preventing excess weight gain and maintaining weight loss (Wakeman, 2016). In the present, while the intake of energy-dense foods have increased, the

types chosen are high in saturated fats, salt, and sugar. In addition to this tradeoff, insufficient amounts of vegetables, dairy, fruit and other healthy products are consumed. Sugar and processed foods lead to inflammation throughout the body and brain which may contribute to anxiety and depression (Sutter, n.d.). Gut bacteria produce about 95% of the body's serotonin, another neurotransmitter that affects mood. Stress and mental distress can halt the production and growth of gut bacteria. They can also affect the amount you eat, in a way called stress eating. It's easy to overeat when stressed and it's also common to undereat when feeling under the weather. Sometimes, stress and depression cause eating habits that can't be controlled. In these types of extreme situations, professional help should be sought out and setting an exercise routine should be one of the first decisions you make after.

Quality of Life Survey (Part Two)

To further work on the predictive model for exercise routines, data about amounts of neurotransmitters must be collected. Luckily, neurotransmitter testing exists in the present time, however a bit expensive. In the future, once it becomes more accessible, the second part of the quality of life survey will be asking attendees to take neurotransmitter tests at various times. Periodic neurotransmitter testing is important to track imbalance which is the primary cause for improper functioning of the communication system in the body (Scheiderer, 2022). A neurotransmitter imbalance can lead to issues such as depression, anxiety, insomnia, and migraines just to name a few. At the moment, neurotransmitter tests are used to monitor responses of individuals towards depression and anxiety medication, but I believe it can be used for this study to help by creating the right workout routine. Urinary neurotransmitter measurements are taken to find changes in neurological changes.

In addition to the written QOL survey, gym attendees, if interested, are asked to perform neurotransmitter tests on specific intervals. The first test will be at the beginning of the testing phase, just to get an understanding of how many neurotransmitters are produced without any types of exercise. After, neurotransmitter tests will be taken before and after a workout, and this specific workout measurement should happen for each change in workout routine, whether it be a different type or attending with a friend. It would be quite extensive to ask for an individual to do these tests consecutively, so perhaps a weekly basis would be more sufficient. Once the individual has taken these baseline tests, the tests will then resume on more of a quarterly basis to keep track, and finally when the testing phase is over, a final measurement will be taken.

The amounts of each neurotransmitter important to working out including dopamine and endorphins should be tracked as data values. A great way to understand correlation between working out factors which information was gathered in the first QOL survey and the numerical values of neurotransmitters could be using K-means clustering methods. The clustering demonstrates the levels of neurotransmitters based on factors such as experience, the workout length, the type of workout, attending with a partner, and other conditions. Fitting these levels with these characteristics in a predictive model will be important for assigning those at risk with mental health a specific workout routine. The training sets of data will be taken from the first batch of prescribed workouts to see whether the predictive model is a great fit. From there, the final touches on the predictive model can be made.

Findings and Next Steps

With the research and an example data collection method provided, the next steps would be to determine how to deal with the data and how to apply it back to the research. As mentioned before, the data collected could be quantitative, qualitative, or perhaps a mix of both. The data should be fed through a predictive model which will be used to assign particular exercise routines for those at risk with mental health to help them release the proper amounts of neurotransmitters during an imbalance. To determine the type of data analysis for this type of predictive model, it would require a first-hand look at the data set to check for quality and other issues. I would also have to understand different types of data analysis as well. This week, we mentioned K-means clustering which could count as a possible method because the model I am creating is going to be using unsupervised learning. I don't know what type of trends I am going to see within the data.

Assumptions

There are a handful of assumptions that I am making while conducting this study. The first being whether people would be interested in filling out a survey, even if we state that it is a mandatory one. While forcing them could be an ethical concern, which I will discuss in the next section, there will probably be other ways to try and motivate them to take the survey. Another assumption I am making is that the population of people that are willing to take are of varying states of mental health. In order for this model to be successful, it has to take into consideration the state of mind to help prescribe workouts. With a population of survey takers who are all healthy mentally, it might be difficult to make a successful model at all. The final assumption is that gyms would be open to posting this survey at their centers. While data is already collected regarding a member's personal information, having a center that is solely for taking the survey

could be a bit crowding, especially at the entrances. At the gym I attend, they already have two kiosks for new members or guests to sign up for working out, so it would work out there.

However, keeping other gyms as possibilities in the future without kiosks at the front could prove to be a hassle. A solution to this would be to possibly have a QR code leading to an online survey that customers could scan on the way in.

Ethical Concerns

The biggest ethical concern for this study will be the recording of medical information. Hospitals and other medical centers do not share or sell information as personal as this, so what would make mental health history an exception? It is possible to state that it is for the general good, but I feel that most requests like these do use this kind of excuse and could possibly lead to a breach in privacy. There will need to be a certain methodology to collecting, studying, and preparing this medical data that will allow for no kinds of breaches.

The second ethical concern will be asking people to take the survey. While I have mentioned that the survey will be mandatory for people entering the gym, I believe that there will be a minority of people who will want to keep their information to themselves, which will be fine. I believe in the long run however, if the people who are skipping the surveys are people with mental health issues, then it could have a negative effect on the model itself.

Challenges/Opportunities

The main challenges arise from data not being collected due to ethical concerns. I will have to find other methods to collect data that will benefit the model. Another challenge will be finding the best means to analyze the data and creating a realistic predictive model. While I have alluded to having the model pick up on several factors, the difficulty to achieve this kind of association between the ten to fifteen factors I have mentioned will be quite a daunting task.

Perhaps this case study would be better accomplished as a group rather than an individual.

Perhaps it will take a decade or two to create the perfect predictive model. Only time will tell.

Additional opportunities to benefit the model could be regarding data about diets. There are already apps and softwares collecting this data, so it may not be necessary to create a whole new tracker for this. While it may not be required for this particular study, it could be something that could be worked on in the future. The diet data can be incorporated into the model to further prescribe a diet required for the difficulty of the exercise routine and for the levels of neurotransmitters.

Another opportunity to better the model would be to research whether gym clothes have an effect on the effectiveness of a workout. I'm sure that wearing much more flexible clothes is preferred over wearing a formal shirt and dress pants, but are brands with specific materials more beneficial than wearing a t-shirt and sport shorts? I suppose clothing types could also affect shoe types. What is the best shoe overall to workout? These are all questions that could affect the model and maybe start prescribing certain workout clothes.

Conclusion

In conclusion, I believe that there is a strong correlation between working out and improving mental health. The starting point for myself and most likely many others happened at the peak of the pandemic when people were confined to their homes with nothing to do but better themselves mentally and physically. While it may be difficult to get started when in a depressive mental state, taking baby steps such as setting a routine, finding a gym buddy, embracing workout preferences, and scheduling personal break time are crucial. Working out has also been scientifically proven to release the right chemicals through neurotransmitters which the amount depends on the difficulty of the exercise routine chosen. In addition to working out, maintaining a healthy diet can help control weight loss or gain as well as release the right chemicals. However, stress eating and unhealthy eating habits occur quite frequently for people with mental health issues. In order to combat these severe issues it's very important to seek professional help and then following that, set up an exercise routine to get started.

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