

## Covid 19: The Third Wave and the Development of Vaccines

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**Abstract: Objectives of the Study:** The objective of the study was to evaluate the role of vaccines for Covid 19 (Corona virus) treatment and control. **Study Design:** The study was conducted in a private hospital of Karachi situated in an upper middle class locality. This was a six months study conducted from July 19, 2021 to January 15, 2022 both days included. **Sampling Procedure and Sample:** A total 278 Covid 19 suspected patients were selected consecutively over the specified period, reporting at the OPD of the hospital were included in the study. After screening the total number of confirmed cases were 241 out of which 38 were vaccinated and 203 were non-vaccinated. **Inclusion Criteria:** Vaccinated and non-vaccinated of all suspected cases of Covid 19 of all age groups showing the primary suspected symptoms of Covid 19. **Data Analysis:** Data was analyzed by using SPSS 23 and Excel software applications. **Result:** A total of 241 patients were confirmed of suffering from Covid 19. 157 of them were completely cured after one month while 12 were completely cured after 45 days. Diagnosis of 35 patients was done at stage II and all of them were completely cured after 45 days. The values of R (0.974), R<sup>2</sup> (0.948) and adjusted R<sup>2</sup> (0.946) indicate that the independent variables support the dependent variable by 97.4%, 94.8% and 94.6% respectively. The Durbin Watson value (0.328) indicates that there is a strong positive relationship between the independent variables and dependent variable. The P / Sig value of zero indicates that the result is significant. **Conclusion:** Vaccines does play a role in reducing the incidence and severity of signs and symptoms of Covid 19 cases. The basic recommended SOPs should be followed while awareness for vaccination should also be widely spread. The new variants and mutation of virus is posing threats and uncertainty.

**Keywords:** COVID19, first wave, second wave, third wave, vaccines.

### INTRODUCTION

Covid 19 one of the most scared pandemic which created havoc around the world is causing death in millions. The recommended preventive and precautionary measures include mobilization limitations, physical boundaries, social distancing, wearing a mask, social distancing, avoidance of social gathering and not going out of home. It is still destructive and causing calamitous infections and deaths. The vulnerability of masses to the pandemic, all over the world focused the medical scientist to develop a vaccine [Moghadas, S.M. *et al.*, 2021]. SARS-CoV-2 results in COVID19 infection. Corona viruses alter and develop with passage of time. WHO (World Health Organization) stated that when virus reproduces itself, it occasionally alters somewhat, that is usual behavior of a virus. This alteration is called “mutation”. Greater than one mutation is called “variant” [W.H.O, 2021].

Some minor to moderate side effects of vaccine are being reported by patients. Adverse reaction found up till now are fever, muscular pain, headache, feeling cold, tiredness and diarrhea. However, these adverse reactions vanishes within the first few days of injection [W.H.O, 2021].

Vaccination drive with blockades like age group eligible for vaccine can eliminate the load of being

admitted to hospitals by 9 to 40 %, provided vaccination used is effective. [Coudeville, *et al.*, 2021] emphasized that easing the blockades minimized COVID 19 hospitalization by more by 30% to 39% [Coudeville, *et al.*, 2021].

Background: the First and Second Wave: Several countries experienced two wave of Covid 19 in 2020 with varying number of infections and mortalities. [Iftimie, S. *et al.*, 2021] noticed that first wave was observed to commence in spring. Subsequently the second wave arrived in later part of summer and autumn. Variation in oldness of patients and criticality of illness was observed. Victims of Corona in first wave were younger [Iftimie, S. *et al.*, 2021]. Time period of hospitalization and death ratio was less in second wave. In second wave more kids and expecting females became victim to the virus compared with first wave. The first wave is believed to commence from March to June 2020 and second wave from July to October 2020 in most parts of the world [Iftimie, S. *et al.*, 2021]. The outbreak of fast worldwide proliferation of critical and serious breathing illness was termed “Coronavirus-2 (SARS-CoV-2)”. It is considered the reason and medium for COVID 19 pandemic. The infection originated from Wuhan, China in December of

2019. The pandemic posed serious threats to the health sector and had social and economic repercussions worldwide. Panic created by the disease made countries to impose stringent lockdowns, curfews and local shutdown. Business and social activities were either ceased completely or partially [Soriano, V. et al., 2021].

### LITERATURE REVIEW

Corona was announced pandemic on 11<sup>th</sup> March 2020. It has impacted 180.7 million people worldwide. [Dawn.com, 2021] reported that it has caused above 3.9 million fatalities around the globe. In Pakistan one million people have been affected with 22,211 deaths [Dawn.com, 2021]

The Third Wave of COVID-19: The third wave of COVID 19 was deadliest. It hit and impacted most parts of the world including Pakistan. [Bukhari, M, 2021] mentioned that two third of ventilators were already in use and few hospitals had limited capacity to admit new patients as already 80% beds were filled. Vaccine was made available by December 2020 and in Pakistan vaccination was started from doctors, nurses and followed by people above 50 years of age [Bukhari, M, 2021]. In Pakistan Sinopharm, SinoVac, Cansino and locally manufactured “Pak Vac” vaccines were used in third wave. 50,000 bottles of Russian made Sputnik V reached Pakistan on 17<sup>th</sup> March 2021. Mass vaccination was possible due to help from friendly neighbor China that donated 1 million shots and further 5 million doses in April 2021 [Bukhari, M, 2021].

The third wave truly made its presence felt in India with mounting casualties and positive cases. [Khan, A, 2021] voiced that the Indian variant of Corona Virus was termed “Delta Variant” and enhanced chances of being critically ill to the extent of admitted in hospital by 2.7 times [Khan, A, 2021].

In the third wave, UK variant also rang alarm bells as the COVID was not only viral but also an intelligent pandemic that could change its shape and forms. [Khan, A, 2021]. The UK mutant was called “Alpha Variant”. The world, including Europe turned focus to mass vaccinate populations as many as possible. Governments barred entry of visitors from countries hard hit by virus like India. South Africa was also found to be epicenter of virus with 56,363 deaths and 1.65 million positive cases. It was termed “South African Variant” [Khan, A, 2021].

Development and introduction of Vaccines: To curb the deadly virus, vaccines were made rapidly. [Moghadas, S.M. et al., 2021] mentioned that harmlessness, safety and effectiveness of various vaccines developed are tested. Pfizer - BioNTech, and Moderna had 90 % efficacy against critical and symptomatic illness [Moghadas, S.M. et al., 2021]. World’s Top 10 Biggest Covid Vaccine Manufacturing Countries are as follows: China, USA, Germany, India, UK, The Netherlands, Russia, Switzerland, South Korea, Brazil, Belgium and Pakistan [McCarthy, N, 2021; TRT World, 2021].

Coverage of Vaccines in Different Countries: Around 212 countries and regions have carried out more than 2 billion shots of Covid 19 vaccines [Pettersson, H. et al., 2021]. [Pettersson, H. et al., 2021] mentioned that this progress has been made within a year of emergence of virus in Wuhan, China. A Large amount of money financed and previous experimentation made it possible for development of vaccines at a swift pace [Pettersson, H. et al., 2021]. At present approximately 42 million vaccine shots are given on a daily basis globally as of 25th June, 2021. Major countries that have bought vaccines are as follows: USA, EU (European Union), India, UK, Indonesia, Canada, Japan, Brazil, Mexico, Vietnam and Pakistan [Doucleff, M; The Express Tribune; The Express Tribune]. Efficacy was the following vaccines were found effective: BioNTech (USA, 95%, two doses ), Moderna (USA, 94.1%, two doses), Sputnik 5 (Russia, 91.6%, 2 doses), Sinovac (China, 85%, 2 doses), Sinopharm (China, 79.34%; 2 doses), Bharat Biotech (India, 78%, 2 doses), Janssen Global Services, LLC (USA, 72%, one dose), CanSino AD5-nCOV ((China, 65.7%, one dose), Convidecia (China, 65.7%, one dose), Astra Zeneca (UK, 62%, 2 doses), Novavax, (49 – 96%, 2 doses) [Jajja, S, 2021; Goodwin, M, 2021; Tramuta-Drobnis, E, 2021; Felter, C, 2021].

Major countries of people vaccinated around the world are as follows: UAE (65%), Malta (60%), Bahrain (60%), Israel (57%), Aruba (55%), Chile (51%), UK (48%), Mongolia, Iceland and Curacao (20, 21, 22, 23, 24).

Major brands of Covid 19 vaccines available up till now are: Moderna (USA), Astrazeneca (UK), Biontech (Germany), Sinovac (China), Cansino (China) [Quito, A, 2021]. Quito [Quito, A, 2021] are of the opinion that Germans and Italians avoid Astra Zeneca Vaccine because of its problematic

clinical trials and testing. People of Philippines have a perception that products of China are low in quality has adversely impacted preference for SinoVac Vaccine dose. Another reason for Philippines' rejection of SinoVac is the updated findings that it has low success rate (50 %) [Quito, A, 2021]. Americans for instance do not prefer Johnson and Johnson vaccine. Reasons are beliefs and religious values. It is believed in USA that Johnson's vaccine is manufacture with cells extracted from feticide. Hence, in USA Moderna and Pfizer are liked. Pfizer is winning the race of vaccines with 95% efficacy [Quito, A, 2021]. In Pakistan friendly neighbors Chinese Vaccine Sinopharm, SinoVac and Cansino V are preferred [Quito, A, 2021].

The People who have been affected by Covid 19 Even after Vaccination and Their Severity of Symptoms: It has been found majority of Covid 19 patients admitted in hospitals are not vaccinated. [Weise, E. et al., 2021] studied that in USA less than 5% patients admitted to hospitals are vaccinated [Weise, E. et al., 2021]. Mortality rates in America are increasingly getting link with casualties not getting COVID 19 vaccinations. [Johnson, C.K. et al., 2021] found that after vaccination mortality rates have reduced significantly in USA [Johnson, C.K. et al., 2021].

However, while vaccines have its advantages they have their adverse reactions as well. These include heart burning and burning in heart muscle or outer lining of heart [Stieber, Z, 2021]. [Villafranca, O, 2021] reported similar experience. Majority of such patients (65%) had Pfizer and Moderna vaccines. Due to the uncertainty in success rate and possible adverse reactions people are hesitant to take the Vaccine [Villafranca, O, 2021]. Interestingly, in USA it has been advised to citizens that they get themselves vaccinated with J and J vaccine. Dawn (31) wrote that it has been directed to get additional vaccination doses of Pfizer and Moderna to counter the easily transmissible Corona variant and mutation that rose from India. The health authorities ensure that getting two distinct brand vaccines is secure [Dawn, 2021]. Europe and Canada has recommended the use of two distinct vaccine jabs to curb rapid proliferation of delta variant. This development has raised question marks on efficacy of J & J vaccine to counter Indian mutation of the virus [Dawn, 2021]. WHO states that vaccines efficacy also include against the Delta variant [W.H.O, 2022].

## MATERIALS AND METHOD

The Covid 19 virus has evolved during the past almost two years and the change has become significantly different from the first ones. The changes are called mutation and a virus with one or more mutations called variants. Some of them are Delta and Omicron variants. Delta variant was classified in May 2021 while Omicron was first reported in November 2021. Vaccines available currently are effective in all of the identified variants. However, all are not equally effective or protective. Infection has been observed despite patients being vaccinated.

### Objectives of the Study

The objective of the study was to evaluate the role of vaccines for Covid 19 (Corona virus) treatment and control.

### Study Design

The study was conducted in a private hospital of Karachi situated in an upper middle class locality. The suspected cases of Covid 19 reporting to OPD of this hospital were included for onward tests and confirmation.

### Period of Study

This was a six months study conducted from July 19, 2021 to January 15, 2022 both days included.

### Sampling Procedure and Sample

A total 278 Covid 19 suspected patients were selected consecutively over the specified period. Sampling was done on the basis of cluster consecutive sampling. Booth vaccinated and non-vaccinated suspected cases of Covid 19 of both genders and all age groups reporting at the OPD of the hospital were included in the study. After screening the total number of confirmed cases were 241 out of which 38 were vaccinated and 203 were non-vaccinated.

### Inclusion Criteria

Vaccinated and non-vaccinated of all suspected cases of Covid 19 of all age groups showing the primary suspected symptoms of Covid 19.

### Exclusion criteria

Patients who did not meet the defined inclusion criteria

### Limitation of the Study

The study was limited to a private hospital of one city of Pakistan and therefore may not represent the total population of the country.

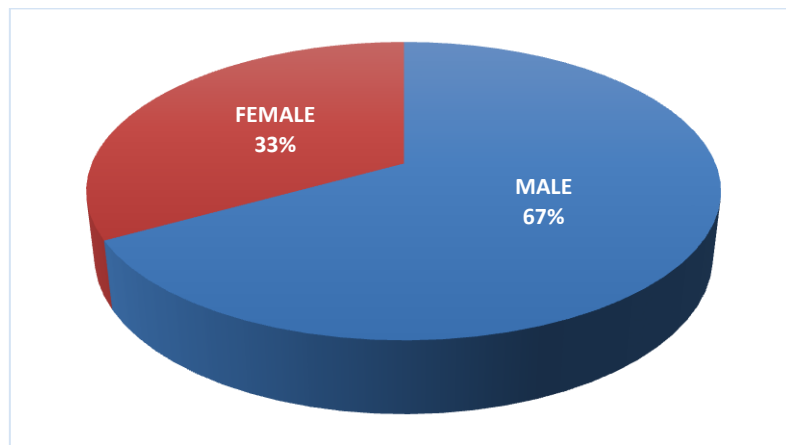
### Data Analysis

Data was analyzed by using SPSS 23 and Excel software applications.

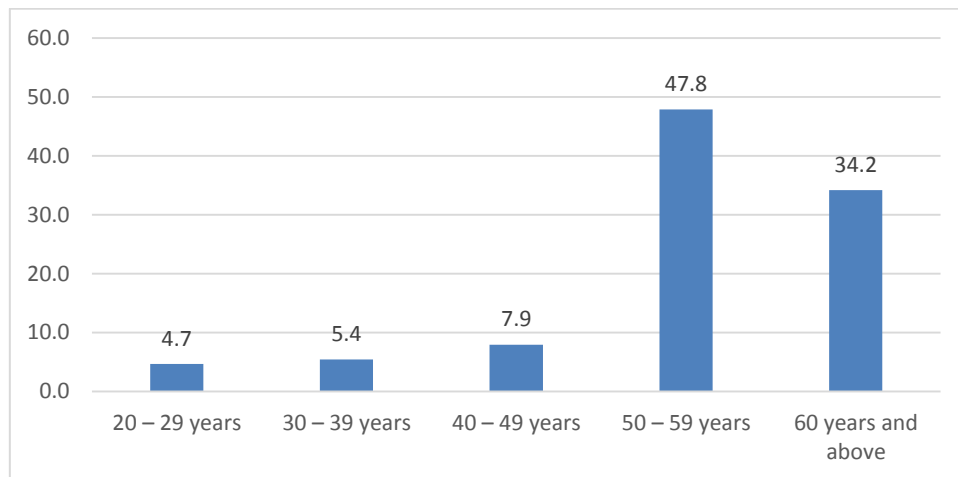
**RESULT**

The reliability of the statistics is 0.961 (Cronbach Alpha) indicates that the study is reliable to the extent of 96.1%. There were 66,9% males and 33.9% females out of 278 persons in this study (**Figure 1**). Age wise 50-59 years were 47.8% and 34.2% were of 60 years and above (**Figure 2**). Rest were having low frequency. Out of the total patients 38 (16%) were vaccinated while 203 (84%) were non-vaccinated (**Figure 3**). Major signs and symptoms were as follows: Dry cough

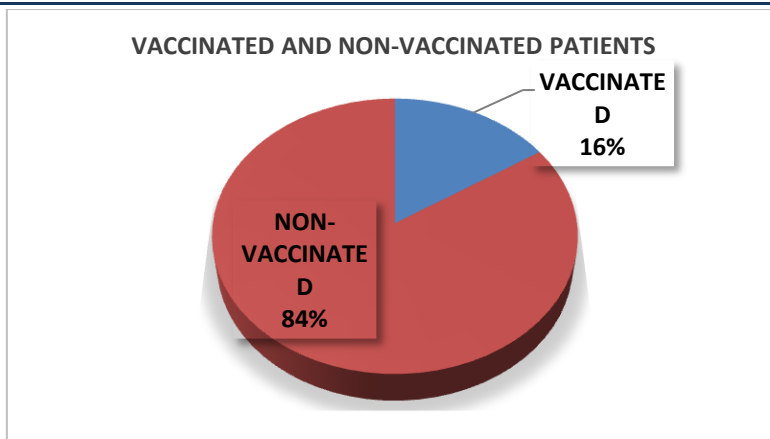
(95.32%), aches and pain (83.81%), headache (77.70%), tiredness (77.70%), loss of taste and smell (76.98%), fever (75.90%), sore throat (73.02%), shortness of breath (68.71%), skin rash (66.91%), chest pain (54.68%) and speech difficulty (54.32%). Other signs and symptoms had less than half frequency (**Table 1**). Comorbid conditions of these patients included: hypertension (58.63%), diabetes (52.52%), pneumonia / bronchitis (42.09%), cardiac diseases (23.02%), arthritic and joint diseases (20.86%) and Alzheimer disease (20.50%). Others had less frequency (**Table 2**).



**Figure-1:** Distribution of patients by gender



**Figure-2:** Distribution of patients by age



**Figure 3:** Status of Vaccination

**Table 1:** Signs and Symptoms (n=278)

Vital Signs and Symptoms	Frequency
Dry cough	265 (95.32%)
Aches and pain	233 (83.81%)
Headache	216 (77.70%)
Tiredness	216 (77.70%)
loss of taste and smell	214 (76.98%)
Fever	211 (75.90%)
Sore throat	203 (73.02%)
shortness of breath	191 (68.71%)
skin rash	186 (66.91%)
chest pain	152 (54.68%)
speech difficulty	151 (54.32%)
difficulty in movement	137 (49.28%)
Conjunctivitis: 127	97 (34.89%)
Diarrhea	74 (26.62%)
Discoloration of fingers or toes	37 (13.31%)

**Table 2:** Comorbidity (n=278)

Hypertension	163 (58.63%)
Diabetes	146 (52.52%)
Pneumonia/bronchitis)	117 (42.09%)
Cardiac Disease	64 (23.02%)
Arthritic and joint diseases	58 (20.86%)
Alzheimer disease	57 (20.50%)
Cancer	43 (15.47%)
Psychiatric illnesses e. g. depression, mania	21 (7.55)

The result of lab tests were as follows: Rapid Antigen Test (positive 86.7%); Covid PCR Test (positive 68.7%); LDH More than 280U/L (Not normal) (66.9%), Covid antibodies Test (positive 75.2%); PCT Test moderate group (58.3%), severe group (36%) and critical group (5.8%); Chest X ray: Ill defined consolidation in lower lobes (11.5%); ARDS Pan lobar pattern of lung involvement (74.1%); HRCT Test: Sub-pleural consolidation (24.1%), Consolidation with air-

bronchogram (37.8%), Displayed reticulations (22.3%), Isolated ground glass appearances (13.7%) and Pleural effusion (2.2%); Inflammatory markers Ferritin Test: males outside normal range (64%), female outside normal range (9.4%); CRP: 10 - 50mg/L (Not normal) (63.7%), More than 50mg/L (Not normal)(9%); D Dimers: 0.5 -2.0 ug/ml (Covid 19 Positive) (63.3%), More than 2.0 ug/ml (Covid 19 Positive) (23.4%) (**Table 3**).



**Table 3:** Laboratory Tests/Investigations

RAPID ANTIGEN TEST		LDH	
	Frequency (%)		Frequency (%)
Positive	241 (86.7%)	140-280 U/L (Normal)	92 (33.1%)
Negative	37 (13.3%)	More than 280U/L (Not normal)	186 (66.9%)
Total	278 (100%)	Total	278 (100.0%)
COVID PCR TEST		COVID ANTIBODIES TEST	
Positive	191 (68.7%)	Positive	209 (75.2%)
False positive	80 (28.8%)	Negative	37 (13.3%)
Negative	7 (2.5%)	Equivocal	32 (11.5%)
Total	278 (100%)	Total	278 (100%)
PCT TEST		CHEST X RAY	
0.05 or less ng/mL in the moderate group	162 (58.3%)	Ill defined consolidation in lower lobes	32 (11.5%)
0.06 - 0.29 ng/mL in the severe group	100 (36%)	ARDS Pan lobar pattern of lung involvement	206 (74.1%)
0.30 - 0.50 ng/mL in the critical group	16 (5.8%)	Normal	40 (14.4%)
Total	278 (100%)	Total	278 (100%)
HRCT TEST		INFLAMMATORY MARKERS: FERRITIN TEST	
Sub-pleural consolidation	67 (24.1%)	FERRITIN - MALES Within normal range	41 (14.7%)
Consolidation with air-bronchogram	105 (37.8%)	FERRITIN - MALES Outside normal range	178 (64%)
Displayed reticulations	62 (22.3%)	FERRITIN - FEMALES Within normal	33 (11.9%)
Isolated ground glass appearances	38 (13.7%)	FERRITIN- FEMALES outside normal	26 (9.4%)
Pleural effusion	6 (2.2%)	Total	278 (100%)
Total	278 (100%)		
CRP		D DIMERS	
0-10mg/L (Normal)	76 (27.3%)	Below 0.5 (Normal) (Covid 19 Negative)	37 (13.3%)
10 - 50mg/L (Not normal)	177 (63.7%)	0.5 -2.0 ug/ml (Covid 19 Positive)	176 (63.3%)
More than 50mg/L (Not normal)	25 (9%)	More than 2.0 ug/ml (Covid 19 Positive)	65 (23.4%)
Total	278 (100%)	Total	278 (100%)

Diagnosis of 169 patients was confirmed at stage I. 157 of them were completely cured after one month while 12 were completely cured after 45 days. Diagnosis of 35 patients was done at stage II and all of them were completely cured after 45

days. At stage II 36 patients could not be confirmed while one confirmed case died within the treatment period. The diagnosis of 37 patients could not be confirmed since their lab test results did not confirm Covid 19 (**Table 4**).

**Table 4:** Diagnosis Treatment Outcome Cross tabulation

DIAGNOSIS	Treatment Outcome				Total	
	Count	Complete cure after one month	Complete cure after 45 days	Death		Unconfirmed (clear) cases
Confirmed at Stage I	Count	157	12	0	0	169
	% within DIAGNOSIS	92.9%	7.1%	0.0%	0.0%	100.0%
	% within TREATMENT	100.0%	25.5%	0.0%	0.0%	60.8%

		OUTCOME				
Confirmed at stage II	Count	0	35	1	36	72
	% within DIAGNOSIS	0.0%	48.6%	1.4%	50.0%	100.0%
	% within TREATMENT OUTCOME	0.0%	74.5%	100.0%	49.3%	25.9%
Not confirmed / clear	Count	0	0	0	37	37
	% within DIAGNOSIS	0.0%	0.0%	0.0%	100.0%	100.0%
	% within TREATMENT OUTCOME	0.0%	0.0%	0.0%	50.7%	13.3%

The values of R (0.974), R2 (0.948) and adjusted R2 (0.946) indicate that the independent variables support the dependent variable by 97.4%, 94.8% and 94.6% respectively. The Durbin Watson value

(0.328) indicates that there is a strong positive relationship between the independent variables and dependent variable. The P / Sig value of zero indicates that the result is significant (**Table 5**).

**Table 5: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson	Sig / P Value
					R Square Change	F Change	df1	df2	Sig. F Change		
1	.974 <sup>a</sup>	0.948	0.946	0.16729	0.948	485.416	10	267	0.000	0.328	0
a. Predictors: (Constant), D DIMERS , RAPID ANTIGEN TEST, LDH, PCT TEST, COVID PCR TEST, INFLAMMATORY MARKERS: FERRITIN TEST, CRP, CHEST X RAY, HRCT TEST, COVID ANTIBODIES TEST											
b. Dependent Variable: DIAGNOSIS											

**DISCUSSION**

Out of the total cases new cases were 6.8 percent worldwide and cumulative deaths were 1.20 % till May 24, 2022. The third week of May, 2022 the death figure was 0.25 % worldwide while for Pakistan it was 0.6 %. Total people infected with Covid 19 was 6.76 % of the total world population since the outbreak. In Pakistan it was 0.7 % of country’s total population of 220 million (WHO). Our study was not targeted to estimate the incidence out of total population. With the emergence of Delta variant the death toll of seven day average in August 2021 was 350 (per day) in USA and started to rise again. In USA 66% population were vaccinated. As high as 93 percent of those who were not vaccinated in some states suffered from Delta variant. In southern USA the vaccination was as low as 30% (Belmonte, 2021). According to the author these deaths were largely preventable. This was followed by Omicron subvariant (Powell, 2022). However, this variant was noted at insignificant in Pakistan. The latest data May 22, 2022 on vaccine shows that worldwide 60.4% of the total population have been

fully vaccinated. In Pakistan 55.7% of the entire populations have been fully vaccinated; total doses given were 249 million, fully vaccinated 123 million (Google.com). In our study out of the total patients 16% were vaccinated while 84% were non-vaccinated.

Following of SOPs still needs to be given preference despite availability of vaccines, since even vaccinated can get infected, although in very less number. Pakistan cannot afford any kind of negligence in vaccination. Being a developing country it needs to take every measure to curb the virus. Third wave was lethal in Pakistan as it was in almost around the world. Getting the entire population vaccinated is a real challenge for Pakistan. Furthermore, the myths, rumors and negative news prevailing among masses regarding vaccines needs to be clarified to motivate people to get vaccinated and control the virus spread thus minimizing infection. Social distancing, wearing a mask and avoiding social gatherings should be followed despite the fact that people are vaccinated, since we yet do not know the efficacy

of vaccine for a prolonged period. But the virus diminished and rose again in form of first, second and what we are witnessing right now a third wave. Some consider it seasonal virus and mass vaccination drives were rolled out to fight the disease. Even after vaccination people got infected with virus but it is believed that death rates and severity of illness diminished substantially.

## CONCLUSION

The unexpected and unforeseen emergence of Corona virus disease shook the whole globe through its ruthlessness devastation. It put the concerned authorities under tremendous challenge as the virus was unpredictable; its characteristics were not fully known. Health sector was put under tremendous strain and vaccines were developed within a record period of time. The basic recommended SOPs should be followed while awareness for vaccination should also be widely spread.

Research work done on vaccines is commendable but new variants and mutation of virus is posing threats and uncertainty. It was found that vaccines does play a role in reducing the incidence and severity of signs and symptoms of Covid 19 cases. Factors like reoccurrence of COVID in patients even after recovering, long term side effects, consistency of virus, the aftermaths of virus apart from breathlessness like heart issues etc. were found to be life threatening. The effectiveness of vaccines on a long term basis is still under observation. Benefits of getting vaccinated against drawbacks needs to be considered.

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**Source of support:** Nil;

**Conflict of interest:** Nil.

**Cite this article as:**

Elahi, G., Elahi, I. and Haq, I.U. "Covid 19: The Third Wave and the Development of Vaccines." *Sarcouncil Journal of Medical Series* 1.4 (2022): pp 1-10