

# POST-COVID COGNITIVE IMPAIRMENT AMONG GENERAL POPULATION OF KHYBER PAKHTUNKHWA: PAKISTAN

Naveeda Sarwar<sup>1✉</sup>, Saima Abid<sup>1</sup>, Zafar Ali Khan<sup>2</sup>, Sanam Gul<sup>3</sup>

## ABSTRACT

**OBJECTIVE:** To assess and compare the cognitive functioning of post-Covid patient with non-Covid person among the general population of Khyber Pakhtunkhwa province of Pakistan.

**METHODS:** This descriptive cross-sectional study was conducted from January to May 2021. Sample of 500 community members, including both post-Covid and non-Covid, from population of Khyber Pakhtunkhwa, Pakistan. Male and female with age of 18-64 years were included, age less than 18 years, having any nervous system or psychiatric illness or previous known cognitive impairment were excluded from the study. Validated Cognitive Functioning Self Reporting Scale (CFSS) questionnaire was used. Data was analyzed through SPSS V.25.

**RESULTS:** Out of 600 approached, 500 (83.3%) participants responded to online questionnaire. Mean age of participants was  $45 \pm 22$  years, Majority ( $n=174$ ; 34.7%) of participants were from 31-40 years' age group. Hypertension ( $n=33$ ; 6.6%) and Diabetes Mellitus ( $n=30$ ; 6%) were the most common comorbid conditions; while 378 (75.6%) had no comorbidities. Mean CFSS values was  $38.4 \pm 11.5$  and  $42.2 \pm 12.04$  for male ( $n=230$ ) and female ( $n=270$ ) participants respectively. Based on standard cut off values of CFSS, mild, moderate and severe cognitive impairment was observed in 46 (24.8%), 127 (68.6%) and 12 (6.4%) cases of post-COVID and 19 (20.4%), 73 (78.4%) and 1 (1.0%) cases of non-COVID participants having no comorbidities.

**CONCLUSION:** Cognitive performance was moderately affected among post COVID patients as compared to non-Covid population, compromising daily executive functioning as well as other elements of mental health such as attention, memory, spatial functioning & inhibition.

**KEYWORDS:** COVID-19 (MeSH); Cognitive Dysfunction (MeSH); Mental Health (MeSH); Descriptive cross sectional (Non-MeSH); Executive functioning (MeSH); General Population (Non-MeSH).

**THIS ARTICLE MAY BE CITED AS:** Sarwar N, Abid S, Khan ZA, Gul S. Post-Covid cognitive impairment among general population of Khyber Pakhtunkhwa: Pakistan. Khyber Med Univ J 2022;14(4):234-8. <https://doi.org/10.35845/kmu.2022.22179>.

- 1: Pak International Medical College, Peshawar, Pakistan.
- 2: Deputy Director HRM, Director General Health Secretariat Office, Peshawar, Pakistan.
- 3: Deputy General Manager, Green Star, Peshawar, Pakistan

Email✉: [naveedasarwar6@gmail.com](mailto:naveedasarwar6@gmail.com)

**Date Submitted:** November 4, 2021

**Date Revised:** October 4, 2022

**Date Accepted:** October 15, 2022

attention, executive function, short-term memory, and psychomotor processing being observed.<sup>7,8</sup> It's not simply COVID-19 survivors who may be at danger of cognitive damage; some evidence suggests that the COVID-19 pandemic has damaged cognition in those who did not even have the disease due to stress. According to a research social cognition test performance worsened during lockdown with impairments evident in individuals who were more isolated.<sup>9</sup>

COVID-19 creates wide range of psychological issues which ultimately leads toward impairment of coping ability of daily life arenas i.e. social, emotional, cognition, and normal physical activities. We assumed that COVID-19 pandemic has detrimental effect on the wellbeing and cognitive functioning of the post-COVID patients and non-Covid people. Since no study has been done so far on this topic in Khyber Pakhtunkhwa, Pakistan this study will help in future studies as a reference and/or for other Public Health interventions. The objective of this study was to assess the cognitive functioning of the Post COVID-19 patients and to compare cognitive functioning of post-Covid patients and non-Covid population in Khyber Pakhtunkhwa Pakistan.

## METHODS

This descriptive cross-sectional study was conducted from June till August 2021. Cochran formula calculated 500

## INTRODUCTION

**N**ovel Coronavirus disease 2019 (COVID-19) has emerged as a pandemic worldwide from the city of Wuhan. WHO declared it as a Pandemic on March 11, 2020.<sup>1</sup> So far it has affected 17, 630, 3596 people worldwide with 3,820,026 deaths.<sup>2</sup> COVID-19 affects every system of the body including nervous system.<sup>3</sup> Various aspect of the COVID-19 is still under study and considerable number of researches has been published.<sup>4</sup>

Cognition is the mental process of acquiring knowledge and understanding through thought, experience, and the senses. It includes various intellect aspects such as attention, memory, knowledge, decision making, planning, reasoning and comprehension etc. Weakening of various aspects of cognition is called cognitive deficit.<sup>5</sup> COVID-19 can damage the brain resulting in neurological symptoms and mental health issues.<sup>6</sup> Patients with neurological symptoms are considered to have impaired cognition in around 30% of cases, with impairments in

**TABLE I: PARTICIPANTS WITH HISTORY OF COVID-19 AND WITH OTHER PHYSICAL ILLNESS**

Co-morbidities	Post-Covid	Non-Covid
Diabetes Mellitus	24 (8.1%)	6 (3%)
Hypertension	19 (6.7%)	14 (6.6%)
Physical disabilities	2 (.7%)	4 (1.2%)
Any other illness	32 (11%)	21 (10.6%)
None	205 (72%)	173 (75%)
Total	282	218

**TABLE II: DESCRIPTIVE STATISTICS OF TOTAL SCORES (N=500)**

Variable	Cognitive functioning of self-report scale				
	Frequency	Min	Max	$\bar{X}$	SD
Covid patient	282	1	3	1.8	.54
Non-Covid person	219	18	66	40.3	10.8
Total	500	18	73	40.5	11.9

**TABLE III: CFSS VALUES OF POST COVID & NON COVID WITH "NO OTHER COMORBID ILLNESS" (N=278)**

CFSS CUT OFF VALUES	POST-COVID	NON-COVID	Total
1-30 (mild)	46 (24.8 %)	19 (20.4 %)	65 (23.4%)
31-60 (moderate)	127 (68.6%)	73 (78.4 %)	200 (71.9%)
61-90 (severe)	12 (6.4 %)	1 (1.0%)	13 (n=4.7%)
Total	185 (66.5 %)	93 (33.4 %)	278

CFSS: Cognitive Functioning Self Reporting Scale

**TABLE IV: GENDER BASED COGNITIVE COMPARISON (N=500)**

Variable	CFSS		t(491.49)	P	Cohen's d
	$\bar{X}$	SD			
Male	38.4	11.5	-3.65	.000	0.32
Female	42.2	12.04			

CFSS: Cognitive Functioning Self Reporting Scale

**TABLE V: REGRESSION ANALYSIS OF COVID STATUS, PHYSICAL DISABILITY AND AGE WITH CFSS**

R	R Square	Adjusted R Square	Std. Error of the Estimate	df1	df2	Sig. F Change
.001	.001	-.005	11.97237	3	496	.884
Coefficient	Unstandardized Coefficients	Standardized Coefficients	t	Sig.	Unstandardized Coefficients	
(Constant)	42.910	3.291		13.038	.000	
Did you suffer from Covid-19?	-.311	1.098	-.013	-.283	.777	
Age	-.435	.596	-.035	-.730	.466	
Are you suffering from any below mention disease?	-.242	.483	-.024	-.501	.617	

sample with confidence interval of 95% and error precision of 5%. Population included post-Covid patients and non-Covid population of Khyber Pakhtunkhwa. Sample included male and female of age 18-64 years. Those under 18 years or having other nervous system or psychiatric illnesses or

previous known cognitive impairment were excluded from the study. Non-Probability convenient sampling technique were used to collect online data through google form sent through emails, WhatsApp and Facebook. Cognitive Functioning Self Reporting Scale (CFSS) questionnaire was used for

the data collection.<sup>10</sup> Its 18 items cover cognitive domains such as attention, memory and spatial-temporal orientation. Each item describes an activity of daily life in which these domains were involved. Participants answered each item on a 5-point Likert scale group into never, almost never, sometimes almost always and always, referring to the past 12 months. The instrument provided an overall score within three ranks i-e mild score (1-30), moderate score (31-60) and severe score (61-70), calculated as the mean of the scores on individual items, where higher values indicate a poorer quality of cognitive functioning. Data were analyzed through SPSS V.25. Study was conducted after approval from Institutional ethical committee.

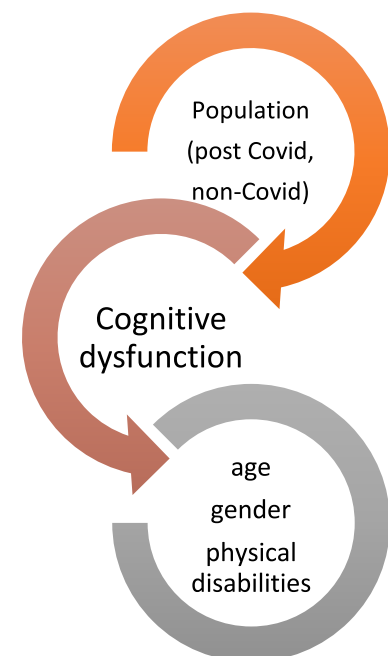
## RESULTS

Out of 600 participants approached, 500 (83.3%) responded to online questionnaire. Out of 500 participants, 230 (46%) were male and 270 (54%) were females. Participants ranged in age from 20-60 years with Mean age of  $45 \pm 22$  years. Overall age was categorized into four class interval:

20-30 years (n= 173; 34.5%)

31- 40 years (n= 174; 34.7%)

### Concept Map



# Normal P-P Plot of Regression Standardized Residual

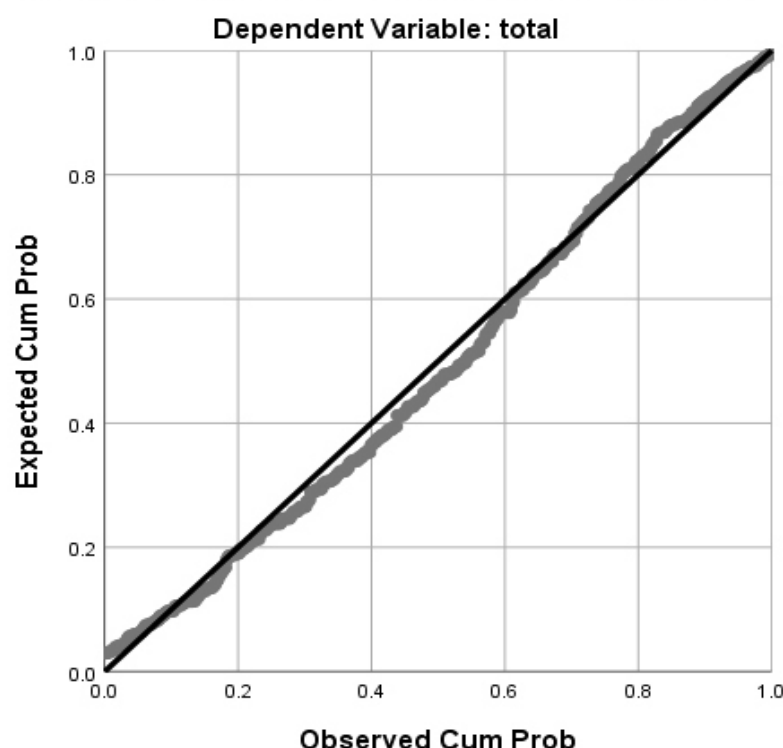


Figure 1: Normal Distribution Plot of Expected and Observed values

41-50 years (n=106; 21.2%) and

51-60 years (n=47; 9.4%).

Out of the total, 282 (56%) had suffered from Covid-19 (with lab tests positivity or clinical diagnosis) while 219 (43%) had no history of Covid-19 infection.

Hypertension (n=33; 6.6%) and Diabetes Mellitus (n=30; 6%); were the most common comorbid conditions; while 378 (75.6%) had no comorbidities (Table I).

Descriptive statistics of "Cognitive Functioning Self Report Scale" are of respondents is shown in Table II.

On the basis of standard cut off values responses were scored as mild (n=109/500; 21.8%), moderate (n=360/500; 72%) and severe (n=31/500; 6.2%). To rule out confounders, all those individuals who had some other illnesses were further excluded and only those individuals who were physically fit (n=278; 55.4%) and had no other illness except Covid-19 infection in the past were separated from the total respondents. In patients

with no comorbid conditions, mild, moderate and severe Cognitive impairment was observed in 46 (24.8%), 127 (68.6%) and 12 (6.4%) cases of post-COVID and 19 (20.4%), 73 (78.4%) and 1 (1.0%) cases of non-COVID participants (Table III).

Mean CFSS values was  $38.4 \pm 11.5$  for male (n=230) and  $42.2 \pm 12.04$  for female (n=270) participants (Table IV).

The analysis (Table V) investigates the effects of the post Covid and CFSS, indicated that the model accounted for ( $R^2 = .001$ ) of the variance. Those who were post-Covid with CFSS (Beta=0.01), while the  $p > 0.05$  (0.777). Analysis for "age" and CFSS showed (Beta=0.03) and  $p > 0.05$  (.466). Those with any physical disabilities (Beta=.024) with CFSS had  $p > 0.05$  (.617). Supplementary result is given in figure 1 with normal distribution plot.

## DISCUSSION

This study was conducted on diverse general population, age 20-60 years,

having past experience of Covid-19 pandemic & subsequent Lock downs in the province of Khyber Pakhtunkhwa. More female population (54%) participated in the online survey than male population (46%). Study included those who had suffered from Covid-19 (56%) and those who had no history of Covid-19 infection (43%). Around 24.4% of participants had some comorbid conditions, most commonly hypertension (n=33; 6.6%) and diabetes mellitus. In overall 378/500 (75.6%) participants having no comorbid conditions, mild, moderate and severe cognitive impairment was observed in 23.4%, 71.9% and 4.7% cases. Mild, moderate and severe cognitive impairment in post-COVID participants having no other comorbid conditions having were present in 24.8%, 68.6% and 6.4% cases as compared to non-COVID participants 20.4%, 78.4% and 1.0% cases respectively.

Cognitive impairment was more significantly pronounced in female than males in our study. The value of Cohens D represented medium size effect emphasizing that difference between two groups was not negligible.

In order to rule out confounders, results were further tapered, all those individuals who were physically fit n=278 (55.4%) and had no other illness were separated from the total respondents. They were further divided into post Covid-19 n=185 (66.5%) and otherwise healthy participants but had gone through stress of lock downs etc. n=93 (33.4%) group to compare cognitive impairment. Interesting findings were observed. It was observed that from post Covid-19 group n=46 (24.8%) had mild, n=127 (68.6%) moderate while n=12 (6.4%) had severe cognitive impairment while from non-Covid-19 or those with no history of Covid-19 group n=19 (20.4%) had mild, n=73 (78.4%) moderate while n=1 (1.0%) had severe cognitive impairment.

A similar single center Cohort study was conducted in Spain where Neurocognitive aspects of the 35 confirmed COVID inpatients were assessed.<sup>11</sup> Similar to our study, the participants were between age 20-60

years. Neurocognitive impairment was observed among 19 patients. However, unlike our study they didn't include the non-Covid patients in the study. Furthermore, they checked the anxiety and depression scores of the COVID patients as well. Similar to our study, their study showed lower scores in memory, attention & mental flexibility of the patients. The more severe symptoms of the COVID, the less scores of cognitive tests (global Cognitive Index).

Another similar study was conducted to assess the cognitive functioning of residents of Italy after social restrictions like lock downs.<sup>12</sup> 1215 residents participated in the Qualtrics-based online-survey. Similar to our study, they concluded that lock downs severely affected the cognitive functioning including attention, temporal orientation and executive functions especially among women. Unlike our study, their study included observation of depression, anxiety, sleep patterns, libido and general health.

A similar study was conducted in Uzbekistan on 110 patients of Corona Virus.<sup>13</sup> Unlike our study, they utilized the MMSE scale and recorded the cognitive performance of the male and female both. Similar to our study, they found that evoked cognitive potential was affected more in female than male.

One of the limitation of our study is that the questionnaire dependent on participants' self-reports, which are susceptible to under- or over-reporting remaining to social desirability. Another drawback is that the study was conducted using a cross-sectional approach, which has a limited range. Longitudinal designs might be used in future research to provide more precise cause and effect estimations.

Moreover, we must emphasize that when we discuss direct and indirect effects, we are referring to statistical probabilistic stochastic words that have no equivalency in deterministic science of cause and effect.

Irrespective of the limitations, current study demonstrated that extreme stressors and trauma backgrounds have a negative influence on executive processes, both directly and indirectly.

Furthermore, the executive functioning scale is a self-reported assessment evaluating perceived impairments in particular areas that map into possible executive function deficiencies

## CONCLUSION

Cognitive performance was moderately affected among post COVID patients as compared to non-Covid population, compromising daily executive functioning as well as other elements of mental health such as attention, memory, spatial functioning & inhibition.

## RECOMMENDATION

- i) In terms of future directions, it is advisable to conduct experimental study by using broad spectrum of neuropsychological procedures in order to determine the factor affected cognitive domains and to elucidate specific pathophysiological changes caused by COVID-19 cognitive impaired patients.
- ii) A greater number of patients should be evaluated over longer time periods to validate the duration of symptoms and the stability of cognitive performance. The clinical profile of the patient should be described and linked to the existence, severity, and duration of cognitive impairment using the COVID-19 spectrum.

## REFERENCES

1. Cucinotta D, Vanelli M. WHO declares COVID-19 a pandemic. *Acta Biomed* 2020;91(1):157-60. <https://doi.org/10.23750/abm.v91i1.9397>
2. World Health Organization (WHO). WHO Coronavirus (COVID-19) Dashboard. [Accessed on: April 01, 2021]. Available from URL: <https://covid19.who.int/>
3. Zou X, Chen K, Zou J, Han P, Hao J, Han Z. Single-cell RNA-seq data analysis on the receptor ACE2 expression reveals the potential risk of different human organs vulnerable to 2019-nCoV infection. *Front Med* 2020;14(2):185-92. <https://doi.org/10.1007/s11684-020-0754-0>

020-0754-0

4. Dehghanbanadaki H, Seif F, Vahidi Y, Razi F, Hashemi E, Khoshmirsafa M, et al. Bibliometric analysis of global scientific research on Coronavirus (COVID-19). *Med J Islam Repub Iran* 2020;34(1):354-62. <http://doi.org/10.47176/mjiri.34.51>
5. Dhakal A, Bobrin BD. Cognitive Deficits. *StatPearls* [Internet]. 2020 Jun 28.
6. Helms J, Kremer S, Merdji H, Schenck M, Severac F, Clere-Jehl R, et al. Delirium and encephalopathy in severe COVID-19: a cohort analysis of ICU patients. *Crit Care* 2020;24(1):491. <https://doi.org/10.1186/s13054-020-03200-1>
7. Pinna P, Grewal P, Hall JP, Tavarez T, Dafer RM, Garg R, et al. Neurological manifestations and COVID-19: Experiences from a tertiary care center at the Frontline. *J Neurol Sci* 2020;415:116969. <https://doi.org/10.1016/j.jns.2020.116969>
8. Ritchie K, Chan D, Watermeyer T. The cognitive consequences of the COVID-19 epidemic: collateral damage? *Brain Comm* 2020;2(2):fcaa069. <https://doi.org/10.1093/braincomms/fcaa069>
9. Bland A, Rosier J, Mehta M, Sahakian B, Robbins T, Elliot R. COVID-19 induced social isolation; implications for understanding social cognition in mental health. *Psychol Med* 2020;1-2. <https://doi.org/10.1017/s0033291720004006>
10. Annunziata MA, Muzzatti B, Giovannini L, Lucchini G. Cognitive functioning self-assessment scale (CFSS): Preliminary psychometric data. *Psychol Health Med* 2012;17(2):207-12. <https://doi.org/10.1080/13548506.2011.596552>
11. Almeria M, Cejudo JC, Sotoca J, Deus J, Krupinski J. Cognitive profile following COVID-19 infection: Clinical predictors leading to neuropsychological impairment. *Brain Behav Immun Health* 2020;9:100163. <https://doi.org/10.1016/j.bbih.2020.100163>
12. Fiorenzato E, Zabberoni S, Costa A,

Cona G. Cognitive and mental health changes and their vulnerability factors related to COVID-19 lockdown in Italy. PLoS One 2021;16(1):e0246204.

<https://doi.org/10.1371/journal.pone.0246204>

13. Urinova G, Nasirtdinova N, Nazarova J. Indicators of cognitive

function in patients with corona virus infection. Academicia 2021;11(1):241-5. <http://dx.doi.org/10.5958/2249-7137.2021.00007.0>

## AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

**NS & SA:** Concept and study design, acquisition, analysis and interpretation of data, drafting the manuscript, critical review, approval of the final version to be published

**ZAK & SG:** Acquisition of data, drafting the manuscript, approval of the final version to be published

*Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.*

## CONFLICT OF INTEREST

Authors declared no conflict of interest

## GRANT SUPPORT AND FINANCIAL DISCLOSURE

Authors declared no specific grant for this research from any funding agency in the public, commercial or non-profit sectors

## DATA SHARING STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request



This is an Open Access article distributed under the terms of the Creative Commons Attribution-Non Commercial 2.0 Generic License.

KMUJ web address: [www.kmuj.kmu.edu.pk](http://www.kmuj.kmu.edu.pk)

Email address: [kmuj@kmu.edu.pk](mailto:kmuj@kmu.edu.pk)