

Impact on Visual Attention and Perseveration among Covid-19 infected individuals in Guwahati city.

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Abstract-

Neurological impact on Covid-19 infected individuals has been a major concern as various research has shown an impact on brain-behavior relationship among Covid-19 survivors. A neurological factor, Visual Attention is noteworthy as it plays a significant role in every individual's life for productive living. A sample of n=120 Covid-19 infected and n=120 non-infected individuals were tested on Visual Attention by adopting the tool, Wisconsin Card Sorting Test. Visual attention and perseveration have been equally impacted among both males and females infected with Covid-19 as compared to non-infected individuals. MANOVA results divulge equal effect on all the attributes of Visual attention among Covid-19 infected individuals.

Keywords: Impact, Visual Attention, Perseveration, Covid-19, Wisconsin Card Sorting Test (WCST).

Introduction

Brain functions are composed of many distinct types of cognitive abilities such as noticing colours, remembering names, calculating time on a watch etc. Every day human beings perform different kinds of cognitive tasks; individuals do not even realize the importance of effort put by the brain and different neural mechanisms. In March 2020, with the start as an outbreak of a deadly virus – Coronavirus continues till date as a petrifying nightmare for most of the world's population. The reverberation of the pandemic is multitude for people around the world and therefore the effects (physical, emotional, behavioral, social etc.) cannot be disregarded.

Covid-19 and its effect on Neurological functioning

COVID-19 infection is associated with Neuro-cognitive disorders (Mukaetova-Ladinska et al., 2021) which has direct and indirect impact often resulting in traumatic stress on executive function deficits (Kira et al., 2021). The effects of acute stressors (traumatic stressors) on executive functions are mostly indirect via their adverse effects on mental health. Neuro-cognitive functions are inevitable when it comes to daily lives of people. From as small as running daily errands to complex calculations, its importance cannot be negated.

Visual attention –

Visual attention refers to the cognitive operations that allow a person to efficiently deal with capacity problem by selecting relevant information and by filtering out irrelevant information. It describes a set of mechanisms that limit some processing to a subset of incoming stimuli.

Visual attention is guided by two approaches of cerebral functioning-

1. Top-Down Approach – This approach is followed when the attention to stimuli is guided by higher order cognitive functioning.
2. Bottom-Up Approach - This approach is followed when the attention to stimuli is guided by sensory periphery.

Visual Attention cannot be defined as a single entity. It can best be defined as a family of processing resources or cognitive mechanisms that can modulate signals at almost every level of the visual system (Karla K. Evans et.al).

Being an executive function, the role of visual attention is to allow our visual system to process visual input preferentially by shifting attention about an image, giving more attention to salient locations and less attention to unimportant regions. It also guides our perception, helps to prioritize information, supports problem-solving, facilitates memory processes, enables task switching, and enhances visual processing efficiency. It also assists in brain and speech language coordination as a major neuro-cognitive skill for everyday functioning. Perseveration, on the other hand is the inappropriate repetition of behavior that is often associated with damage to the frontal lobe of the brain in neuropsychology. It can also be defined as an inability to interrupt a task or to shift from one strategy or procedure to another causing hinderance in smooth everyday functioning.

Methodology

Objective-

1. Impact of Covid-19 on visual attention and perseveration among infected and non-infected individuals.
2. Impact of Covid-19 on visual attention and perseveration among infected males and non-infected males.
3. Impact of Covid-19 on visual attention perseveration among infected females and non-infected females.
4. Impact of the three attributes of Visual attention on Covid-19 infected individuals across both genders.

Hypothesis-

5. There will be no significant difference in the functioning of Visual Attention and perseveration among Covid-19 infected and non-infected persons.
6. There will be no significant difference in the functioning of Visual Attention and perseveration among Covid-19 infected males and non-infected males.
7. There will be no significant difference in the functioning of Visual Attention and perseveration among Covid-19 infected females and non-infected females.
8. There will be no significant effect among the three attributes of Visual attention on Covid-19 infected individuals across both genders.

Participants

Inclusion Criteria:

- ❖ Individuals infected with Covid-19.
- ❖ Individuals non-infected with Covid-19.
- ❖ Individuals who have undergone RTPCR/RAT Testing.

- ❖ Individuals who were symptomatic.
- ❖ Individuals residing in Guwahati City.
- ❖ Individuals with basic proficiency to read and write.

Exclusion Criteria:

- ❖ Individuals who were asymptomatic with Covid-19.
- ❖ Individuals who are differently abled.
- ❖ Genders other than male and female.
- ❖ Individuals with co-morbidities of Type 2 Diabetes, Kidney Disease and Severe Chronic Obstructive Pulmonary Disease (COPD).

Tool Adopted-

- ❖ **Wisconsin Card Sorting Test** - The Wisconsin Card Sorting Test (WCST) is a standardized neuropsychological tool developed by David A. Grant and Esta A. Berg that is frequently used to measure various higher-level cognitive processes. For this study, the concept of visual attention and perseveration have been taken into consideration to determine whether an individual can focus, shift set and sustain attention on a particular task.

Results Analysis

To explore if there are any significant functioning differences, following process were adopted:

- ❖ The total respondents in the study were N=240 which consists of both Covid-19 infected and non-Covid infected individuals (Infected males = 60, infected females =60, non-infected males = 60 and non-infected females = 60).
- ❖ The Socio-Demographic tool aided the researcher in gaining insight about the basic details of the participants.
- ❖ T – test was applied across all groups to understand the presence of any differences in the selected variables for this study.
- ❖ MANOVA Test was performed among the three attributes of Visual attention and perseveration on infected individuals across both genders.
- ❖ The data collected is represented in tabular form for each category of variable chosen for this study.

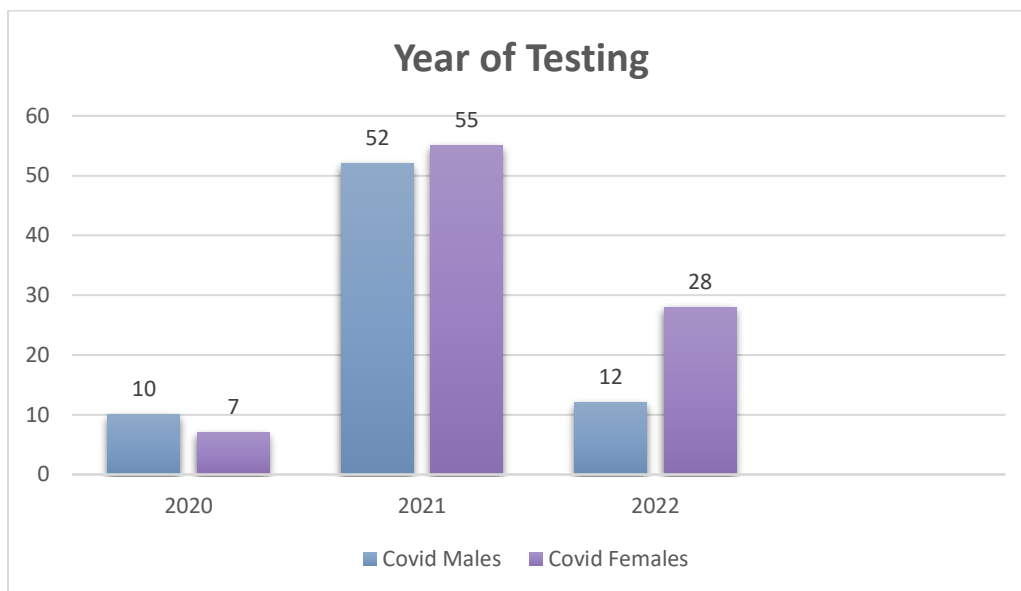
Socio Demographic Data:

The socio-demographic tool was prepared by the researcher with questions determined to help the researcher to understand significant information which shall support the study. For example, information on year of Covid-19 testing, average age of participant, method of isolation undergone along with the presence of post covid-19 symptoms.

Following graphs below will show the representations of the various socio-demographic variables:

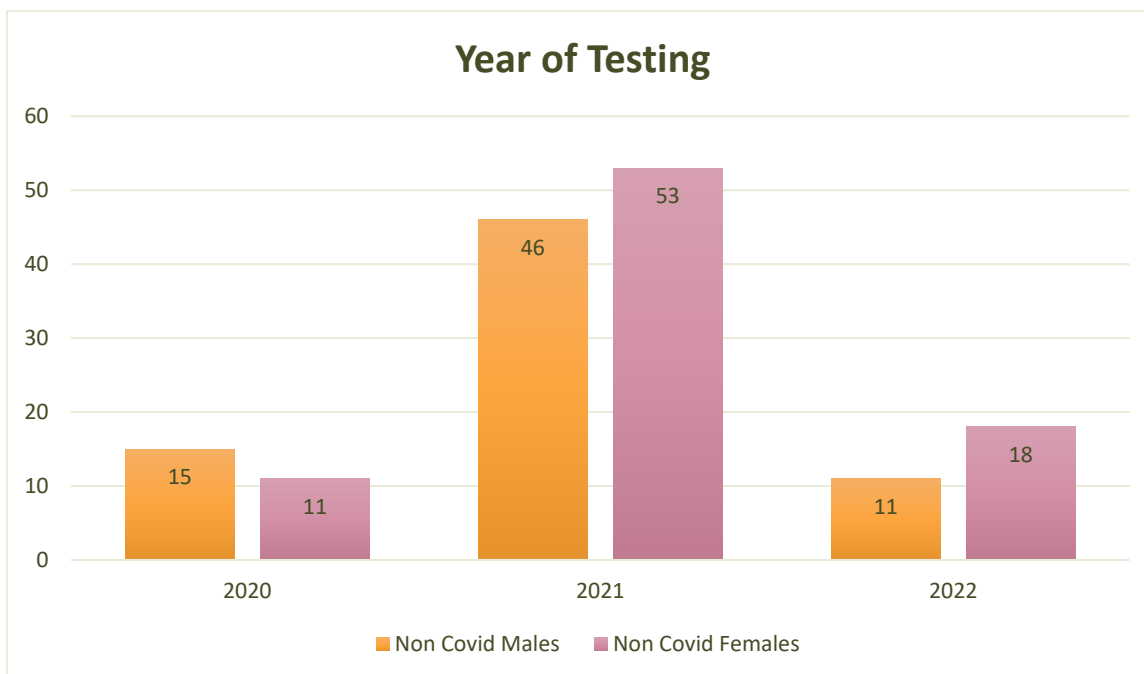
1. Year in which participants were tested positive for Covid-19 Testing

Graph 1.1 – Representation of year of Covid-19 testing (positive/negative) among males and females (Covid)



From the above graphical representation, it can be noted that most people who were infected with Covid-19 tested positive in 2021.

Graph 1.2 – Representation of year of Covid-19 testing(positive/negative) among males and females (non-Covid)

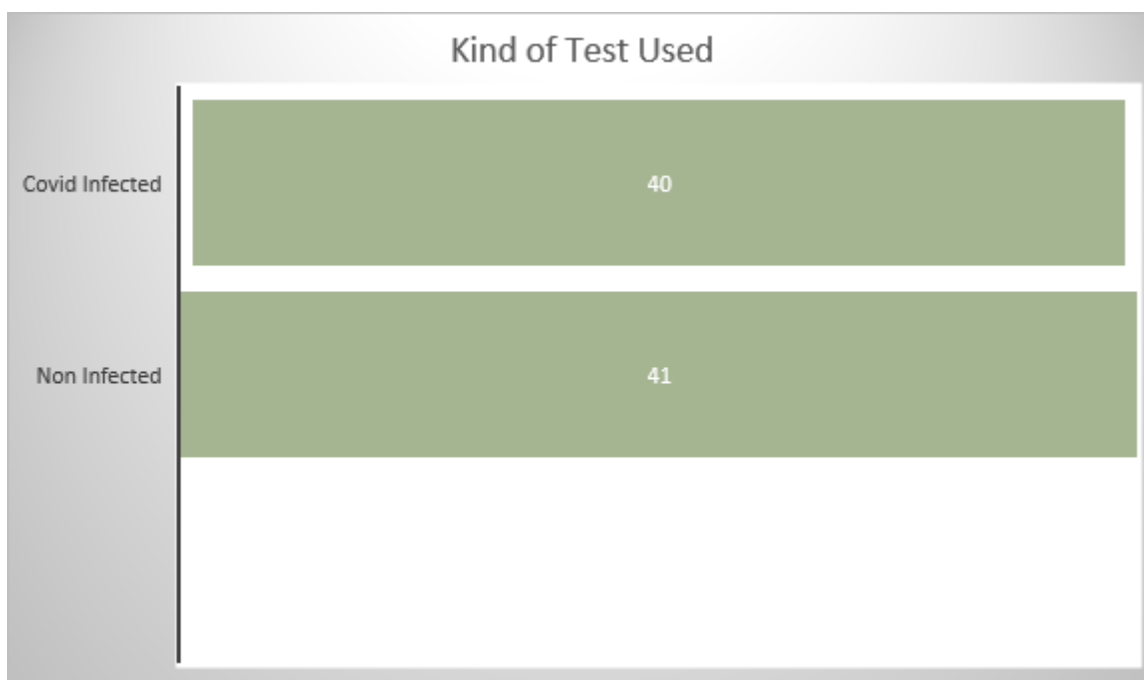


The graphical findings revealed that majority of non-Covid individuals underwent testing in the year 2021.

It has been observed that even though the years of testing for Covid-19 positive varied among Covid-19 infected individuals they did live with the symptoms of visual attention deficit and perseverance effect that let to disruption in their everyday life with stress being enhanced when they were tested on WCST. Individuals who were tested negative for Covid-19 did not show significant symptoms of visual attention deficit and loss of perseverance in Wisconsin test when compared.

2. Average Age of Two groups:

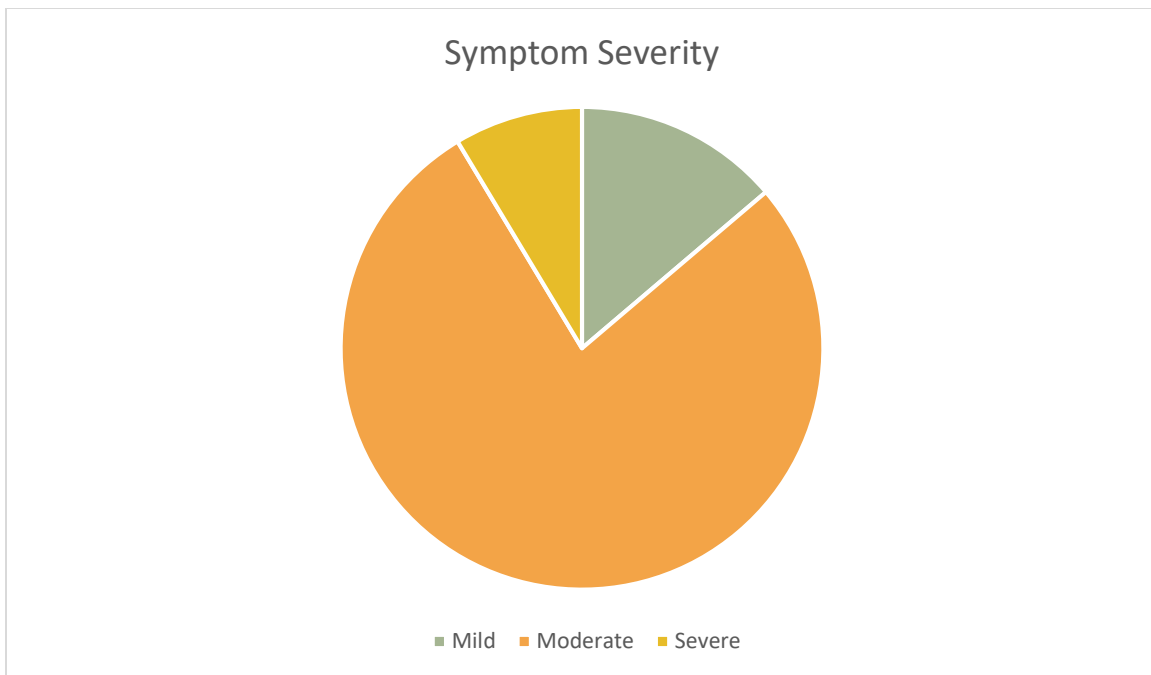
Graph 2.1- Representation of age between Covid infected and Non-Infected Individuals



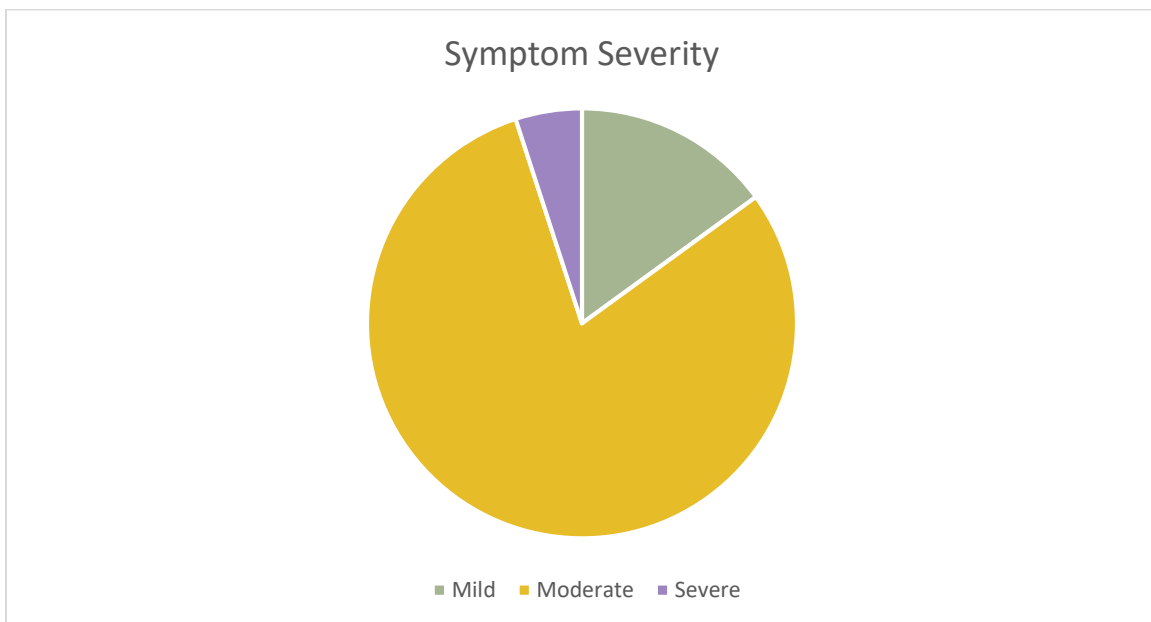
Participants who were tested for WCST for Covid-19 infected and non-infected individuals, it was observed that their average age was almost the same which clearly depicts age could not be a factor of decline in visual attention and perseverance among Covid-19 infected individuals, but it was the infection that had affected visual attention and perseverance as non-infected individuals of the same age did not show significant decline in the same.

3. Severity of Symptoms

Graph 3.1: Representation of symptom severity among Covid-19 infected Males



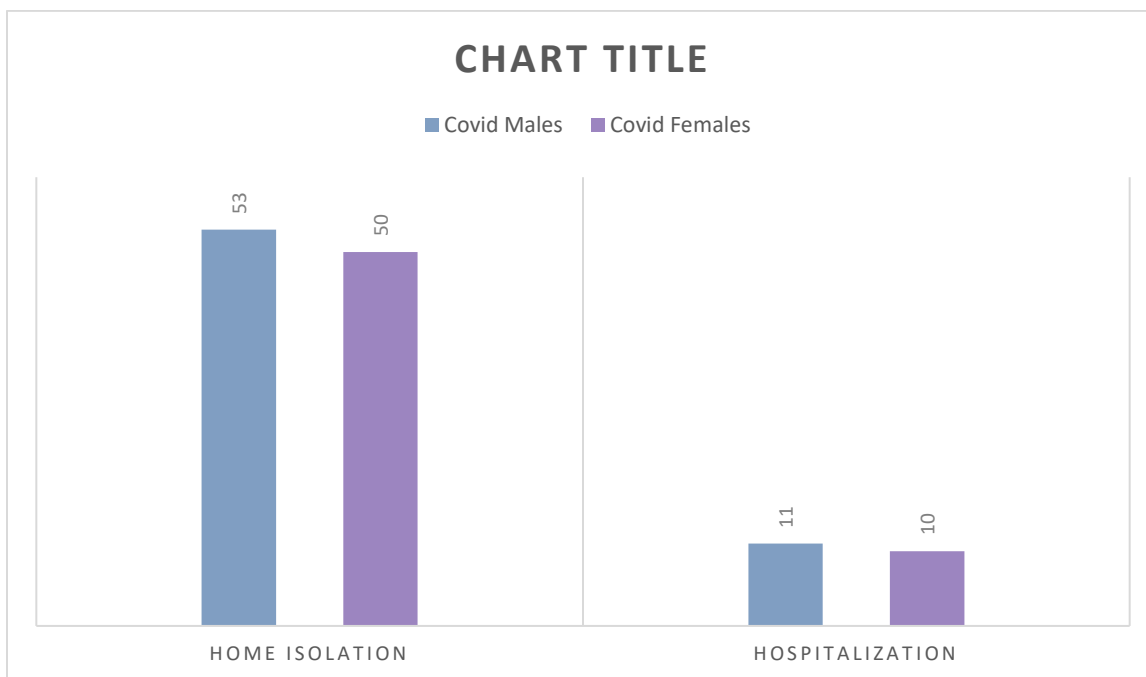
Graph 3.2: Representation of symptom severity among Covid-19 infected Females



There has been similar pattern of symptom severity among male and female participants who were tested positive. Most of the individuals who were tested on WCST with Covid19 positive were higher on moderate and severe symptoms. Very few participants showed mild symptoms in both the groups of male and female participants who were covid19 positive participants.

4. Hospitalized/Home Isolation

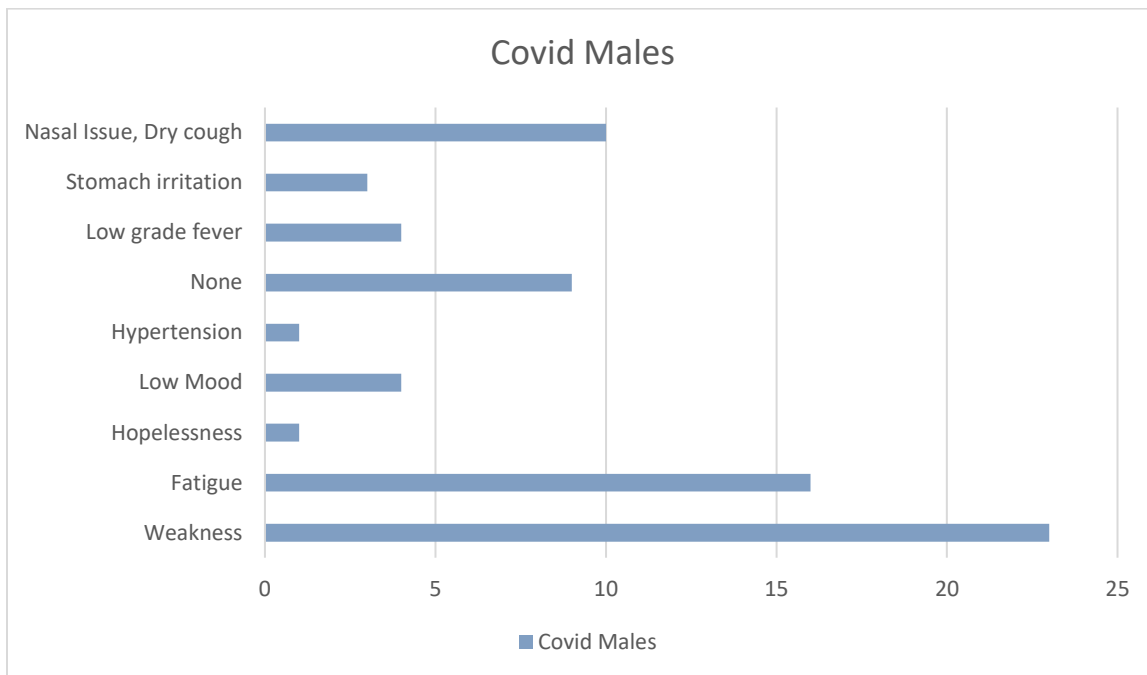
Graph 4.1: Representation of covid-19 males and females under Home Isolation vs. Hospital care.



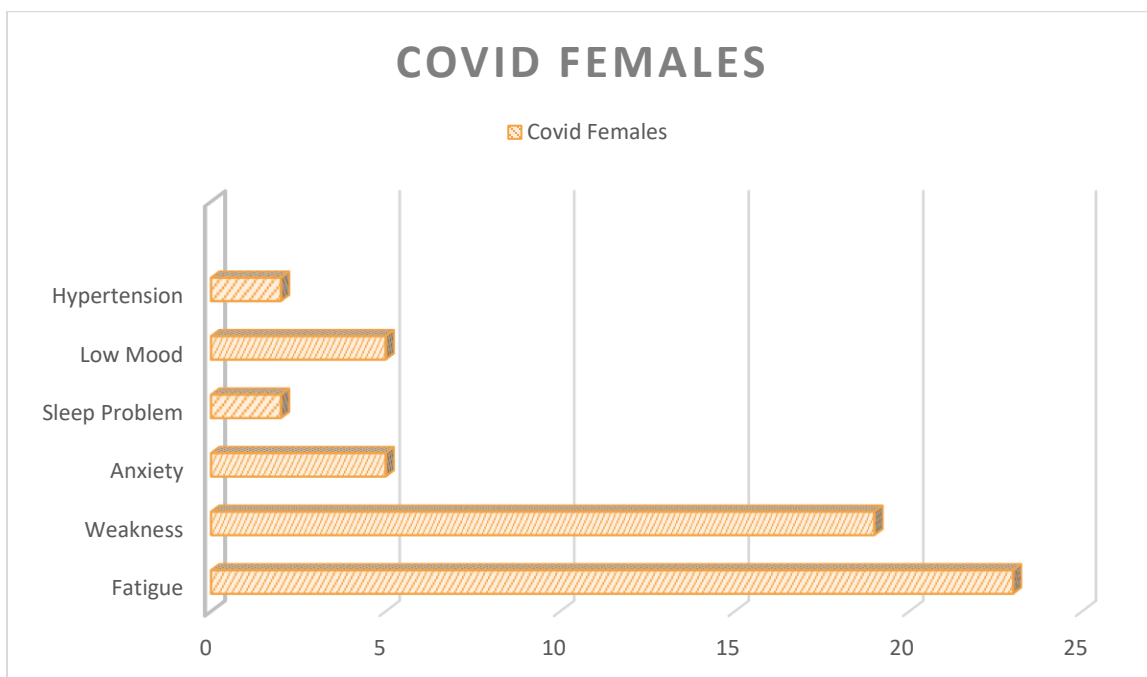
The participants who were tested Covid-19 positive and tested for the present research on the WCST were mainly under home isolation during the pandemic. This was true to both males and females. There were a very few participants among both males and females who were hospitalized after being detected covid19 positive. So, very severe Covid-19 symptoms showing very high count of CT (Cycle Threshold values) between 17-24 viral load participated in few numbers in the present study. Most of the participants were in the moderate CT value range (24-35). Yet, visual attention and perseverance impairment were detected among individuals.

5. Post-Covid Symptoms

Graph 5.1: Representation of post-covid symptoms among Covid-19 Males



Graph 5.2: Representation of post-covid symptoms among Covid19 females



Post Covid-19 symptoms reported by participants both male and female Covid-19 survivors. Interestingly it has been reported by male participant on physiological symptoms. Female reported

more on psychological symptoms. Nasal issues, dry cough, stomach irritation were symptoms complained by Covid-19 infected male but covid19 infected female did not complain of any physiological symptoms. Both male and female complained that they newly developed hypertension, low mood, sleeplessness, anxiety, weakness, fatigue as reported by individuals.

To understand if Covid-19 has impacted an individual’s ability to sustain attention visually along with being able to maintain focus on a task, The Wisconsin Card Sorting Test was adopted. T Test was computed to statistically define the difference. Following tables show the results for each:

Table 1.1 – Visual Attention T statistics results among Covid-19 and non-Covid group.

Category	Mean	Std. Deviation	P Value	Critical Value
Covid	1.01	7.22	.000	2.33
Non Covid	1.12	6.88		

Objective- Impact of Covid-19 on visual attention and perseveration among infected and non-infected individuals.

Hypothesis- There will be no significant difference in the functioning of Visual Attention and perseveration among Covid-19 infected and non-infected persons.

The statistical computation results of T-test among Covid-19 and non-Covid group on Visual attention reveals significant difference at 0.01 level. Therefore, null hypothesis is rejected, and alternate hypothesis is accepted. This means that visual attention has been significantly impacted for infected individuals.

Table 1.2 - Visual Attention T statistics results among Covid-19 males and non-Covid males.

Category	Mean	Std. Deviation	P Value	Critical Value
Covid	1.00	7.08	.000	2.33
Non Covid	1.11	7.51		

Objective - Impact of Covid-19 on visual attention and perseveration among infected males and non-infected males.

Hypothesis - There will be no significant difference in the functioning of Visual Attention and perseveration among Covid-19 infected males and non-infected males.

The T-test analysis between infected males and non-infected males show a significant difference at 0.01 level which means that the infected males made more errors in the test and were unable to follow the sorting principle of the task. The null hypothesis is rejected, and alternate hypothesis is accepted.

Table 1.3 - Visual Attention T statistics results among Covid-19 males and non-Covid females.

Category	Mean	Std. Deviation	P Value	Critical Value
Covid	1.00	7.33	.000	2.33
Non Covid	1.12	6.21		

Objective - Impact of Covid-19 on visual attention perseveration among infected females and non-infected females.

Hypothesis - There will be no significant difference in the functioning of Visual Attention and perseveration among Covid-19 infected females and non-infected females.

The T-test computation among infected females and non-infected females show significant difference at 0.01 level which means that the infected females made more errors in the test and were unable to follow the sorting principle of the task. Therefore, the null hypothesis is rejected and alternate hypothesis is accepted.

Table 1.4 – MANOVA statistics between colour, form and number of Covid-19 males and females in WCST.

Category	Mean-CM	Mean-CF	SD-Males	SD-Females	Sig.	Critical Value
Colour	6.66	6.01	2.41	2.22	.507	2.33
Form	5.71	6.33	2.14	2.46	.214	
Number	7.43	6.1	2.08	2.31	.180	

Objective- Impact of the three attributes of Visual attention on Covid-19 infected individuals across both genders.

Hypothesis- There will be no significant effect among the three attributes of Visual attention on Covid-19 infected individuals across both genders.

MANOVA test was computed to explore the influence of the three attributes – colour, form and number on visual attention and perseveration among infected males and females from the WCST. The results show that all the three attributes have equally impacted visual attention of infected individuals. Therefore, they have not been able to grasp the sorting principle of WCST. Therefore, null hypothesis is accepted, and alternate hypothesis is rejected.

Discussion:

The result clearly reveals significant difference between the Covid-19 infected survivors and non-infected individuals. Therefore, it is evident that Covid-19 individuals who were tested on WCST from Guwahati city were diagnosed with neuro-cognitive impairment in visual attention. The MANOVA results form Table 1.4 show that in the sorting task every factor has equally impacted the visual processing ability of the infected group in this study. The factors (colour, form and number) have proportionately impacted visual attention and perseveration. The ventral occipital lobe which is part of the visual system in human beings controls the colour centre in addition to other areas responsible for recognizing and processing specific visual stimuli, such as faces, words, and objects. The ventromedial occipitotemporal cortex appear to be indispensable for the normal processing of shape and of contour information within the ventral stream system that allows us to recognize objects. The parietal brain regions, such as bilateral intraparietal sulci, left angular gyrus, and bilateral superior parietal cortices, play distinct roles in number processing (Dehaene et al., 2003). The Covid-19 infected individuals thus are being left with impairment of the Occipital lobe.

Visual attention which is the function of the occipital lobe allows for the cognitive operations of a person to efficiently deal with capacity problem by selecting relevant information and by filtering

out irrelevant information. These impairments therefore are a major concern as the deadly infection had affected daily activities among infected individuals. When Covid-19 infected males were compared with non-infected males, and Covid-19 infected females were compared with non-infected females, both the groups followed similar trend of results.

The present research is supported by the following studies of reporting how patients infected with the Covid-19 virus were experiencing visual symptoms during their illness (Jonas J. et. al 2022) and post-COVID-19 patients have shown attention impairments several weeks after discharge (Almeria et al., 2020).

The infected individuals struggle maintaining focus in text, leading to difficulty in managing comprehension and speed, finding difficulty in alignment and consistency, lost accuracy in visual concepts such as sizes, shapes, and letters. These, symptoms have greatly impacted their daily functioning as it impairs reading, writing, drawing, driving, navigation, unable to track belongings etc. Perseveration has also been greatly impacted by Covid-19 leading to repetition of thoughts, words, action persistently significantly impacting performances along with difficulty in transition from one task to another, thereby impacting conversations by repetition of same topics and phrases. Further, their perseverative thoughts were frustrating. Therefore, the WCST test implies impairment in visual attention and perseveration.

Conclusion-

From the above discussion it can be concluded by saying that there is an effect on visual attention and perseveration of individuals infected with Covid-19 irrespective of gender. It is pertinent to note that individuals from Guwahati city who were tested on WCST need to be addressed on their visual attention impairment caused due to Covid-19 infection. Testing and intervention can be recommended to Covid-19 survivors for smooth functioning of day-to-day activities. Those detected with the impairment can be supported by brain training exercises and Neuro-feedback therapy for improvement.

References:

1. Dinakaran, D., Manjunatha, N., Kumar, C. N., & Suresh, B. M. (2020). Neuropsychiatric aspects of COVID-19 pandemic: A selective review. *Asian Journal of Psychiatry*, 53, 102188.
2. Amerio, A., Bianchi, D., Santi, F., Costantini, L., Odone, A., Signorelli, C., Costanza, A., Serafini, G., Amore, M., & Aguglia, A. (2020). Covid-19 pandemic impact on mental health: A web-based cross-sectional survey on a sample of Italian general practitioners.
3. Naming the coronavirus disease (COVID-19) and the virus that causes it. [https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-\(covid-2019\)-and-the-virus-that-causes-it](https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-(covid-2019)-and-the-virus-that-causes-it). Accessed May 1, 2020.
4. Lam, M. H. B., Wing, Y. K., Yu, M. W. M., Leung, C. M., Ma, R. C. W., Kong, A. P. S., et al. (2009). Mental morbidities and chronic fatigue in severe acute respiratory syndrome survivors long-term follow-up. *Arch. Intern. Med.* 169, 2142–2147. doi: 10.1001/archinternmed.2009.384

5. Alnefeesi Y, Siegel A, Lui LMW, et al. Impact of SARS-CoV-2 infection on cognitive function: a systematic review. *Front Psychiatry*. 2021;11:621773. doi:10.3389/fpsyt.2020.621773
6. Murphy, D., Wade, D., Bunnage, M., Doyle, A.M., Dupont, S., Fish, J., Firschman, P., Friczelle, D., Morrison, V., Moss-Morris, R., Murray, H., & Twose, P. (2020). *Meeting the psychological needs of people recovering from severe coronavirus*. British Psychological Society.
7. Narayanan, J., Wilson, B. A., & Evans, J. J. (in press). A case of Balint's syndrome after Covid-19 (to appear in the *newsletter of the International Neuropsychological Society* 2).
8. Ritchie, K., Chan, D., & Watermeyer, T. (2020). The cognitive consequences of the COVID-19 epidemic: Collateral damage? *Brain Communications*.
9. Zhang, J., Lu, H., Zeng, H., Zhang, S., Du, Q., Jiang, T., et al. (2020). The differential psychological distress of populations affected by the COVID-19 pandemic. *Brain Behav. Immun.* 87, 49–50. doi: 10.1016/j.bbi.2020.04.031
10. Université de Sousse, Faculty of Medicine of Sousse, Mental illness Epidemiology Research Laboratory LR12ES04, Screening and Early Management, Sousse 4000, Tunisia
11. Capone, V.; Caso, D.; Donizzetti, A.; Procentese, F. University Student Mental Well-Being during COVID-19 Outbreak: What Are the Relationships between Information Seeking, Perceived Risk and Personal Resources Related to the Academic Context? *Sustainability* 2020, 12, 7039.
12. Drigas, A.; Papoutsis, C. The Need for Emotional Intelligence Training Education in Critical and Stressful Situations: The Case of COVID-19. *Int. J. Recent Contrib. Eng. Sci. IT* 2020, 8, 20–36.
13. Sudre CH, Murray B, Varsavsky T, Graham MS, Penfold RS, Bowyer RC, et al. Attributes and predictors of long COVID. *Nat Med*. 2021;27:626–31.
14. Elliott P, Bodinier B, Eales O, Wang H, Haw D, Elliott J, et al. Rapid increase in Omicron infections in England during December 2021: REACT-1 study. *Science*. 2022;375:1406–11.
15. Davis HE, Assaf GS, McCorkell L, Wei H, Low RJ, Re'em Y, et al. Characterizing long COVID in an international cohort: 7 months of symptoms and their impact. *EClinicalMedicine*. 2021;38:101019.
16. Beach SR, Praschan NC, Hogan C *et al*. Delirium in COVID-19: A case series and exploration of potential mechanisms for central nervous system involvement. *Gen. Hosp. Psychiatry* 2020; 65: 47–53.
17. Ebrahimi, O. V., Hoffart, A., & Johnson, S. U. (2021). Physical distancing and mental health during the COVID-19 pandemic: Factors associated with psychological symptoms and adherence to pandemic mitigation strategies. *Clinical Psychological Science*. 10.1177/2167702621994545
18. Kastner S, Pinsk M A. Visual attention as a multilevel selection process. *Cognit Affect Behav Neurosci* 20044483–500.
19. Corbetta M, Shulman G L. Control of goal-directed and stimulus-driven attention in the brain. *Nat Rev Neurosci* 20023201–215
20. Kanwisher N, Wojciulik E. Visual attention: insights from brain imaging. *Nat Rev Neurosci* 2000191–100
21. Beraki S, Aronsson F, Karlsson H, Ogren SO, Kristensson K. Influenza A virus infection causes alterations in expression of synaptic regulatory genes combined with changes in

- cognitive and emotional behaviors in mice. *Mol Psychiatry*. 2005;10(3):299-308. doi: 10.1038/sj.mp.4001545.
22. Sudre CH, Murray B, Varsavsky T, et al. Attributes and predictors of Long COVID. *Nat Med*. 2021;27:626-631
23. COVID-19 rapid guideline: managing the long-term effects of COVID-19. 18 December 2020. www.nice.org.uk/guidance/ng188. Accessed November 12, 2021.
24. Alnefeesi Y, Siegel A, Lui LMW, et al. Impact of SARS-CoV-2 infection on cognitive function: a systematic review. *Front Psychiatry*. 2021; 11:621773. doi: 10.3389/fpsyt.2020.621773
25. Xiang YT, Yang Y, Li W, Zhang L, Zhang Q, Cheung T, et al. Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. *Lancet Psychiatry*. (2020) 7:228–9. 10.1016/S2215-0366(20)30046-8.
26. Nicola Morelli,a,b,* Eugenia Rota,c Paolo Immovilli,a Marco Spallazzi,d Davide Colombi,b Donata Guidetti,a and Emanuele Michielettib, *Eur Neurol*. 2020 May 11 : 1–2
The Hidden Face of Fear in the COVID-19 Era: The Amygdala Hijack Published online 2020 May 11. doi: 10.1159/000508297