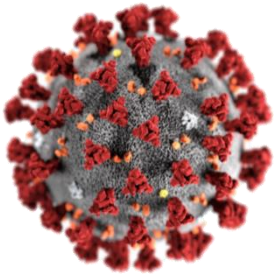


RMU & COVID-19

RAWALPINDI MEDICAL UNIVERSITY
Department of Infectious Diseases

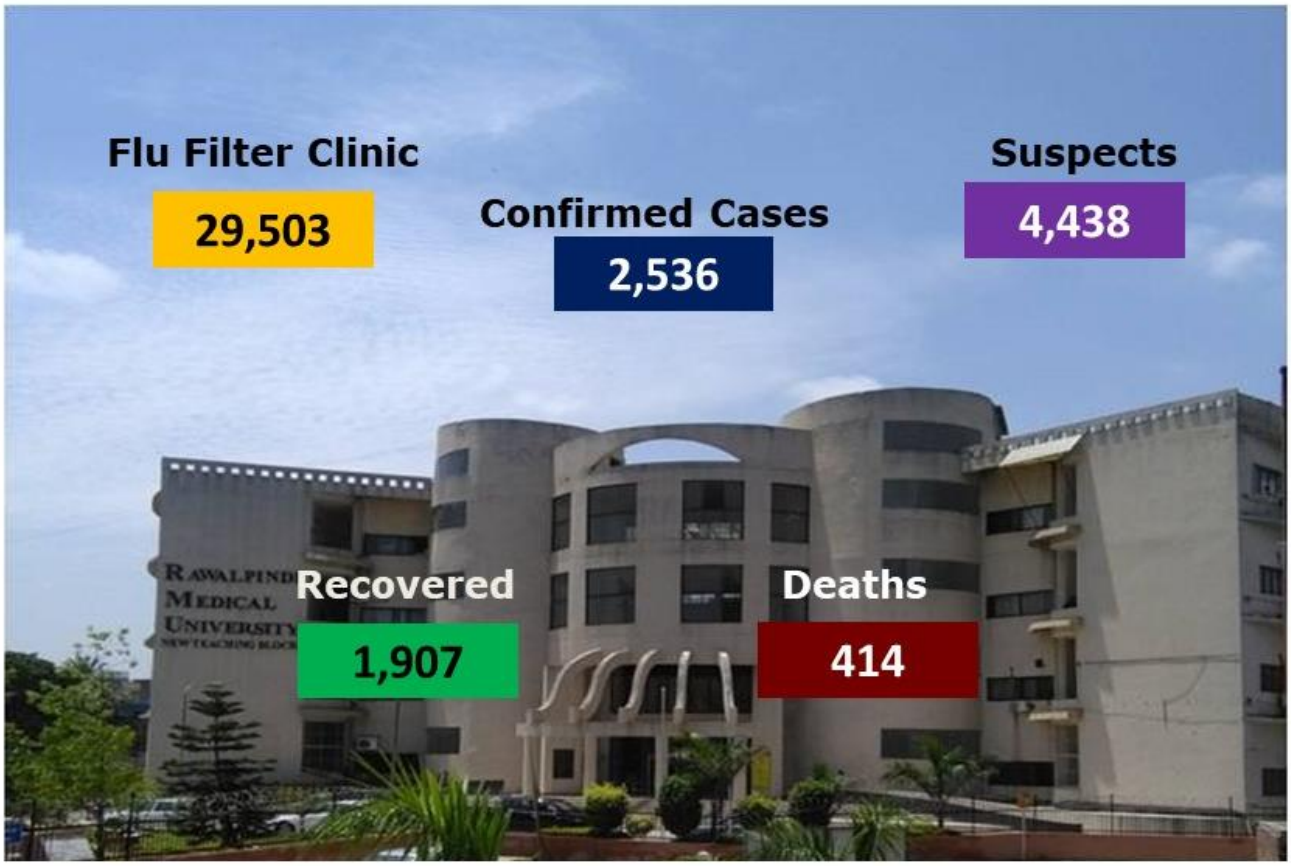
وَمَنْ اَحْيَاهَا فَكَاَنَّمَآ اَحْيَا النَّاسَ جَمِيْعًا ﴿٣٢﴾

اور جس نے ایک انسان کی جان بچائی،
گویا اس نے پوری انسانیت کی جان بچائی

And whoever saves one,
It is as if he had saved mankind entirely.

MISSION STATEMENT

“Enter to Learn; Leave to Serve.”



Rawalpindi Medical University

Message from the Vice Chancellor

Prof. Dr Muhammad Umar (Sitara-e-Imtiaz)

MBBS, MCPS, FCPS, FRCP (Glasgow)
FRCP (London), FACG (USA), AGAF(USA)

With the world engulfed in a pandemic and panic everywhere, we live in unprecedented times. It was thought impossible that a pandemic of this magnitude would ever occur, but unfortunately, we faced the worst. In these times of crisis, sacrifices were made by healthcare workers and researchers worldwide.

This book is a tribute to all of those unnamed and unsung heroes who risked their lives day and night, regardless of their personal safety. It is an honor to be a part of this fraternity and I am proud of the hard work and determination of all healthcare workers. May Allah have mercy on us all and end this pandemic soon.

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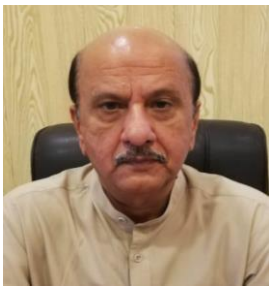

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Dr Rafique Ahmed
MS BBH

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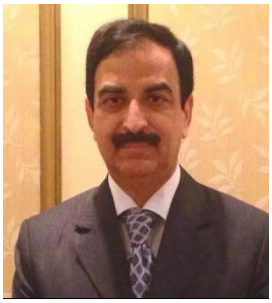
MS DHQ

Dr Khalid Randhawa
MS RIU&T

Dr Zahid Minhas
RMU

Clinical Team



Prof Fazl Ur Rehman

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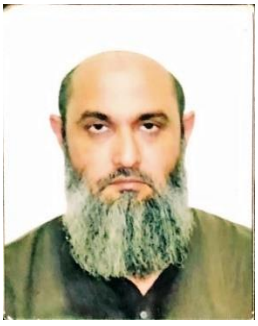
Dr Saima Ambreen



Dr Abrar Akbar

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Dr Qaiser Aziz

Dr Sara Mujtaba

Dr Imran Arshad

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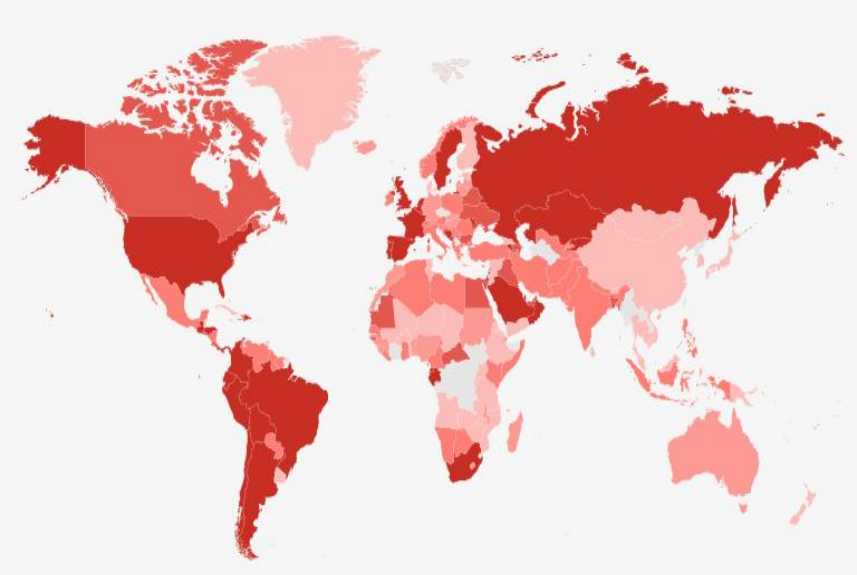
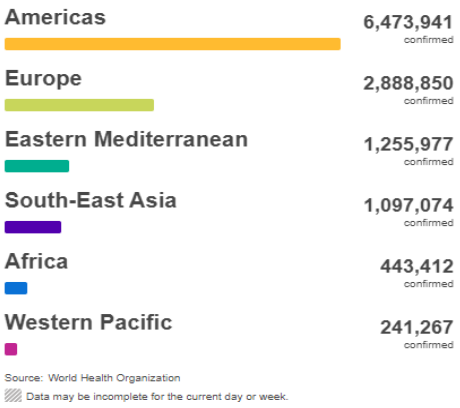
GLOBAL PROSPECTIVE

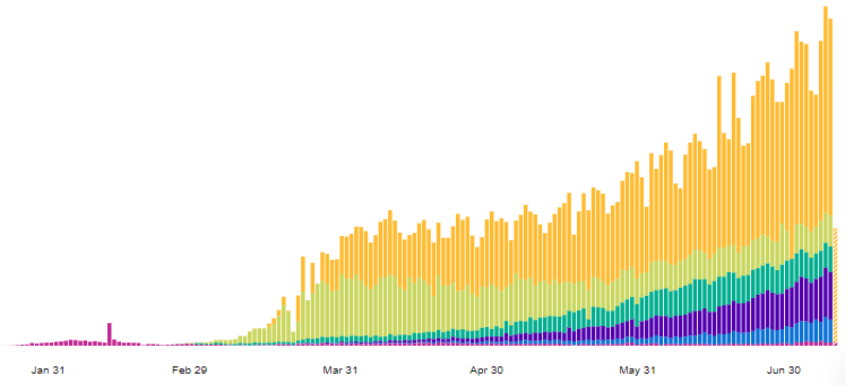
COVID-19 has been ravaging the world, since the first reported case in Wuhan, China on 17/11/2019. Since then, more than 16 million cases have been ported worldwide, with over 650,000 deaths worldwide. Currently more than 10 million cases have recovered.



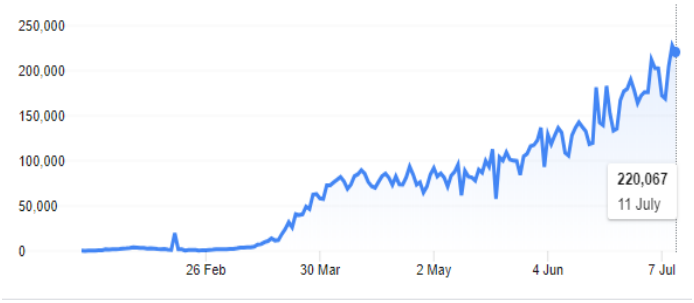
COVID-19 Worldwide Impact



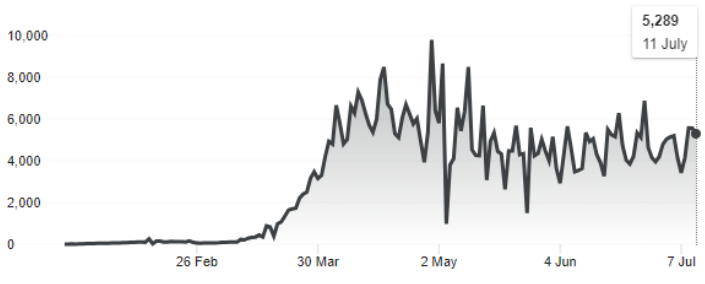
Regional Statistics



Daily New Cases, Region wise



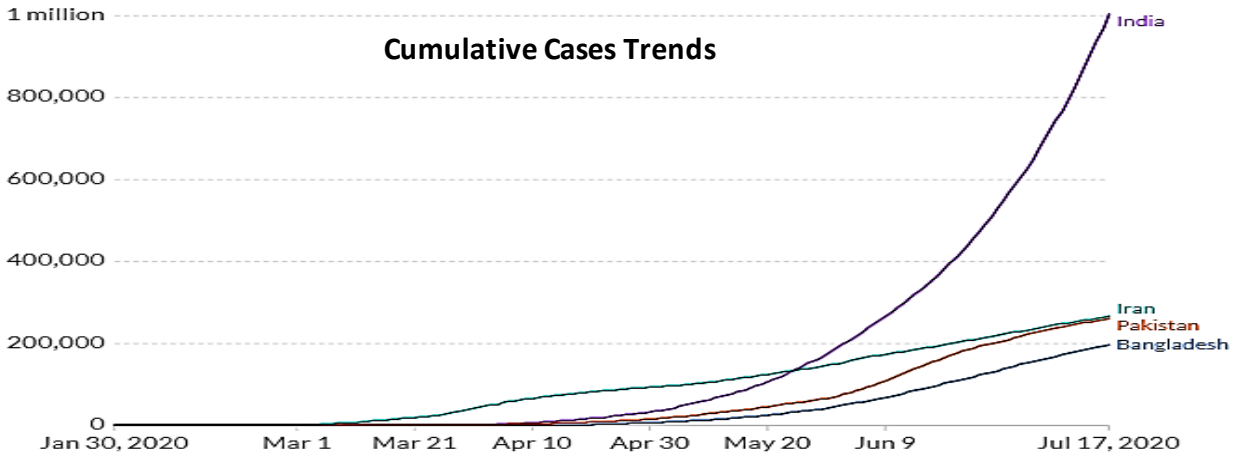
Daily New Cases



Daily Deaths

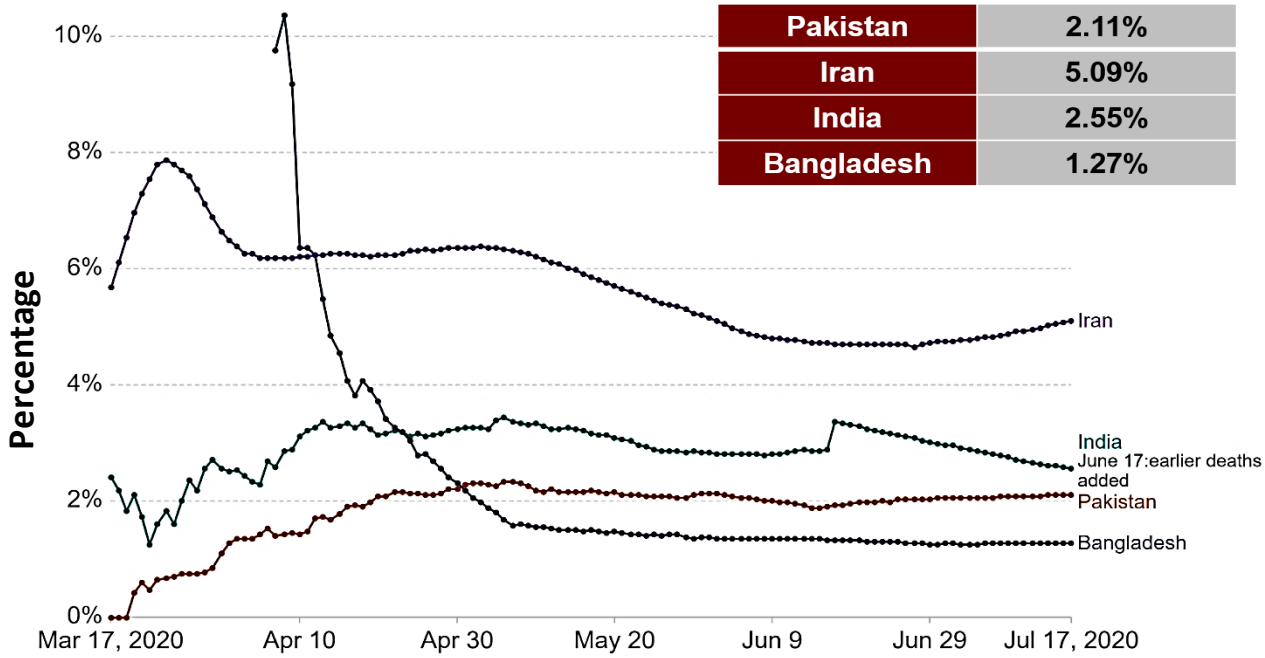
REGIONAL PROSPECTIVE

Region	Cases	Deaths
Pakistan	259,999	5,475
India	1,008,480	25,664
Bangladesh	199,357	2,547
Iran	269,440	13,791

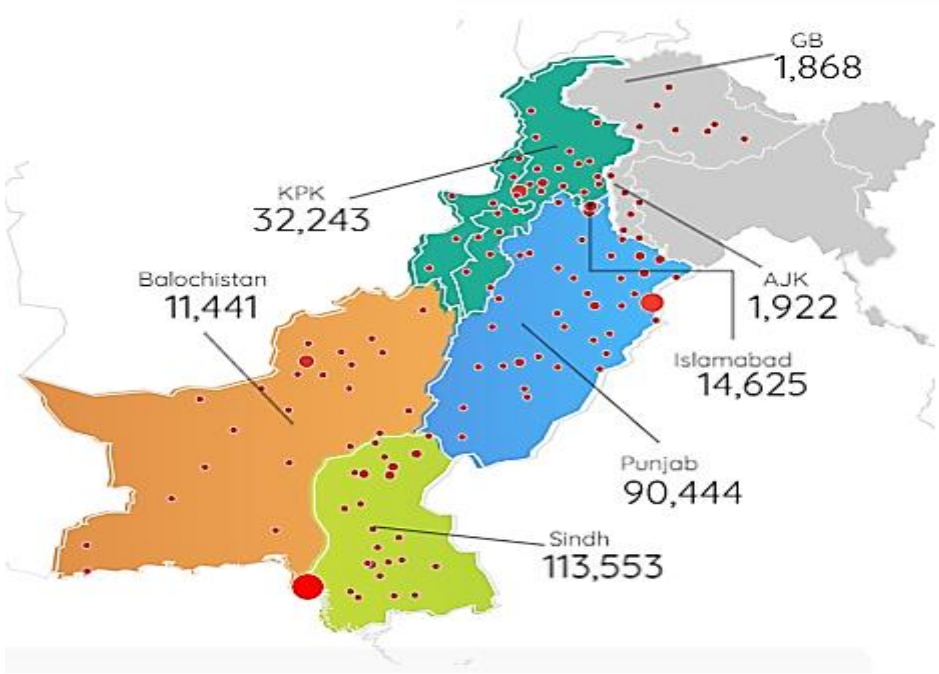


Case Fatality Rate

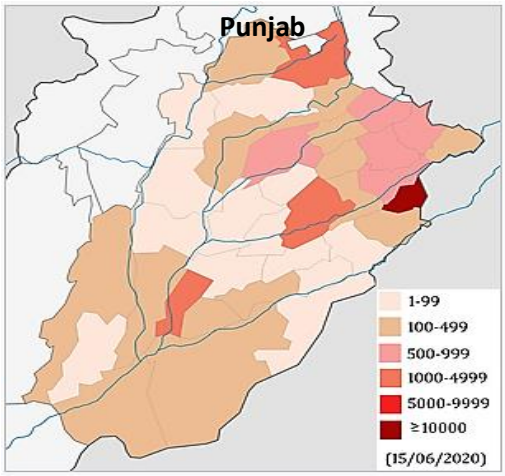
Pakistan	2.11%
Iran	5.09%
India	2.55%
Bangladesh	1.27%

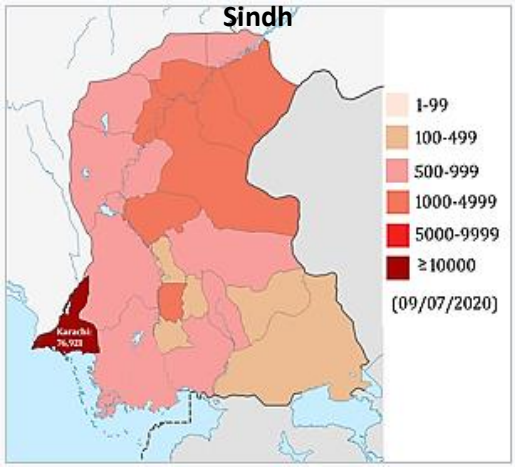


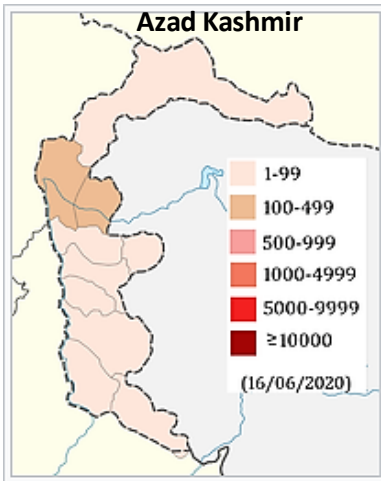
NATIONAL TRENDS

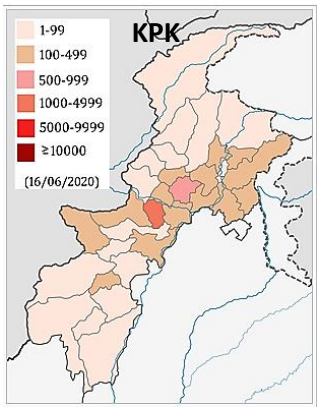


Nationwide Impact



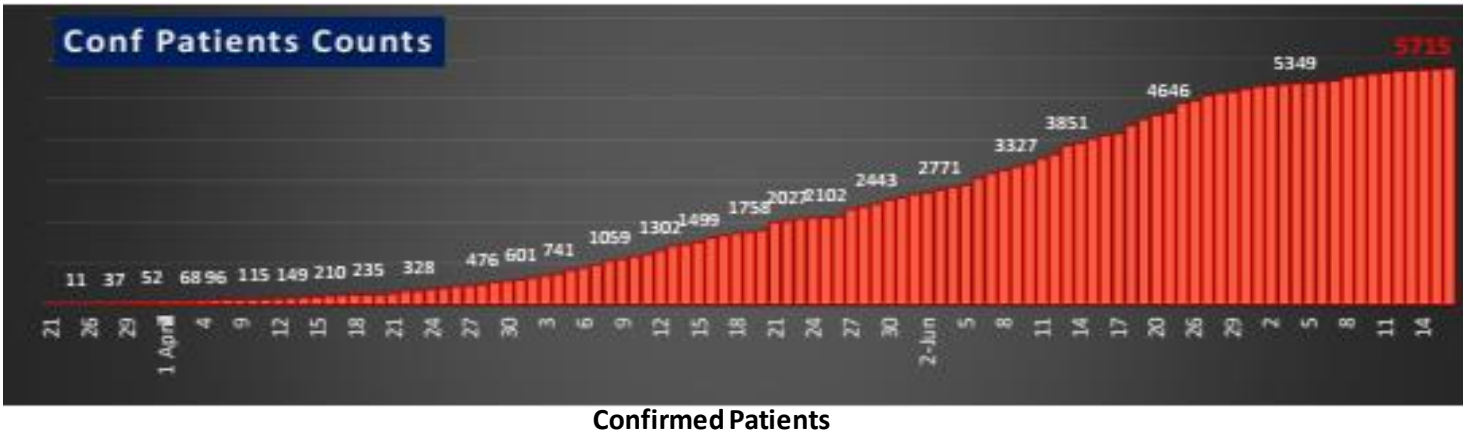






RAWALPINDI DISTRICT PROSPECTIVE

Total Confirmed Cases	Rawalpindi Cases	Cases in 24 Hour	Total Deaths 339		Deaths in 24 Hour	Total Recovered	Recovered in 24 Hour
			RWP	Other			
6324	5715	18	272	67	1	5059	0



Confirmed Patients

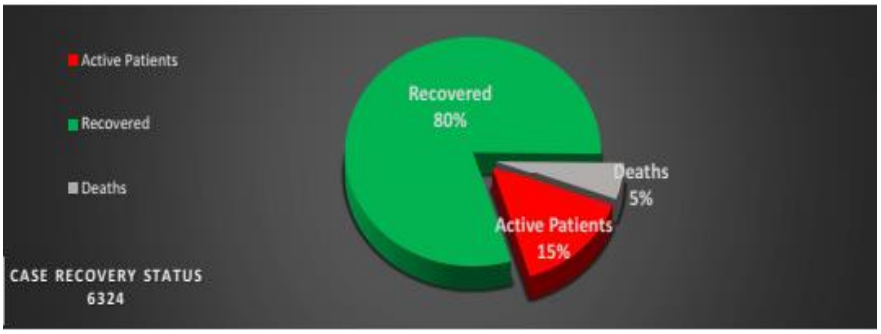
SITUATION IN NUMBERS

Cases in Pakistan 257,914

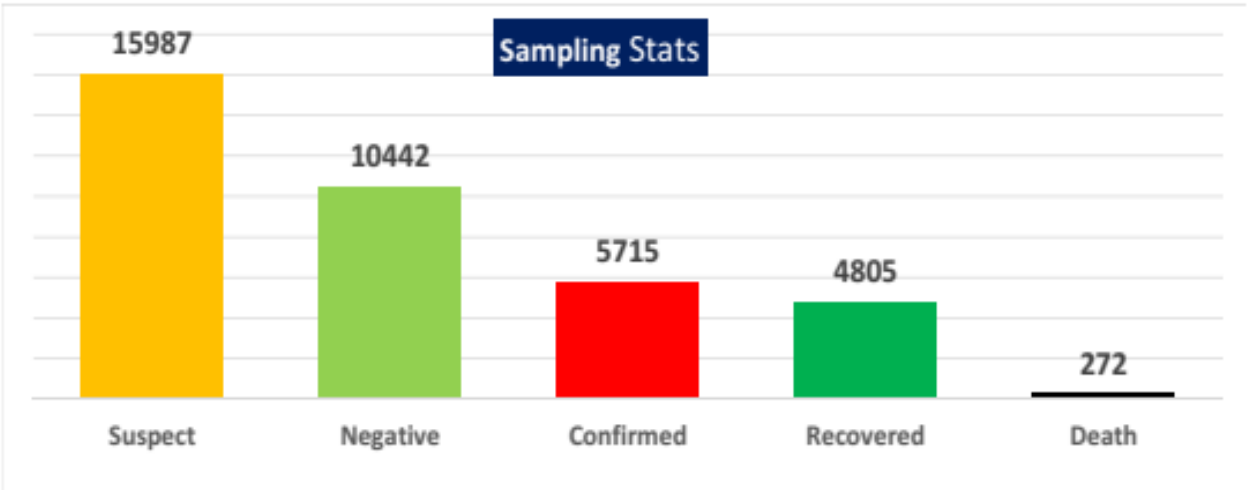
CASES IN RAWALPINDI

Total Suspected	15987	Negative	10442
Result Awaited	213	Confirmed	5715
Recovered	4805	Deaths	272

COVID-19 Worldwide Impact



Patient Statistics



INTRODUCTION

After an initial outbreak of COVID-19 in Wuhan, China, the disease spread to nearby countries in the east, making the first epicenter. The disease then made its way to Europe and Iran, soon afterwards, thus putting Pakistan on high alert.

The disease entered Pakistan on 26 Feb 2020, through Iran, in the guise of a student, who was detected in Karachi. Within the next 20 days, cases were reported throughout Pakistan, despite attempts to contain the virus.

The first case in Rawalpindi was reported on the 24th of March 2020, when a student returning from Dubai tested positive at Benazir Bhutto Hospital, marking the start of the pandemic. Since then, nearly 6,000 cases have been reported in the region, with the pandemic still ongoing but the peak having passed Pakistan.

It was initially decided that Benazir Bhutto Hospital and Rawalpindi Institute of Urology would be major Corona Centers, with Benazir Bhutto Hospital hosting the first Flu Filter Clinic. Holy Family Hospital and District Headquarters Hospital initially played a supporting role while continuing their normal functioning. However, as time passed, the number of patients increased and they too have been playing an equal role in management.

Along with the hospitals, 2 field hospitals were setup, one in the Sports Complex and the other at Red Crescent hospital. While symptomatic and critical patients are kept in the hospital, mild cases are kept in the field hospitals or were sent for home isolation, which also lessens the psychological impact of the disease.

RIU&T

240 Beds

BBH

196 Beds

HFH

200 Beds

DHQ

14 Beds

SCFH

120 Beds

RCH

120 Beds

PREPARING FOR THE PANDEMIC

The impact of COVID-19 on the population was no less than terrifying, with the disease spreading like wildfire throughout the world and the death toll rising, with no knowledge of this novel disease, it was essential to try and get a head start. Establishing the framework of management was no easy task and involved thousands of hours of research to ensure no minor detail was missed. Seeing how rapidly the situation was changing and the lack of definitive guidelines, RMU had to rely on its experience in dealing with epidemics and leadership involved before.

The situation was closely monitored and before long, it was understood that the disease would make its way into Pakistan and we could only delay the inevitable. Since December, nearly 3 months before the disease reached Pakistan, preparations were already in place. The ideal location for the flu filter clinics had to be chosen and the precautions to be taken had to be decided, patient flow had to be regulated and most of all, the prime objective was to minimize exposure and enable functioning to be as smooth as a well-oiled machine.

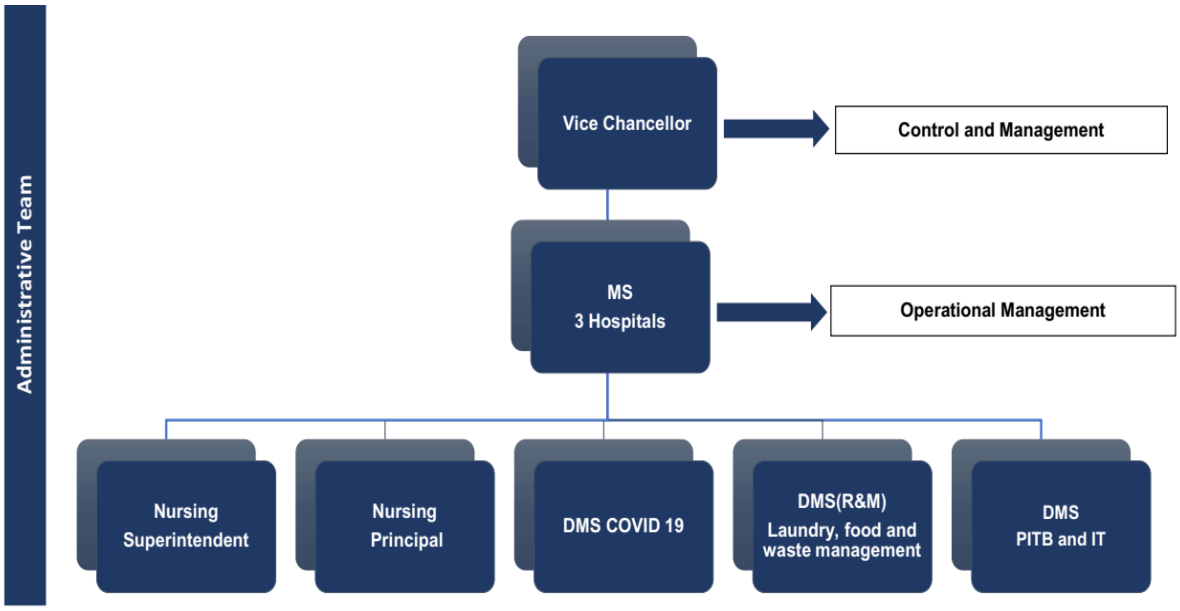
In order to make all of this possible, the worthy Vice Chancellor, along with his core team worked day and night to draw up plans and flowcharts on patient management, decided contingency plans and give out rapid guidelines. Not only this but educating healthcare workers on the fast-approaching danger was another task on its own. Each and every department was educated on what COVID-19 was, how to manage it and the precautions which needed to be taken. The provincial government also lent its support and regularly visited to ensure the availability of all which was required.

Chief Minister Visit to RIU&T

Advisor to Chief Minister's Visit to Department of Infectious Diseases

CHAIN OF COMMAND ORGANOGRAM, ADMINISTRATIVE/CLINICAL

In order to get organized, it was essential to designate a hierarchy to ensure smooth running of the organization. To ensure so, the organization was divided into 2 teams, an administrative team, led by the Vice Chancellor, Rawalpindi Medical University and a clinical team, led by the Dean of Medicine and Head of Infectious Diseases.



COORDINATION AND LINKAGES:

During these times of crisis, the University was working in close coordination with several major government entities. These entities provided support in fulfilling the deficiencies and acquiring better tools to manage COVID-19 patients. The district government, 111 Brigade, X Corps, NDMA all played an essential role in providing protective equipment for the better management of patients. Regular meetings were held with these identities to ensure the smooth running of all facilities and addressing any shortcomings or issues that may have been faced by the University

Meeting with Commissioner Regarding Current Situation

NDMA Officials visiting RMU

ADMINISTRATIVE MEETINGS

Ensuring that the clinical teams and the administrative teams were on the same page was nothing short of essential. Coordination between the hospital teams was the key to dealing with this epidemic. For this very purpose, regular meetings were held with the administrative and clinical teams. These meetings were held even twice a day to make sure no stone was left unturned in ensuring the best possible patient care. The Vice Chancellor worked closely with the MS of all the hospitals and ensured the availability of all possible resources.

All MS meeting with VC

VC RMU meeting with BBH team

ESTABLISHMENT OF A NEW CORONA HOSPITAL AT RIU&T

Rawalpindi Institute of Urology and Transplant was built from ground up under the guidance of the worthy Vice Chancellor, who along with the team from the department of Infectious Diseases, visited the site every day and identified areas in the hospital to serve different purposes. The Vice Chancellor along with the team from the Department of Infectious Diseases, themselves put up signs, posters and markings in the hospital. The hospital was visited multiple times at different hours of the day to ensure all facilities were available for the patients and working was streamlined. The hospital has been designated as the Corona Hospital and currently has the capacity to hold around 300 patients, with potential for expansion. Many challenges were faced during the setup of this hospital, but with on the go fixes, these were able to be overcome.

Health Minister Prof. Yasmeen Rashid visiting RIU&T

Railway Minister Sheikh Rasheed Ahmed visiting RIU&T

Health Secretary Nabeel Awan visiting RIU&T

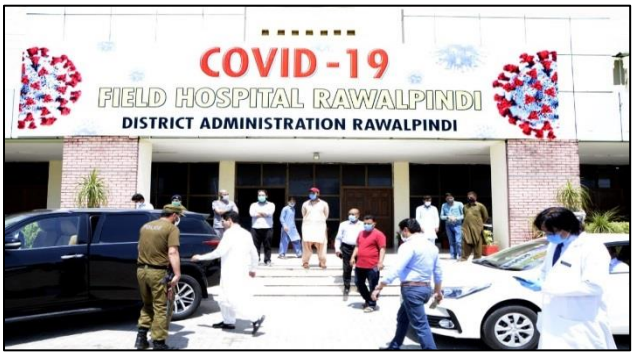
FIELD HOSPITALS

With the turnout expected to be overwhelming and the existing facilities catering to general patients, along with COVID-19 patients, the establishment of field hospitals seemed necessary to lessen the burden on the tertiary care hospitals. With the initial surge consisting of mostly stable patients, it was found suitable to take care of them at a dedicated facility, thus sparing them the psychological burden of being around sick patients.

For this purpose, two field hospitals were established and placed under the management of Rawalpindi Medical University. Each facility with equipped with 120 beds and a dedicated staff to monitor them 24 hours.

SPORTS COMPLEX FIELD HOSPITAL:

The sports complex field hospital was the first to be established in Rawalpindi. Due to its close proximity to RIU&T, it was chosen to cater to patients from RIU&T. The field hospital had a capacity of 120 patients, which could be increased, depending on the situation being faced.



Sports Complex Field Hospital

RED CRESCENT FIELD HOSPITAL:

The management of Rawalpindi Medical University and Red Crescent Hospital, had previously worked together before during the Dengue Epidemic of 2019, when patients were shifted to lessen the burden on Holy Family Hospital, which was nearing full capacity.

This year, once more, in a time of need, Red Crescent Hospital was declared a corona care center. It is currently equipped with 120 beds, out which 16 are oxygen beds and 04 are ventilator beds.

Red Crescent Hospital

QUARANTINE FACILITIES

The nature of the disease required the separation of individuals who may have been exposed from the rest of the population, until a time when it could be absolutely determined that the individual would not develop the disease, in a process called quarantine. This is extremely essential to contain the disease, as breaking the transmission chain is key in stopping the spread of infection. Travelers, arriving from abroad were quarantined at these facilities for 14 days at a time, where they were provided all basic necessities, including meals. For this purpose, 2 separate 1000 bedded facilities were allocated in 2 universities. These facilities worked in liaison with RMU and Allied Hospitals and in close coordination with the district authorities.

During the pandemic, these facilities catered to over 2000 individuals arriving from all over the world.

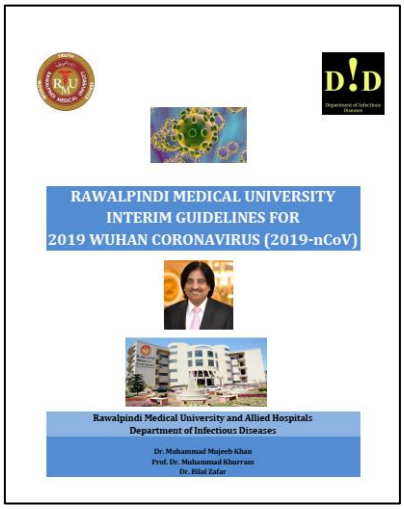
- **Fatima Jinnah Women University, Rawalpindi**
- **University of Arid Agriculture, Rawalpindi.**

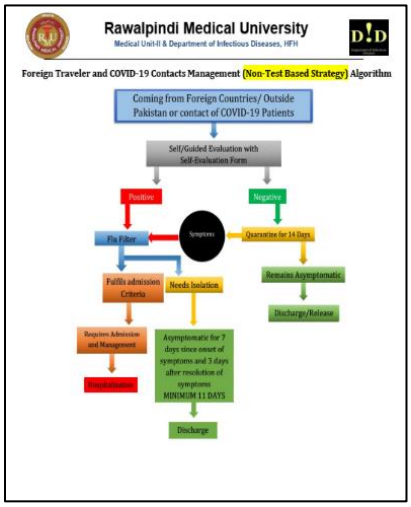
Fatima Jinnah Women University

University of Arid Agriculture

Development of Rapid Guidelines for management of COVID-19

Before the pandemic hit Pakistan, the Department of Infectious Diseases released rapid guidelines, which based on guidelines issued by the WHO, CDC and various countries dealing with the pandemic at that time. The department also made flowcharts and treatment guidelines to further aid in management. Along with the guidelines, Self-evaluation forms, OPD forms and Registrations were dispersed throughout the hospitals to provide further guidance.





INITIAL BEDS DEDICATED FOR COVID-19

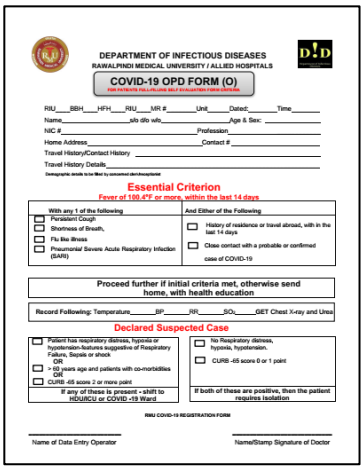
Along with Rawalpindi Institute of Urology, facilities were set aside for COVID-19 in the 3 Allied hospitals i.e. Benazir Bhutto Hospital, Holy Family Hospital and District Headquarters Hospital. As BBH and RIU&T were dedicated Corona Hospitals, a larger portion of facilities were dedicated for COVID-19 patients and a smaller portion was initially dedicated from HFH and DHQ, but with room for expansion. An initial break down is presented below

Hospital	RIUT	BBH	HFH	Total
Isolation Beds	00	10	20	30
General Beds	50	12	06	68
Ventilators	20	08	08	36
Oxygen Beds	00	15	15	30
Total	**70**	**45**	**49**	**164**

Initial Bed Distribution

Flu Filter Clinics

Understanding the danger and contagiousness of the disease and the fact that the Allied Hospitals are the major hospitals of the region, setting up dedicated Flu Filter Clinics, away from the rest of the patients was of utmost important to prevent further spread and contamination. The first Flu Filter Clinic was setup in BBH, within the psychology department, which was located a point away from the main hospital building and had a separate entrance. This facility has received the bulk of the patient and its streamlined design allows smooth functioning. In the same way, a dedicated flu filter clinic had been setup at HFH and DHQ, which continue to filter patients 24 hours a day. The Flu Filter Clinic is usually the first point of contact with the patient and the OPD form is filled at this point. The forms are shown below:



DEPARTMENT OF INFECTIOUS DISEASES
RAWALPINDI MEDICAL UNIVERSITY / ALLIED HOSPITALS

COVID-19 OPD FORM (O)

Essential Criterion
Fever of 100.4°F or more, within the last 14 days

With any 1 of the following	And Either of the Following
Persistent Cough Shortness of Breath, Flu like illness Pneumonia/ Severe Acute Respiratory Infection (SARI)	History of residence or travel abroad, with in the last 14 days Close contact with a probable or confirmed case of COVID-19

Proceed further if initial criteria met, otherwise send home, with health education

Record Following: Temperature_____BP_____RR_____SO2_____GET Chest X-ray and Urea

Declared Suspected Case

Patient has respiratory distress, hypoxia or hypotension-features suggestive of Respiratory Failure, Sepsis or shock OR > 60 years age and patients with co-morbidities OR CURB -65 score 2 or more point	No Respiratory distress, hypoxia, hypotension. CURB -65 score 0 or 1 point
If any of these is present - shift to HDU/ICU or COVID -19 Ward	If both of these are positive, then the patient requires isolation

RIU COVID-19 REGISTRATION FORM

Name of Data Entry Operator | Name/Stamp Signature of Doctor

DEPARTMENT OF INFECTIOUS DISEASES
RAWALPINDI MEDICAL UNIVERSITY / ALLIED HOSPITALS

HFH | BBH | DHQ | RIU

COVID-19 REGISTRATION FORM (R)

Essential Criterion
Fever of 100.4°F or more, within the last 14 days

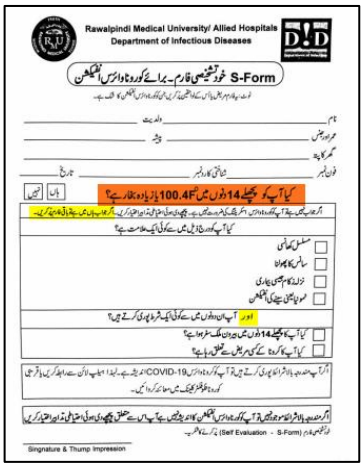
With any 1 of the following	And Either of the Following
Persistent Cough Shortness of Breath, Flu like illness Severe Acute Respiratory Infection (SARI), pneumonia, Acute Respiratory Distress Infection, Sepsis and Septic Shock in a person requiring hospital admission, with no other etiology that fully explains the clinical presentation.	A person with history to or reside in to China, Iran, Italy and other endemic countries/areas in the last 14 days. Close contact with a confirmed or probable case of COVID-19, while that patient was ill

Record Following: Temperature_____BP_____RR_____SO2_____Get Chest X-ray

Declared Suspected Case

Patient has respiratory distress, hypoxia or hypotension-features suggestive of Respiratory Failure, Sepsis or shock OR > 60 years age and patients with co-morbidities	No Respiratory distress, hypoxia, hypotension.
Shift to HDU/ICU	Shift to Isolation

Name/Stamp Signature of Doctor



Rawalpindi Medical University/ Allied Hospitals
Department of Infectious Diseases

S-Form

کیا آپ کو پچھلے 14 دنوں میں 100.4F یا زیادہ بخار ہے؟

Signature & Thump Impression

O-Form **R-Form** **S-Form**

Emergency Bay

The first point of contact for nearly all sick patients is the Emergency Room, and given the novelty of the virus, it was unknown how severe the impact would be. Another important aspect was that very little was known about how the virus spreads. Keeping that in mind and the large influx of patients in the emergency room, special precautions had to be taken to protect not only the staff but other patients as well. Special arrangements were made in the CMO room, to ensure minimal contact and a separate bay was designated to deal with patients suspected of COVID-19. This area was cordoned off from the rest of the emergency with a one-way path.

Emergency Bay in Holy Family Hospital

Personal Protective Equipment

Considering the nature of the disease, the acquisition of personal protective equipment (PPE), was of utmost importance. Initially the inventories of the hospitals were done and the amount of PPE required was calculated and supply chains were established. Donations were received for use on individual basis as well donated to the taskforce and hospitals.

Personal Protective Equipment	Requirement per Shift	Requirement per day	Requirement/30 days
Gown	29	29 X 3(Shift) = 87	87 X 30 = 2610
Glove	29	29 X 3 = 87	87 X 30 = 2610
N95 Mask	29	29 X 3 = 87	87 X 30 = 2610
Surgical Mask	29	29 X 3 = 87	87 X 30 = 2610
Shoe Covers	29	29 X 3 = 87	87 X 30 = 2610
Goggles	29	29 X 3 = 87	87 X 30 = 2610
Face Shield	29	29 X 3 = 87	87 X 30 = 2610

Total PPE required for 100 patients/30 Days = 3000 kits

- Keeping In Mind The Quality And Utilization Of PPE,
- The Number Of PPE Used May Vary Accordingly

	BBH	HFH	DHQ	RIU	TOTAL
Face Shields	50	Nil	Nil	Nil	50
Goggles	50	175	Nil	170	270
N95 Masks	200	300	20	200	720
Gowns	1890	175	Nil	3015	3135
Caps	500	600	Available	3015	4115
Gloves	5100	2000	1000	220	8,320
Surgical Masks	9100	2000	1000	500	10,600
Alcohol Based Hand Rub	1017	Available	Available	50	Available

Complete PPE SETS	RIU	BBH	HFH	DHQ	TOTAL*
	400	300	400	100	1200

PPE Requirement and Availability

Human Resources

Securing human resources proved to be another challenge on its own, with the University having to depute staff from other hospitals to staff Rawalpindi Institute of Urology. However, further more guidelines were issued by the government and a strategy was devised to ensure there were enough human resources available. Walk in interviews are being conducted every Monday to ensure the staff present is in accordance to the Punjab Government yardstick and guidelines.

Hospital	Professor	Asco. Prof	Asist. Prof	AMS/DMS	SR	SMO	MO	PGT	HO	Nurses	Paramedics	Ward boys	Janitor	Total
HFH	01	01	02	04	02	02	46	15	15	47	35	18	18	**206**
RIU	00	00	00	02	03	00	31	00	00	220	00	00	*OS	**256**
BBH	02	00	01	04	04	08	20	12	12	72	12	14	18	**179**
DHQ	01	00	01	04	06	19	35	13	15	35	20	10	12	**171**
Total	**04**	**01**	**04**	**08**	**15**	**29**	**132**	**40**	**42**	**374**	**67**	**42**	**48**	**812**

Human Resources Dedicated for COVID-19 Management

Clinical Support

In order to tackle any pandemic, clinical support is of utmost importance. Medicines and other essential medical equipment were stockpiled in the designated hospitals and wards beforehand, to ensure availability at all times. Deficiencies were identified and the gaps were filled.

Food Services

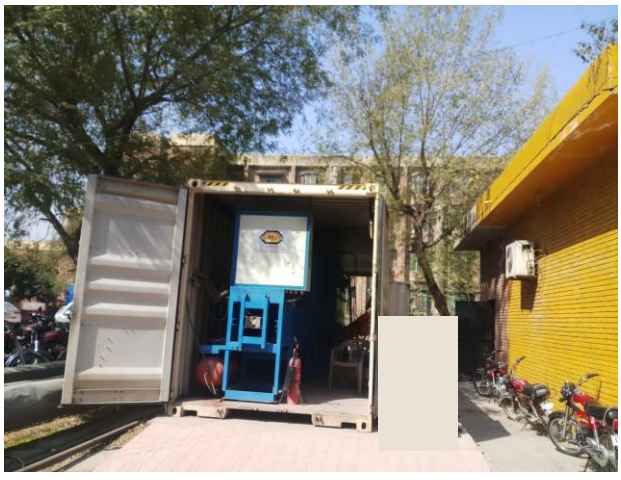
Providing food to patients in isolation presented a challenge on its own. The first challenge was calculating the amount of cutlery and dishes required, as the nature of the disease prevented open access. The second challenge was arranging food resources for the patients and along with the management, various organizations volunteered and came forth to provide a steady food supply.

Dress Code and Laundry Service

Insisting on being thorough, all aspects of patient care, including the hygiene. Knowing it would not be possible to transport clothes in and out of the isolation areas, a laundry plants were set up within the areas and hospital wear was provided to each patient.

Waste Management

The nature of the disease increases the importance of proper waste disposal. The contaminated surfaces continue to remain infective for long periods of time even after exposure has ceased. For this purpose, standard operating procedures were developed in line with the guidelines issued by Punjab Government.



State of the Art Incinerator Plants

Laboratory and Imaging Services

The contagiousness of the disease deemed it necessary to procure dedicated laboratory and imaging facilities, as there was always a risk of cross contamination. With guidance from the pathology and radiology department, a dedicated laboratory was established at RIU&T, within the isolation ward and preexisting laboratories were upgraded in all the remaining hospitals. Holy Family Hospital was the only BSL III lab. Portable chest x ray machines were acquired and designated to each zone.

With the starting of the pandemic, the PCR laboratory at Holy Family Hospital was upgraded, a negative pressure system was installed along with a coat of antibacterial and antiviral paint. The entire staff was then trained by the World Health Organization and National Institute of Health, in order to safely handle the virus. The National Disaster and Management Agency provided support to all the Allied Hospitals and provided an automated extractor and PCR machine to the Allied Hospitals, which increased the testing capacity from 92 a day to 300/day.

The pathology teams were working under the mentorship of Prof Dr Naeem, the Head of Pathology. The team at Holy Family Hospital was led by Dr Shireen and Dr Rida Khan. The team at Benazir Bhutto Hospital was led by Dr Nadeem Ikram and Dr Kiran.

Prof Naeem

Dr Shireen

Dr Nasir Khan

Dr Rida Khan

Dr Kiran Asher

Blood CP	COVID-19 PCR	X-rays
12344	11058	7502

Benazir Bhutto Hospital				
	Total	Positive		Negative
BBH	3244	852	26.2%	2392
Others	2906	620	21.3%	2286
Total	6150	1472	23.9%	4678

Holy Family Hospital				
	Total	Positive		Negative
HFH	1788	641	35.8%	1174
RIU&T	2380	475	19.9%	1905
DHQ	579	151	26%	428
BBH	1302	256	19.6%	92
Others	48	16	33.3%	32
Total	4908	1304	26.5%	3604

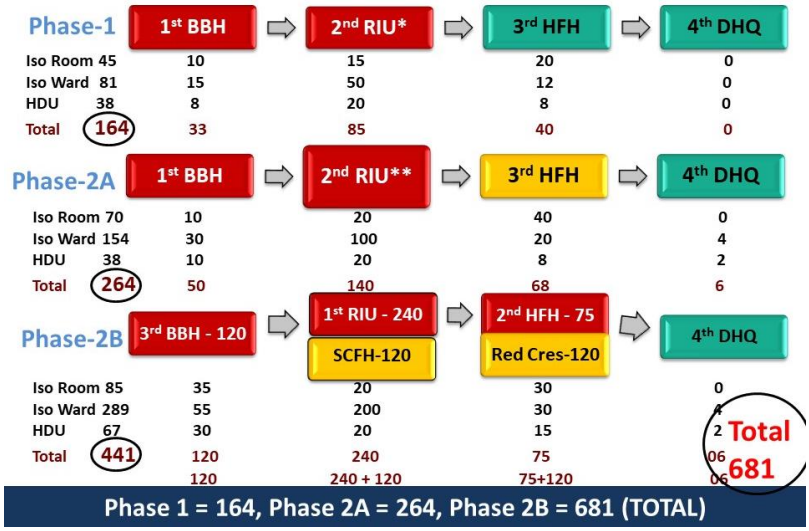
BSL III Laboratory at HFH

3 Phase Beds Capacity Building Plan

With the intensity, deadliness and rapid spread of the virus becoming more and more obvious each day, preparing for the fast-approaching pandemic was nothing less than preparing for war. Preparing expansion plans was of utmost importance and urgency as the rate of spread in Pakistan was unknown at that time. Each hospital came forth with an expansion plan, in which resources, wards and human resources were set aside and including in expansion phases, based on patient load.

As the disease is respiratory in nature, it was essential that beds be supplied by a central oxygen system to ensure an uninterrupted supply and allow the operating of ventilators. Ventilators had to be dedicated and elective procedures had to be postponed to allow the availability.

Following the expansion plan, initial emphasizes was made on the availability of general beds, while substitutes, such as oxygen cylinders were sought as a temporary fix, while a central oxygen supply was setup. In the second phase of expansion, the first step was in RIU&T, as it hosted a vast majority of COVID-19 patients, while slightly increasing beds in BBH and HFH, as the load increased.



The second step of Phase 2 was establishing a central oxygen supply at RIU&T and upgrading the preexisting central oxygen capacity of BBH, all while increasing the capacity at both centers. HFH hospital was also placed on alert in this step and the capacity there was moderately increased. Along with the upgradation of existing facilities, 2 field hospitals were established, at the Sports Complex and Red Crescent Hospital. Their purpose served to accommodate stable patients, while symptomatic patients were kept at the hospitals. As mentioned before, these steps had to be taken in the wake of a rapid influx of patients.

Phase 3, the current phase, was launched in the wake of an exhaustion of beds of oxygen beds. This phase was focused on expanding the capacity at BBH, by including other wards and by establishing a central oxygen supply at Holy Family Hospital. This step proved to be crucial as following Eid, the number of critical patients increased exponentially after Eid and exhausted preexisting facilities.

The next phase will include the inclusion of private healthcare facilities, which will be detailed further ahead.

271 Beds → 471 Beds

Station	Current	Cardio	Disaster Hall	MU-I/II	Dengue Hall	EYE	Ortho? Others?
Oxygen Beds	147	22	25	50	25	25	?
Vents	23 Adult 5 Paeds	10 Adult (CCU)	08 Adult (New ICU)	05 Adult (MICU)	5 Paeds (PICU)	?	?
General Beds	94	45 (Psych)	20 (Private Ward)	29 (Others)	X		

200 New oxygen beds created

Benazir Bhutto Hospital

40 Beds → 100 Beds

Station	Current	D!D	Isolation	MU-I	MU-II
Central Oxygen Beds	44	44	00	?	?
Vent Beds	16	16	00	CCU	ICU
General Beds	40	00	40	X	

50 New oxygen beds created

Holy Family Hospital

85 Beds → 228 Beds

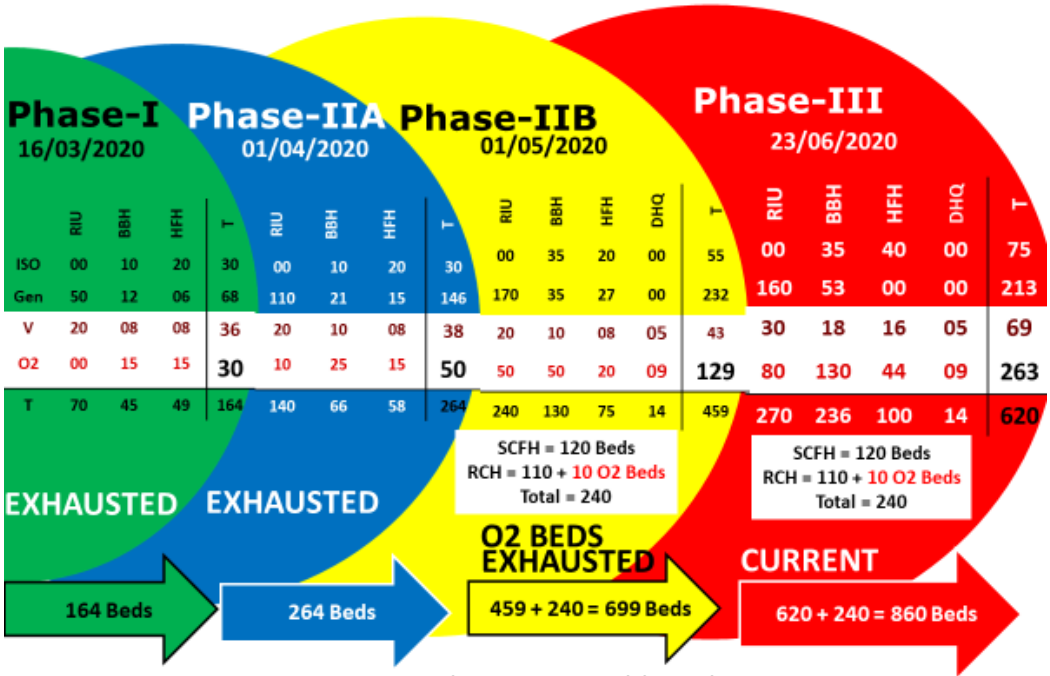
Station	Current	B Block	C Block	ICU 4-8	E Block	2nd Floor
Central Oxygen Beds	90	20	20	30	20	?
Vent Beds	31	21	00	10	00	?
General Beds	107	15	43	40	09	?

110 New oxygen beds created

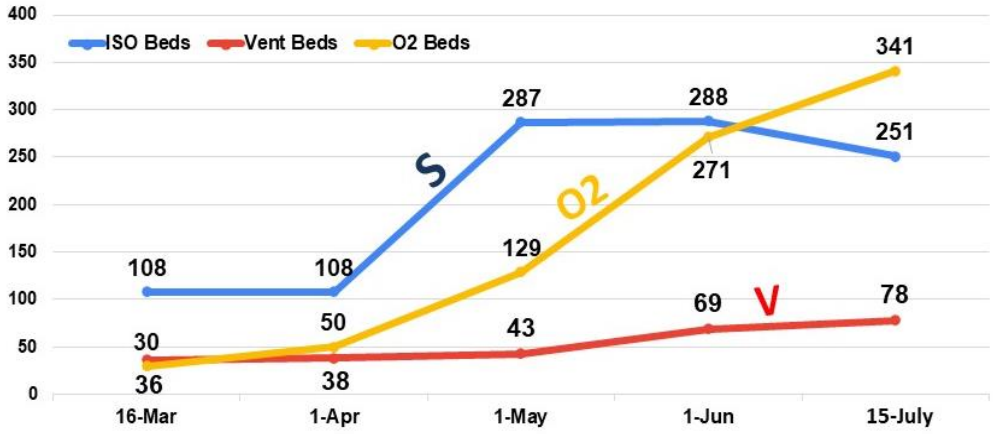
Rawalpindi Institute of Urology and Transplant

3 phase capacity building vs Occupancy ratio in RMU Hospital

The expansion plan was designed to accommodate stable patients initially, however as the pandemic worn on, it became evident that oxygen beds were the need of the hour. On the 1st of May, our worst fears came to be and the number of available oxygen beds reached capacity. In order to cater to this ever-increasing demand, the hospitals upgraded their existing oxygen supplies and converted normal bays to HDUs and ICUs. Further down the line, this proved to be a very good decision, considering the surge following the Eid holidays.



Dynamic Beds Capacity Building Plan



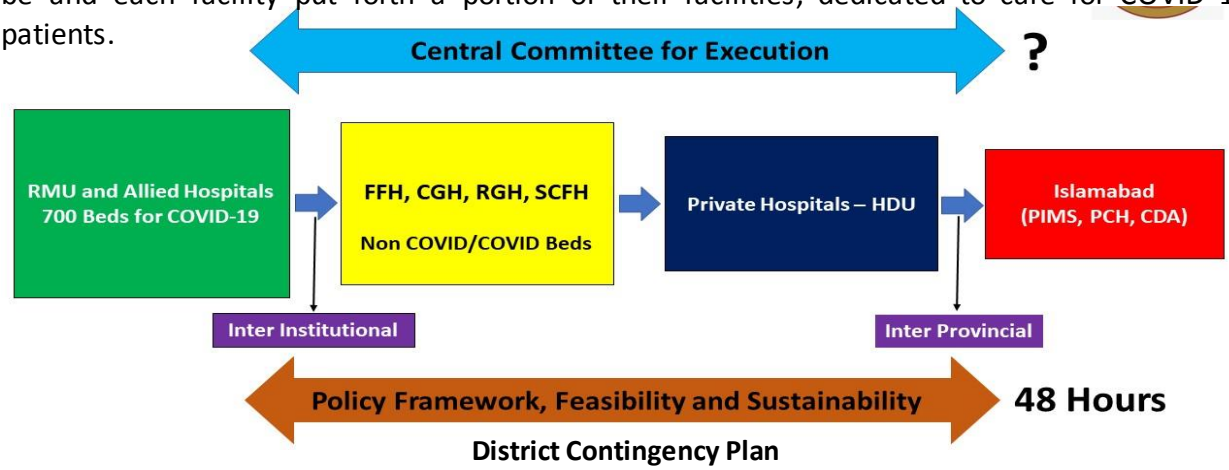
Hospital	RIU&T	BBH	HFH	DHQ	RCH	Total
ICU- Vent	30	18	16	5	0	69
HDU-O2	80	30	52	9	10	271
Total	110	138	68	14	10	340

Dynamic Development of HDU and ICU Beds

Combined plans of RMU & private hospitals

With the worldwide situation in mind, and the collapse of healthcare systems of even the most advanced and developed countries, it was essential to think several steps ahead. Keeping in mind the situation in the USA, UK and Italy and the determination to ensure we wouldn't face a similar fate, a further contingency plan was devised to ensure the continued availability of resources throughout the city, especially HDU and ICU beds.

Once the major hospitals of the twin cities were full, it was devised to include semi government and private healthcare facilities. Each of these facilities were requested to dedicate a portion of their available facilities incase the worst came to be. This contingency plan came to be and each facility put forth a portion of their facilities, dedicated to care for COVID-19 patients.



District Contingency Plan

HOSPITAL NAME	BEDS	ISO ROOM	O WARD	HDU
Cantonment General hospital Rwp	300			
Pakistan Railway Hospital Rawalpindi	500			
Social Security Hospital Rawalpindi				
Wah General Hospital Wah Cant				
Watim General Hospital Islamabad				
Christian Hospital Taxia				
Ripha intl Hospital Islamabad				
Hearts International Ra	107			
Attock Hospital				
Al Ihsan Hosp walpindi	50			
Al Sayyed Hospital				
Bilal Hospit				
Bahria Hosp Phase 8 Rawal	50			
Ahmed Medical Compl ndi	200			
Safari Hospital wn				
Reliance Hospital Rawalpin				
Valley Clinic Rawal	50			
Nusrat Hosp pindi				
Jinnah Memorial Hospital Rawalpi	50			
Maryam Memorial Hospital Raw	50			
Fauji Foundation Hospital	111			
Al Shifa Eye Trust	190			

Sports complex field hospital for confirmed patients = 120 beds

Red Crescent hospital for confirmed patients = 120 beds

Private Healthcare Facility Beds = 297

Home/Central Isolation Facilities for Asymptomatic Confirmed patients = ???

Increase RIU Bed Capacity to 300 - 400 beds

Armed Forces Hospitals Beds = ???

?

Private Hospitals Inclusion Plan

Patient Burden in Pakistan

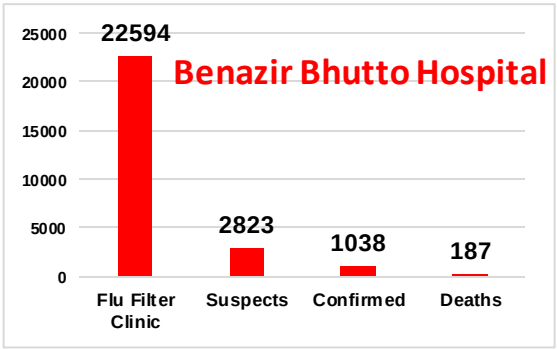
COVID-19 was first detected in Pakistan on the 26th of February 2020, in Karachi, when a student returning from Iran tested positive, and on the same date, another individual returning from Iran as well tested positive in the Islamabad. After that the number of cases gradually started increasing, at a relatively slow rate, with the measures taken by the government to slow down the spread. In the first 15 days of the epidemic, less than 15 cases were reported. Over the next fortnight, the number of cases detected started to increase, but all of the detected cases were inbound travelers. However, on the 13th of March, the first locally transmitted cases were detected in Sindh, and that was when all alarms bells started blaring. A major influx occurred following the annual Raiwand Ijtama and the early release from quarantine of pilgrims returning from Iran. Since that point, strict measures were enacted and the rise in the number of cases remained slow, however following Eid, there was a massive spike in the cases and till this day Pakistan remains submerged in the epidemic.

Pandemic at Rawalpindi Medical University

Rawalpindi Medical University and its Allied hospitals confirmed their first case on the 23rd of March 2020, at Benazir Bhutto Hospital, following which the individual was shifted to RIU&T. This put the entire administration on high alert and all the hospitals were then ready to receive and treat COVID-19. Throughout the pandemic, Benazir Bhutto Hospital played a major roll and dealt with a bulk of patients single handedly, the flu filter clinic received more than 20,000 patients alone. A brief overview of how individual hospitals handled the disease follow:

- ## Benazir Bhutto Hospital:

After being declared the main corona hospital in Rawalpindi, BBH set aside a dedicated facility in their premises, which was located to one side as to not disturb the function of the rest of the hospitals. The challenge was to cater to a bunch of individuals, all of whom were potentially infected by the virus. The turnout of the patients proved to be overwhelming initially, partially attributing to the novelty of the disease and rapidly changing guidelines. However, decisions were made on the fly and accommodations were made on priority. The net result was a smooth function well-oiled machine, that despite receiving a huge number of patients managed to strive in the situation.



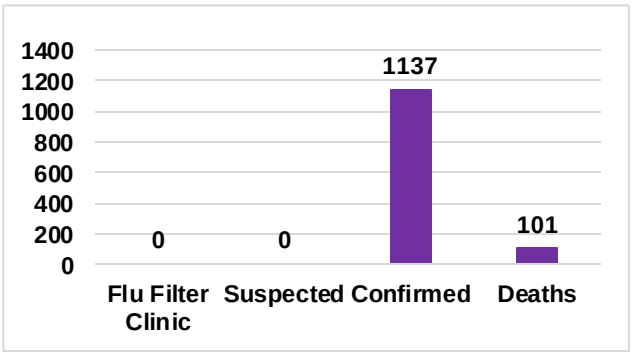
Till date, the Flu Filter clinic screened more than 20,000 patients, which is more than 75% of all patients. 12% of all

screened patients were suspected to have the disease and nearly 4.5% of all screened patients were positive and 1/3rd of all tested patients was positive. Unfortunately, this high patient load contributes to the number of mortalities, which in proportion was higher than the other hospitals.

The administrative team was led by the MS Dr Rafiq. The Clinical Teams at Benazir Bhutto Hospital were led by Prof Fazal Ur Rehman and Prof Muhammad Ali Khalid. The Senior Registrars monitoring the junior doctors were Dr Imran Arshad, Dr Shaheer Ehsan, Dr Sara Mustafa, Dr Sadaf Zaman, Dr Sana Ahmed and Dr Rizwan Mehmood. Dr Inayat Ur Rehman was the key focal person involved who ensured record keeping and smooth functioning.

Rawalpindi Institute of Urology & Transplant:

Rawalpindi Institute of Urology & Transplant, being built up from the ground was used only as a corona care center for positive patients. Setting up this new facility from scratch and with the pandemic looming overhead was no easy task and work was put in at all over of the day to make sure the hospital was ready to receive its first patient before the pandemic reached the region.



Since the pandemic started, the hospital would receive patients from the district government and the Allied Hospitals of RMU, before facilities were made in the hospitals to cater to the patients. The hospital has a dedicated team with a dedicated staff, running 2 ICUs parallelly. The hospital initially received the bulk of the patients and helped out greatly in managing the patients.

Till date, RIU&T has received and managed more than 1000 patients and has discharged nearly 1/4th of all patients. The death rate remained at a low 6.7%.

Dr Khalid Randhawa led the administrative team, along with Dr Tahir Rizvi and Dr Naeem Malik. The clinical team at RU&T was led by Dr Qaiser Aziz. Senior Registrars from the remaining hospitals did their duties at RIU&T, to bridge the gap.

Holy Family Hospital:

Holy Family Hospital initially played a supporting role to RIU&T and BBH. During the pandemic, it dealt mostly with general patients of medicine, surgery etc. With the

Obs&Gyne department of Pakistan Institute of Medical Sciences, Islamabad, the main hospital of serving Islamabad was sealed, patients were referred to Holy Family Hospital. This only added to the burden of the hospital, who stepped up their services. The hospital continued to offer indoor services during the pandemic.

As time went on, with the initial surge almost filling the hospital to capacity, it was deemed necessary to increase the capacity of central oxygen beds and come up with a contingency plan, as the Allied Hospitals were near full capacity at one point. With the upgradations complete, Holy Family Hospital then managed COVID-19 patients in house, instead of referring to the field hospitals or RIU&T.

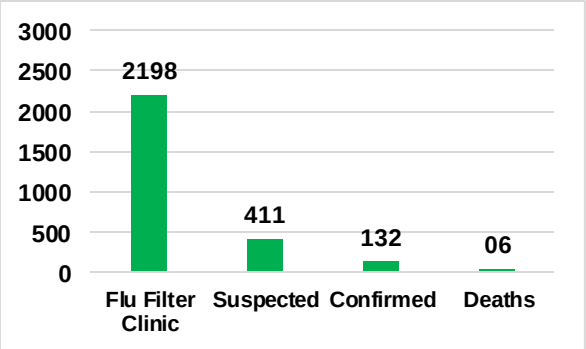
Holy Family Hospital has a fully functional flu filter clinic, which functions 24/7. Laboratory facilities and imaging facilities are inhouse. Laboratory testing is also down in house. So far, Holy Family Hospital has screened over 4000 patients and nearly half of those were suspected to have COVID-19. The percentage of suspected patients testing positive was nearly 50%, with nearly 500 patients. The mortality rate was high at 20%, with 102 deaths.

The administrative team was led by Dr Shehzad Ahmed. The Dean of Medicine, Dr Muhammad Khurram, the Head of Infectious Diseases, Dr Muhammad Mujeeb Khan and the Head of Medical Unit 1, Dr Saima Ambreen led the teams at Holy Family Hospital. The Senior Registrars performing their duties included Dr Salman Mushtaq, Dr Nida, Dr Najia, Dr Madiha Umair, Dr Madiha Nazar, Dr Sadaf Rafique, Dr Humaira, Dr Omer Daraz and Dr Asad Ur Rehman. Dr Bilal Zafar was centered at Holy Family Hospital and was incharge of the records of all 6 healthcare facilities, along with his regular duties.

District Headquarters Hospital:

DHQ hospital was very supportive, with them running a very dedicated flu filter clinic and had a separated isolation ward. Facilities were spared for COVID-19 only and despite having a small setup for COVID-19, comparatively, contributed significantly to the battle. RIU&T dedicated an isolated HDU, equipped with 14 centrally supplied oxygen beds and 5 dedicated ventilators.

The hospital screen nearly 2100 patients and suspected 330 of those patients to have COVID-19. 1/3rd of the suspected patients tested positive and depending on their clinical condition, were either treated in house or transferred to one of the corona care centers, i.e. BBH or RIU&T. Despite the low turnover, COVID-19 tends to take a heavy toll and 6 patients lost the battle for their lives.



The DHQ administrative team was led by Dr Farzana. The clinical team at District Headquarters Hospital was led by Dr Shehzad Manzoor, Dr Lubna Miraj, Assistant Professor, Dr Arshad Satti, Consultant. The Senior Registrars include Dr Umar Kaleem, Dr Shumaila, Dr Tahira, Dr Hina. Dr Mobeen Jawad performed the tiring task of ensuring data was always uptodate.

Cumulative Trends

Benazir Bhutto Hospitals flu filter clinic started functioning on the 16th of March 2020, followed by Holy Family Hospital the next day and DHQ a few days later. Since then, the hospitals have been working nonstop. As obvious below, Benazir Bhutto Hospital was the main focus hospital, screening and suspecting the most patients, whereas the highest patient load was at Rawalpindi Institute of Urology & Transplant, as that was developed as a dedicated corona care center.

Dealing with the highest number of patients also means facing the highest mortality rate, as evidenced by BBH and HFH, as they usually admitted critical patients who were too sick to be transferred to the dedicated facility. A table detailing the burden is given below:

Hospital Name	Flu Filter Clinic	Total Suspects	Total Confirmed Cases	Confirmed Admitted	Suspects Admitted	Total Discharged	Shifted Out	Death	Home Isolation
Benazir Bhutto Hospital	22650	2826	1042	15	11	600	240	187	00
Holy Family Hospital	4647	1200	525	08	06	197	182	117	21
Institute of Urology	00	00	1138	18	00	848	25	101	146
District Headquarters	2206	412	132	00	01	79	44	06	03
Sports Complex Field – HOS	00	00	00	00	00	00	00	00	00
Red Crescent Field Hospital	00	00	190	04	00	183	00	03	00
Total	29,503	4,438	2,536	45	18	1,907	491	414	170

Commutative Data Sheet

	RIU			BBH			HFH			DHQ			SCFH			RCH			TOTAL		
	TOT	Fill	Vac	TOT	Fill	Vac	TOT	Fill	Vac	TOT	Fill	Vac	TOT	Fill	Vac	TOT	Fill	Vac	Fill	Vac	TOT
Isolation Rooms	00	00	00	35	00	35	40	08	32	00	00	00	00	00	00	00	00	00	08	67	75
Isolation Wards	140	04	136	14	04	10	04	04	00	05	02	03	120	00	120	100	04	96	18	365	383
ICU / Vent	30	02	28	23	01	22	16	01	15	05	00	05	00	00	00	04	00	04	04	74	78
HDU / O2	70	05	65	124	43	81	40	00	40	04	01	03	00	00	00	16	00	16	49	205	254
Total	240	11	229	196	48	148	100	13	87	14	03	13	120	00	120	120	04	116	79	711	790

Daily Data Sheet

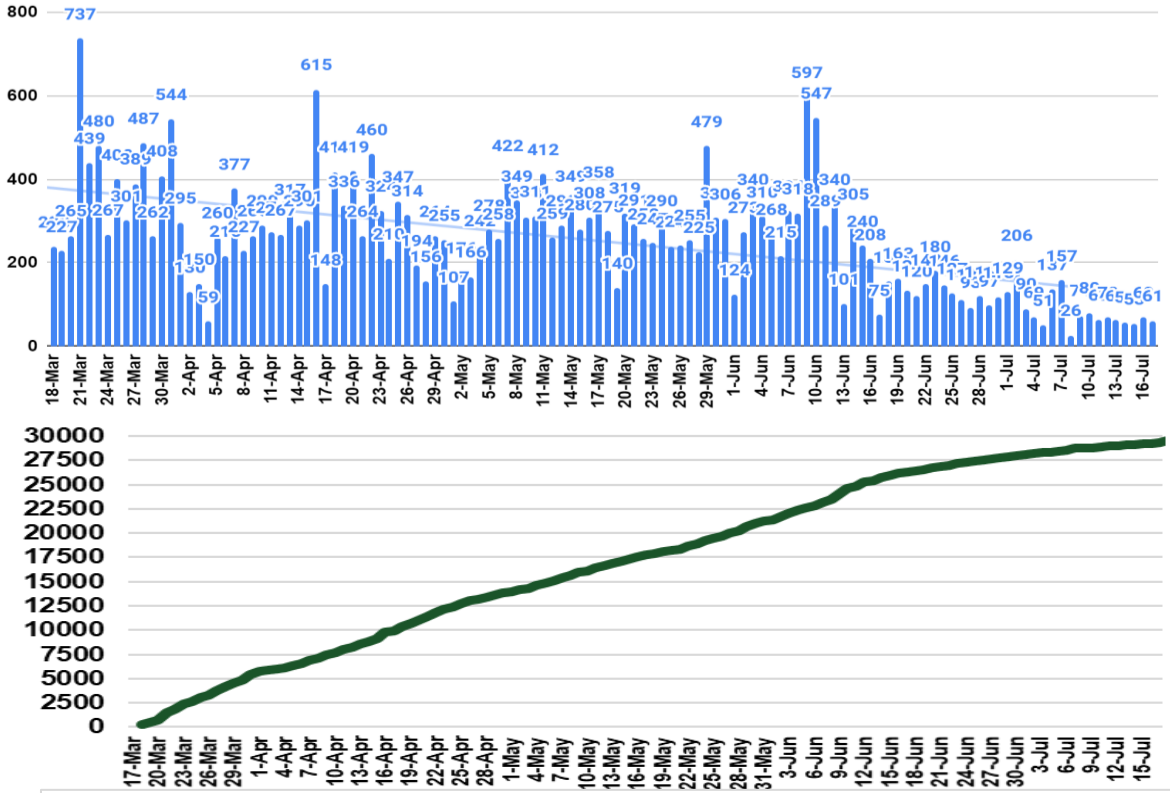
Flu Filter Clinics

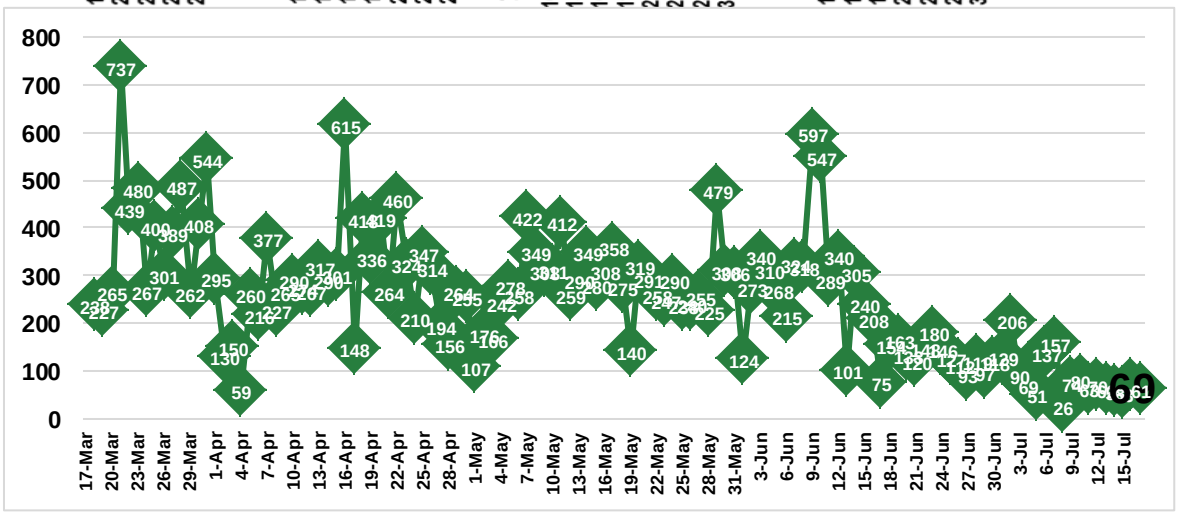
The flu Filter clinics have been working day and night, for the past 3 months, screening patients at 3 different locations. This is usually the point of first contact, and the uncertainty of status of the individual being screened puts the staff at huge risk. Since they started functioning, they have catered to more than 27000 patients. Which amounts to an average of nearly 2000 patients per week.

In terms of influx, May was the busiest month, however, the first half of June, proved to be the major challenge, with nearly 4600 individuals being screened in those days. After the

15th of June, the influx of patients has been greatly reduced. With only 1500 individuals being screened in the past two weeks.

Keeping the trend chart in view, it is fairly obvious that the burden on the Flu Filter Clinics was constant throughout. However, towards the end of July, the curve has begun to flatten.



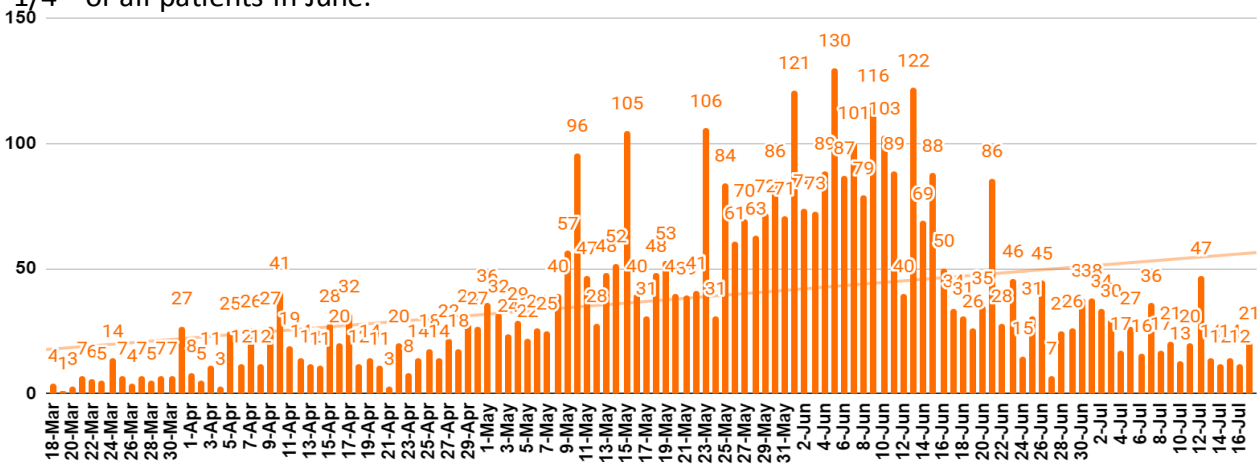


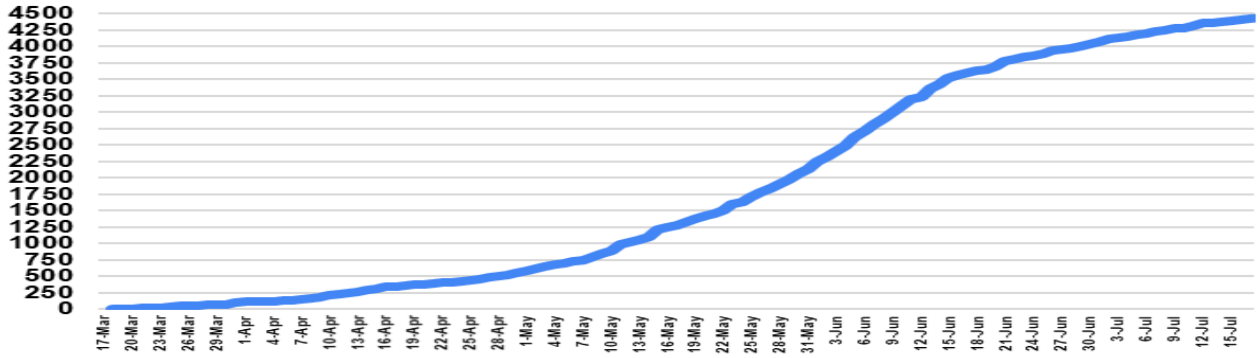
Suspects

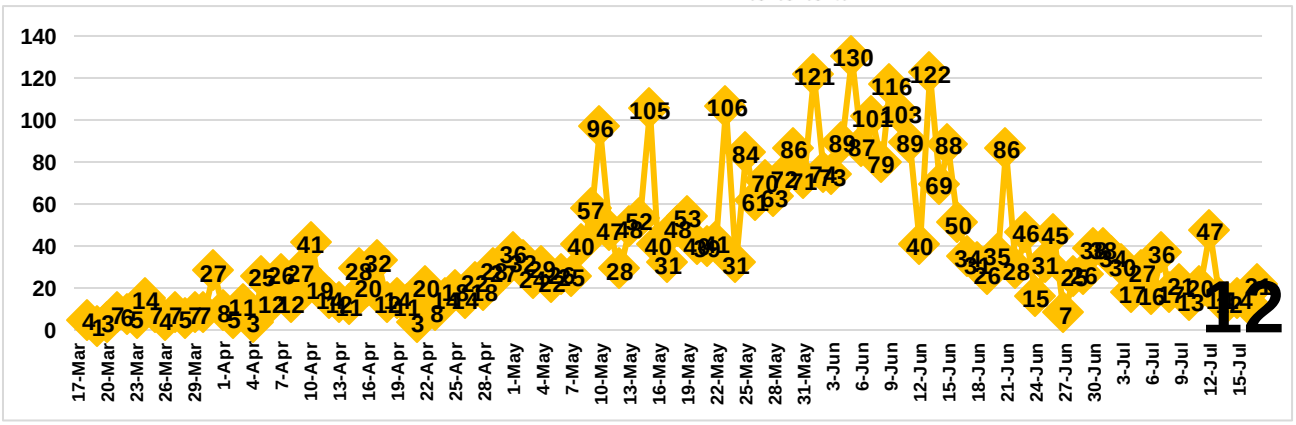
Upon presentation to the flu filter clinics, all patients were screened according to a standardized OPD form (O-Form), which is used to register the patient at the flu filter clinic and then a Registration form (R-Form). Once, suspected the registered, he is admitted for testing in the isolation ward, where he'd remain separate from the rest of the affected patients to make sure the transmission is not spread on.

Month	Screened
March	5444
April	8442
May	8744
June	6369

The first month, March, due to the sudden influx of patients and low prevalence of COVID-19 in the society in the start, 1.9% of screened patients fulfilled the criteria of suspects. The following month, the ratio was slightly higher at 6.1%. The following month in May, the ratio of patients suspected rose 3 fold to 18% and further increased to nearly 1/4th of all patients in June.



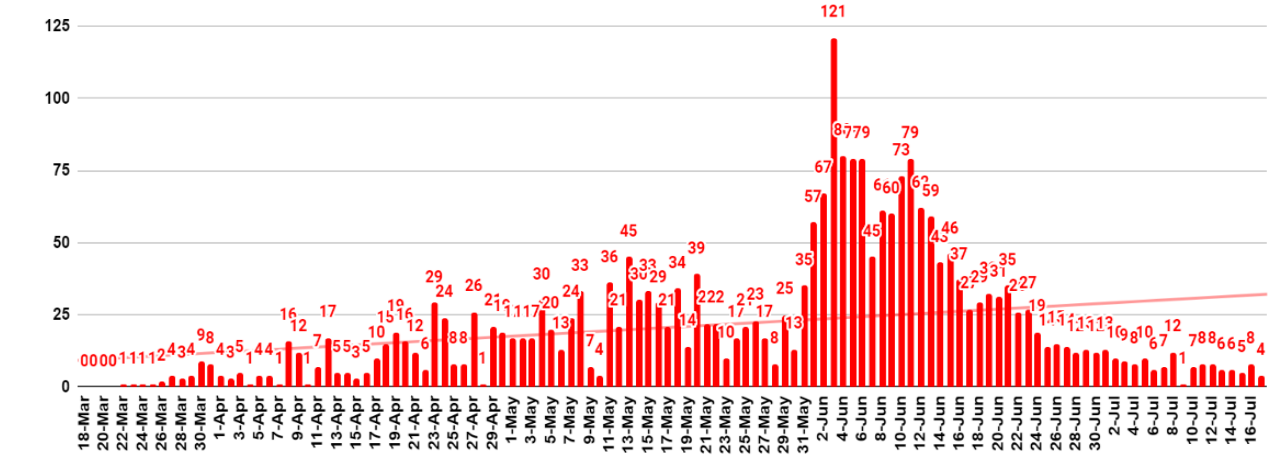


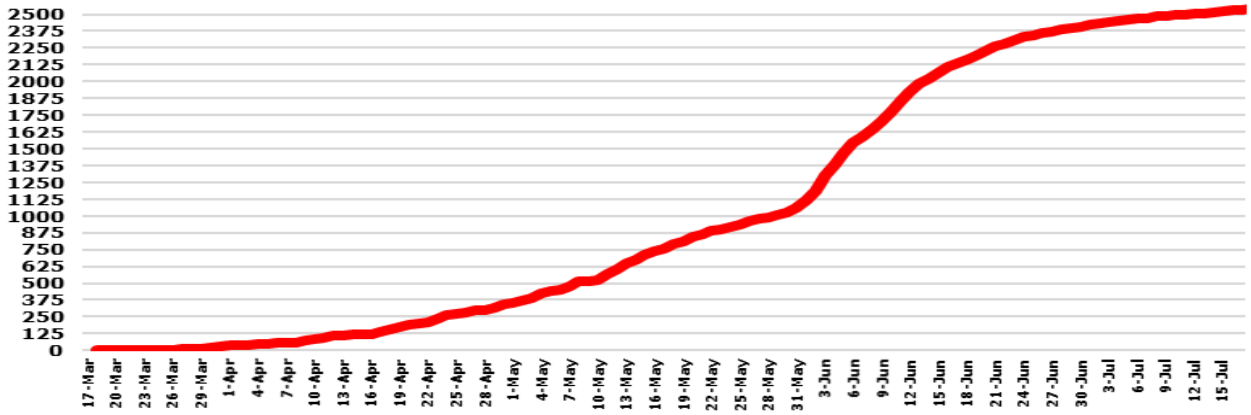


Confirmed Patients

Once a patient was confirmed, an entire series of events was set in motion. With alarm bells sounding all around, all 4 hospitals and field hospitals were put on high alert. The first confirmed case was detected 5 days after the flu filter clinics started screening patients. Confirmed patients then started increasing gradually, though the rate remained relatively low in the month of March, with averaging 2.2 confirmed cases per day. The following month, the average nearly quintupled to 10.2 confirmed cases per day, with 307 total cases in April. May saw a total of 691 at a rate of 22.2 cases per day. The first half of June proved to be the heaviest of the pandemic, with nearly 50 confirmed patients. The latter half, the number of confirmed is gradually falling and currently averaging 20 patients a day, with a downward trend. At this point in times, the curve has flattened out, though it seems that the curve follows the pattern of suspected patients.

The overall percentage of suspected patients testing positive is currently 52%. There was however a variation, with the rate being low initially but increasing as the pandemic progressed. In March, it was 25%, with only 1/4th of patients testing positive, in April it rose to nearly 60%, with 2/3rd testing positive. May saw a drop to 43% and June saw the rate bounce back to 60%.



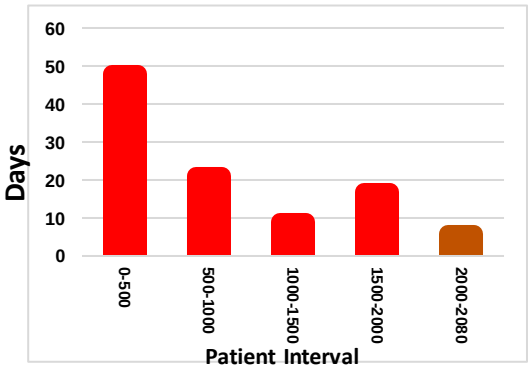


Intervals

The only way to truly understand the gravity of the disease and the rate at which the burden increased, in if the burden is studied in intervals. As shown in the table on the right, it can be seen that the most patients were received during the first week of June, where average rate of

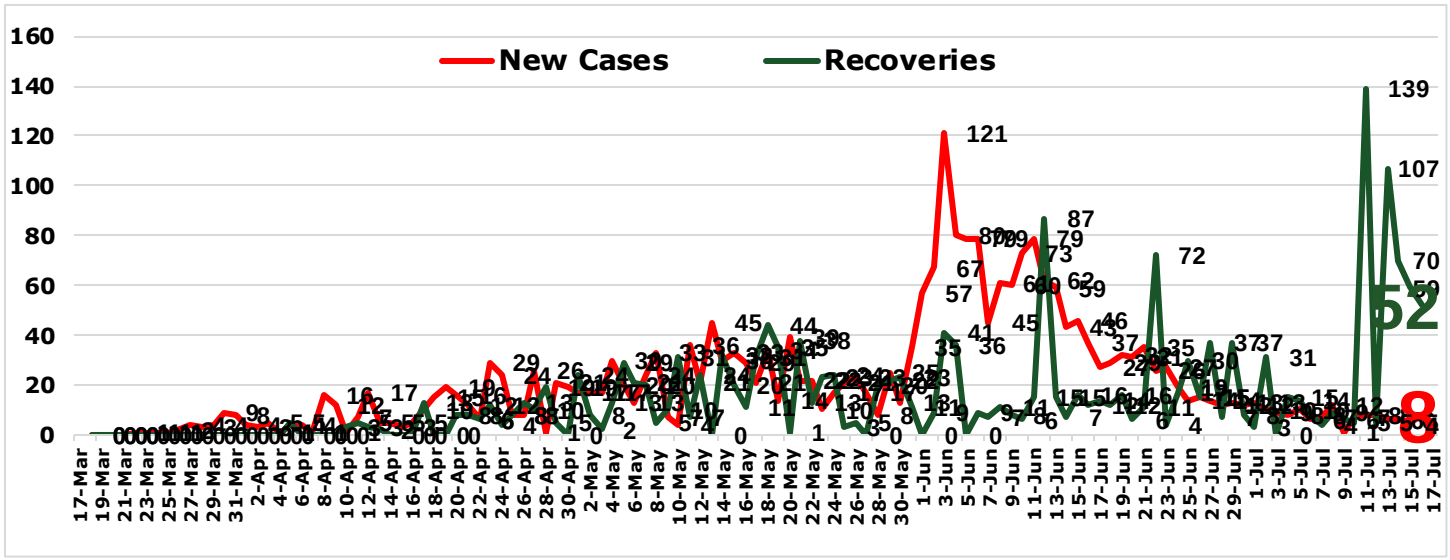
admission was more than double that of the second highest interval. However, this has been followed by a drastic drop in the number of patients being admitted, following the initial surge.

Interval	Cases	Average	% Change
18/03 - 01/04	38	2.5	--
02/04 - 16/04	89	5.9	+134.2%
17/04 - 01/05	231	15.4	+159.5%
02/05 - 16/05	359	23.9	+55.4%
17/05 - 31/05	315	21	-12.2%
01/05 - 15/06	745	49.7	+136.5%
01/06 - 28/06*	268	17.8	-64%



Patient Intervals Chart

As demonstrated by the bar chart on the left, the shortest interval was the third one of 09 days, which coincides with the massive post Eid surge in cases. This chart gives us some idea about the transmission rate, as a shorter interval coincides with a higher transmission rate in the previous interval. The graph below shows the relationship between new cases, which further shows the turning point of the epidemic, i.e. when recoveries overtook new cases.

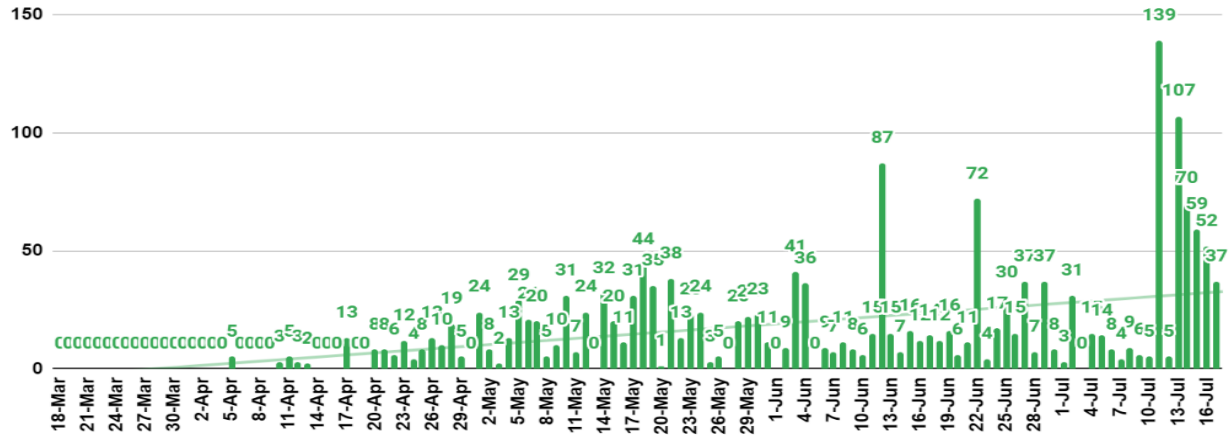


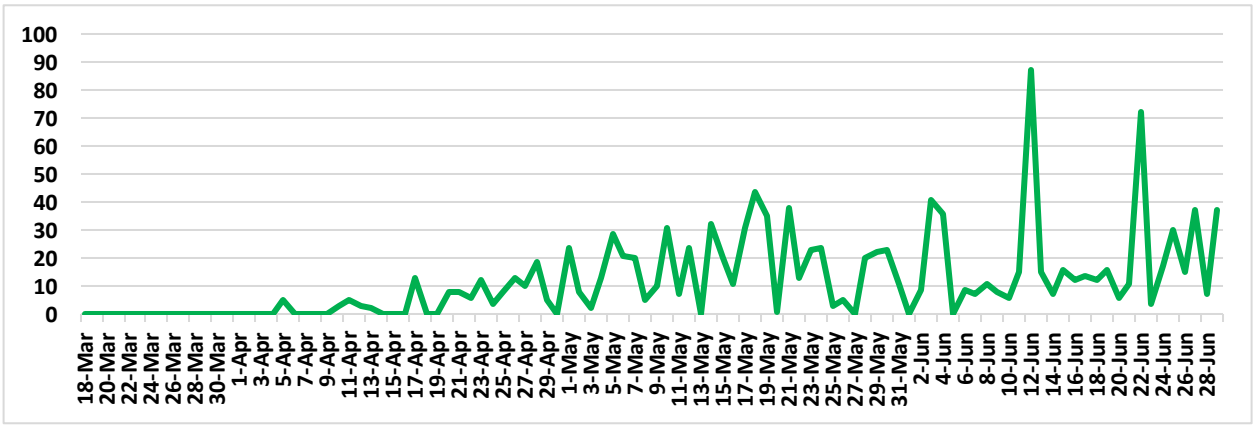
New Cases vs Recoveries Chart

Discharged Patients

Since the starting of this epidemic, more than 1200 patients have recovered and been sent home. The criteria to discharge a patient is based on their clinical condition and 2 consecutive negative PCR reports. The average duration of stay was found to be 11 days, initially, however since the advent of home isolation, this cannot be accurately determined.

Lately the recovery rate has increased and has overtaken new cases. These waves represent a combination of patients being discharged from the hospital as well as home isolation.





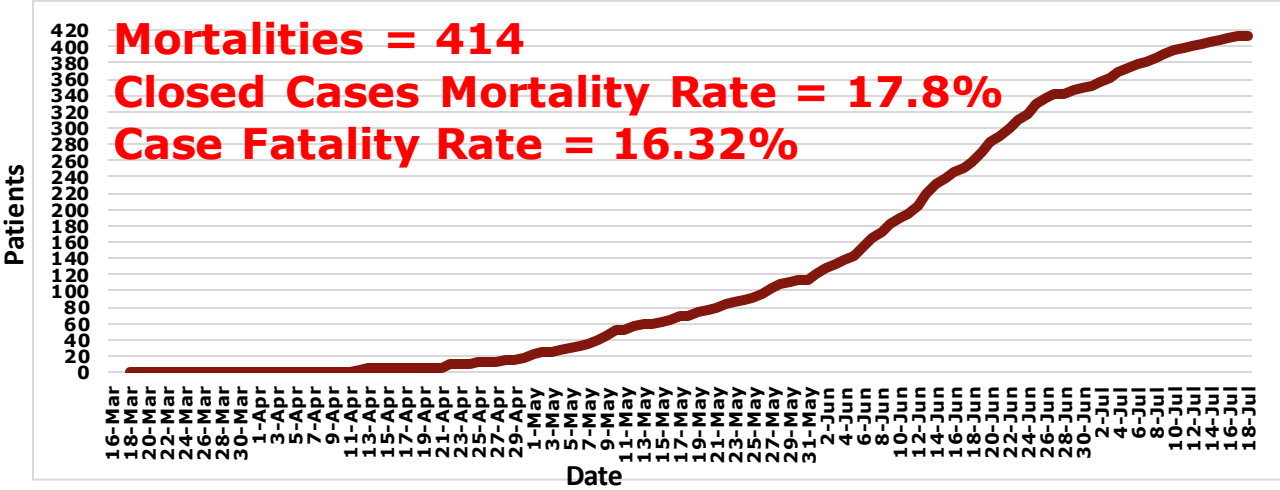
HDU/ICU Management

The main challenge in the pandemic proved to be those patients requiring HDU and ICU care. Holy Family dealt with the greatest number of critical patients, which also explains the relatively higher mortality rate comparatively. A team led by Dr Abrar Akbar, Head of Critical Care and Dr Jawad; Head of Anesthesiology led the way. Dr Abdul Naeem, Assistant Professor and Dr Asif Jalil were key players in this role.

		HFH	RIU&T	BBH	DHQ	RCH	Total
HDU/ICU Patients		224 (66.5%)	385 (34.10%)	289 (23.1%)	08 (18.18%)	10 (5.8%)	864 (37.77%)
On O_2		142	289	176	07	10	575
O_2	High Flow*	114	216	124	04	05	463
	Low Flow	28	73	52	01	03	159
On Vent		82	93	113	01	02	291
On O_2 Expired		37 (26%)	19 (6.5%)	11 (8.87%)	04 (57.14%)	02 (20%)	73 (8.44%)
On Vent Expired		74 (93.9%)	74 (79.5%)	106 (93.80%)	01 (100%)	01 (50%)	256 (87.97%)

Mortality

The case fatality rate was calculated at 16.3%, whereas the mortality rate amongst closed cases stood at 16.6%. Of the 414 mortalities at RMU and Allied Hospitals, Benazir Bhutto Hospital had that most mortalities at 187, with a 46% share overall, followed by Holy Family Hospital at 117 deaths (29%) and Rawalpindi Institute of Urology, with 101 deaths (22%). District headquarters Hospital and Red Crescent Hospital accounted for a combined 3% with 9 mortalities between them.

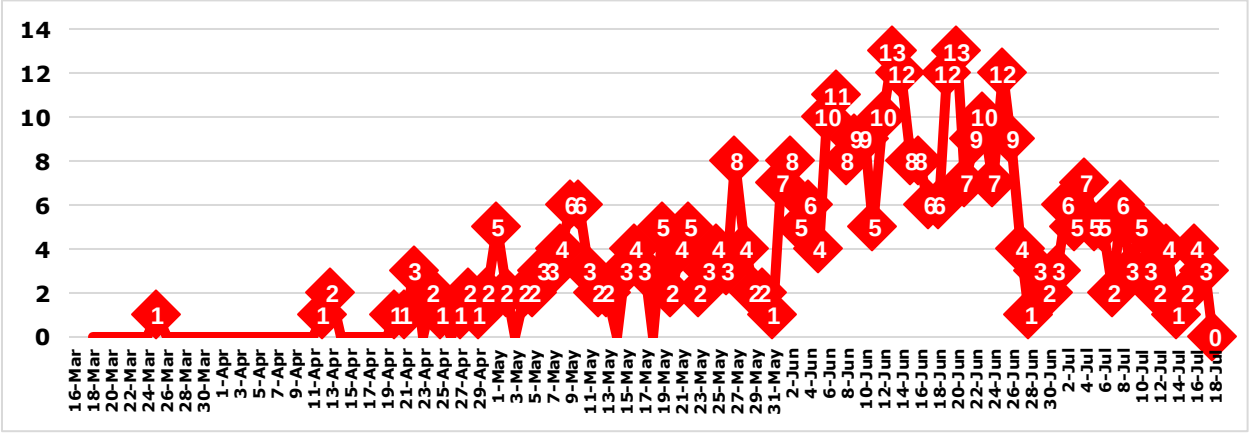


Mortality Trends

The mortality rate showed a slow increase initially, however later on during the epidemic, the mortality rate increased significantly. This was in proportion with the patient trends, with more critical patients being received.

Month	Mortalities	Mortality Rate
March	01	2.9%
April	17	5.5%
May	99	14.3%
June	234	22.4%
July	63	31.5%

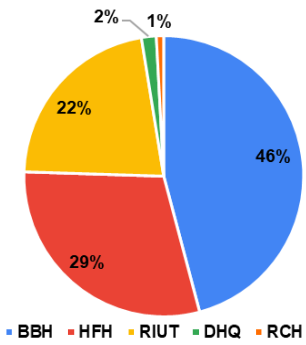
Monthly Distribution of Mortalities



Daily Mortalities Graph

Characteristics

Of the 414 COVID-19 deaths, Benazir Bhutto Hospital accounted for 46%, Holy Family Hospital accounted for 29%, RIU&T for 22%, whereas District Headquarters Hospital and Red Crescent Hospital account for 2% and 1% respectively (Fig 1.). Mortality was significantly higher in males than females, with a 2:1 distribution ratio (Fig 2.)



Mortality was highest amongst those above 40 years old with them accounting for 87% of all deaths. Amongst this 87%, 55% of deaths were amongst those aged above 60 and 45% below 60 years of age, which shows a distribution of nearly 50% (Fig 3.).

The mean duration of stay was found to be 4.9 Days with, the longest stay being 41 days and the least being less than 1 hour, with a couple of cases being brought in expired. 92% of all patients who

expired were received in critical condition, with 7% arriving in moderate state. 70% of patients required ventilatory support.

Comorbidities were present in 78% of patients, with 56% of those having more than a single comorbidity. Hypertension and Diabetes accounted for the 52% of all comorbidities, followed by Ischemic Heart Disease (14.8%), Renal Failure (9.4%), Lung Disease (7.2%), Liver Disease (6.8%) whereas other accounted for 14.8%. (Fig 4.)

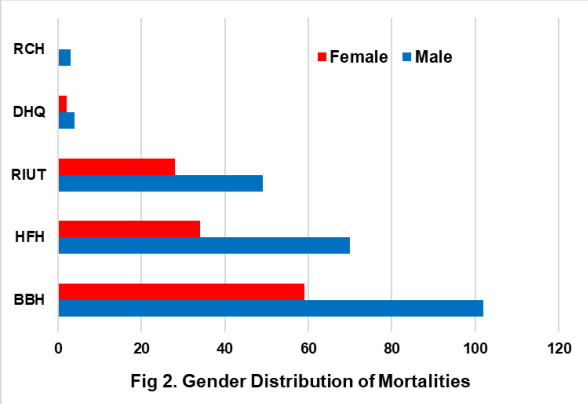


Fig 2. Gender Distribution of Mortalities

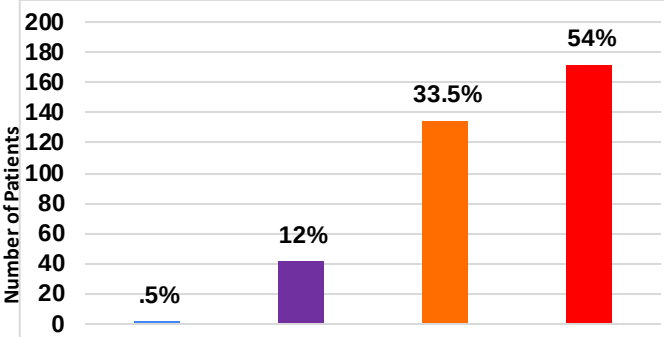


Fig 3. Age Distribution

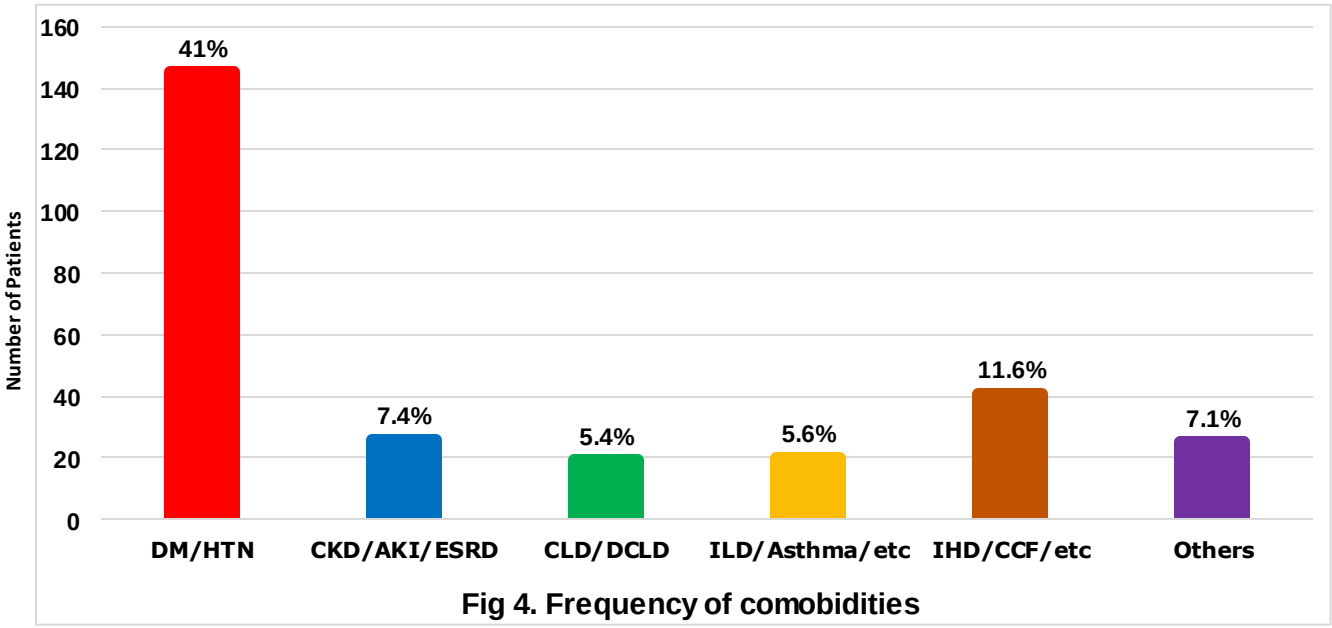
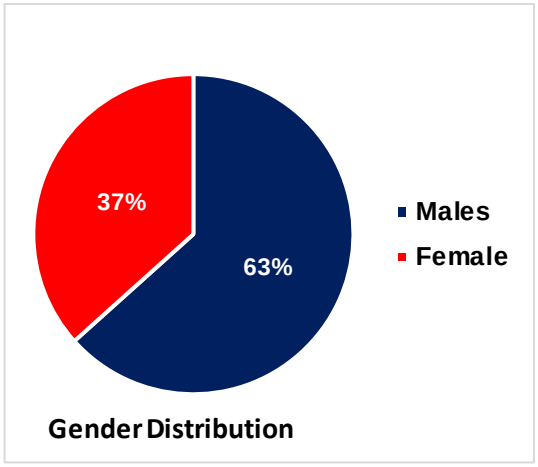


Fig 4. Frequency of comobidities

Benazir Bhutto Hospital

The number of mortalities was 184 at Benazir Bhutto Hospital. The case fatality rate at Benazir Bhutto Hospital was found to be 26.7%. The gender distribution was about 2:1, with more deaths amongst males than females. The average age was found to be 57 years of age. The most affected age group were those aged above 40, accounting for 81% of all deaths. Multiple comorbidities were seen in 50% of patients, with hypertension and diabetes being the leading cause of death. 289 patients presented in critical condition out of which 110 were put on ventilatory support.



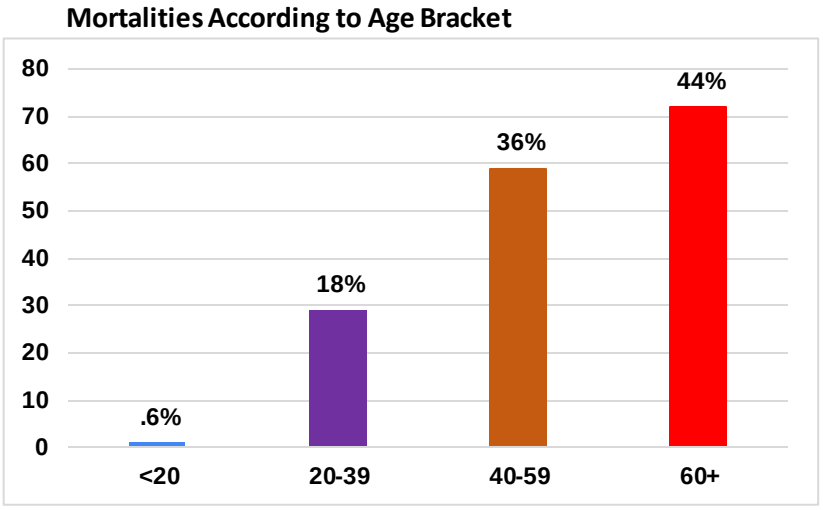
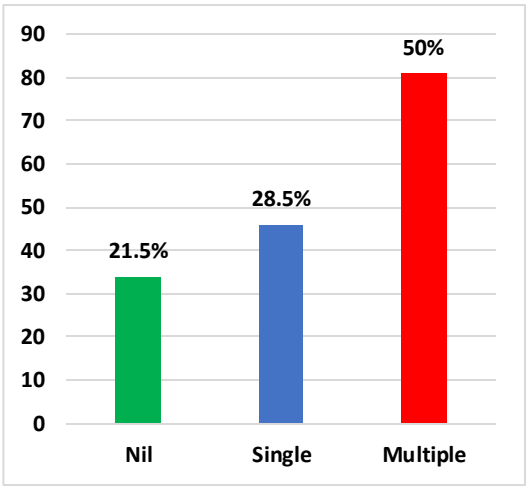
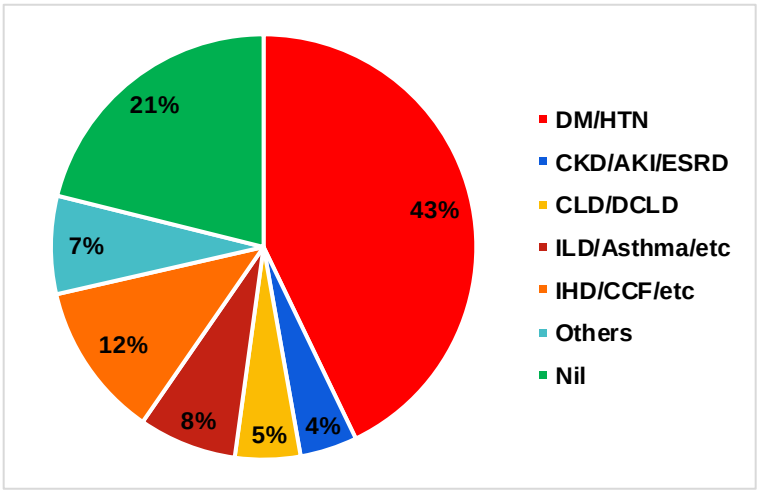


Fig 1. Frequency of Distribution Amongst Hospitals



Distribution of number of comorbidities

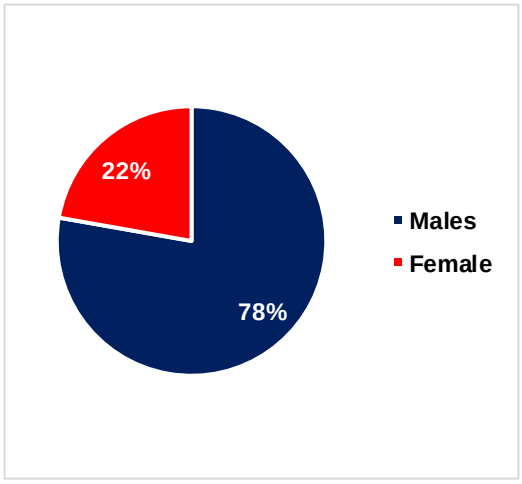


Distribution of comorbidities amongst Mortalities

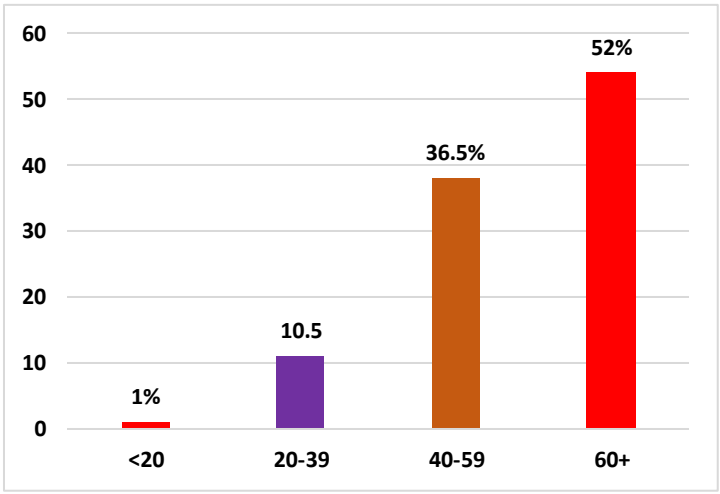
Mild on Admission	Critical on Admission	Required Ventilatory Support
09	280	113

Holy Family Hospital

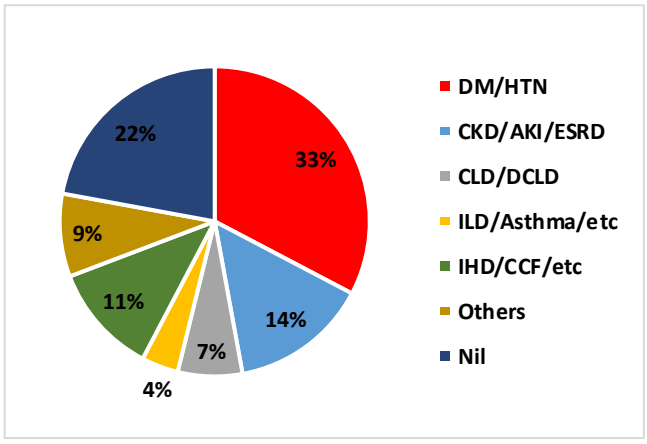
A total of 114 mortalities took place at Holy Family Hospital, with a case fatality rate of 33.8%. The gender distribution was 2:1, with 2 males for every female. The most affected age group was of those above 40, with more than 88% of mortalities. Those above 60 years of age accounted for around 60% of those patients. The leading comorbiditiy was once again Diabetes and Hypertension, although a significant number was suffering from renal disease and required dialysis. A major portion of patients were critical on admission and required ventillatory support.



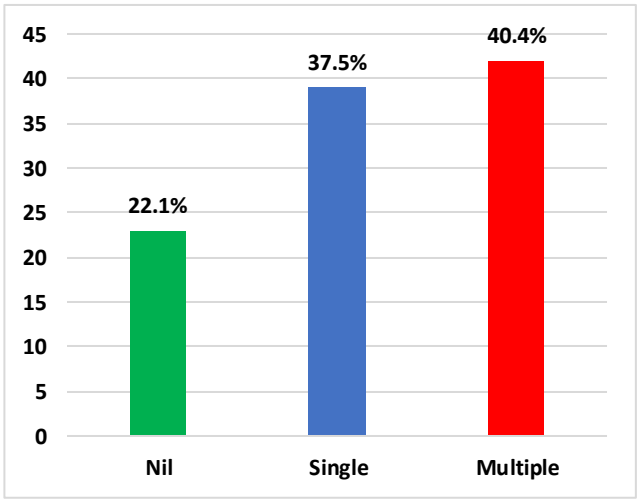
Gender Distribution



Mortalities According to Age Bracket



Distribution of comorbidities amongst Mortalities

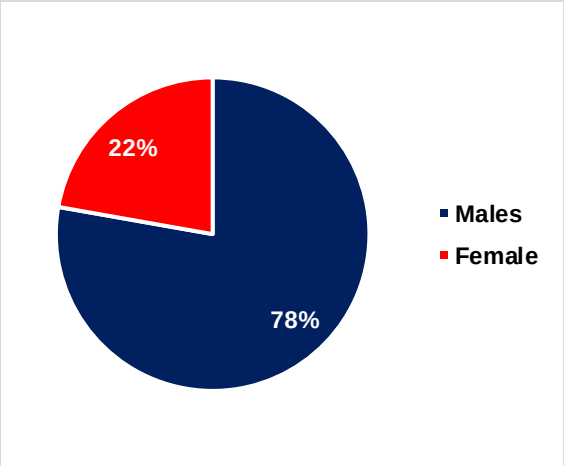


Distribution of number of comorbidities

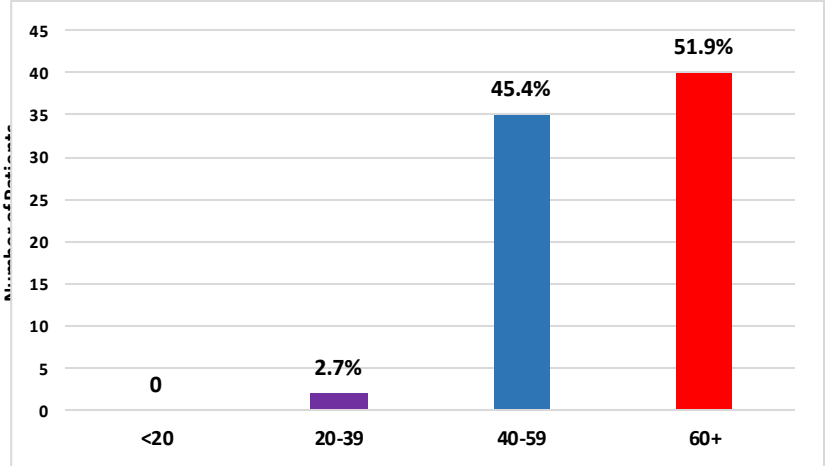
Mild on Admission	Critical on Admission	Required Ventilatory Support
16	224	82

Rawalpindi Institute of Urology & Transplant

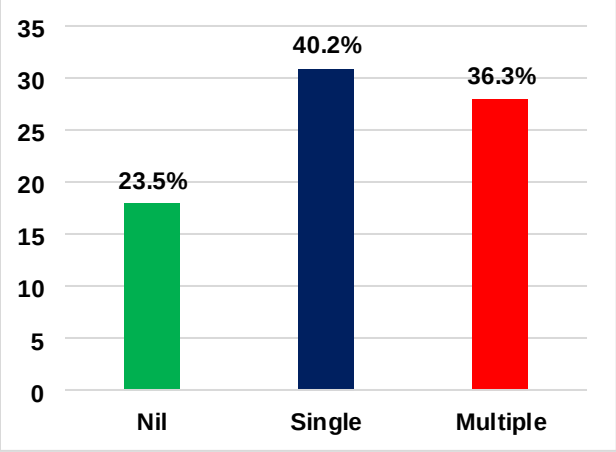
Rawalpindi Institute of Urology treated the major bulk of the patients, with most the stable patients being shifted to RIU&T, whereas critical patients were kept at the hospital where they were received i.e. Holy Family Hospital and Benazir Bhutto Hospital. Total number of mortalities were the case fatality rate was a low 7%, due to this very reason. All of the fatalities were received in critical condition, with 24% requiring ventilatory support. The male to female ratio was once again 2:1, with the average age of the mortalities was found to be 61 years of age. Nearly all of the mortalities were amongst those aged above 40 years and half of those were above 60 years of age. Most mortalities had a single comorbidity, however slightly less had multiple comorbidities. The leading comorbidities were found to be hypertension and diabetes mellitus.



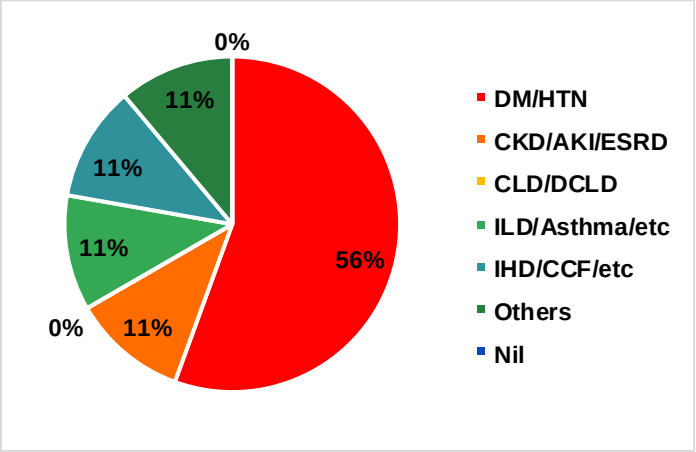
Gender Distribution



Mortalities According to Age Bracket



Distribution of comorbidities amongst Mortalities

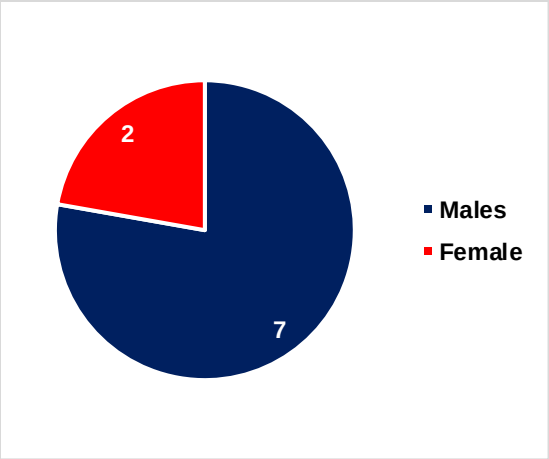


Distribution of comorbidities amongst Mortalities

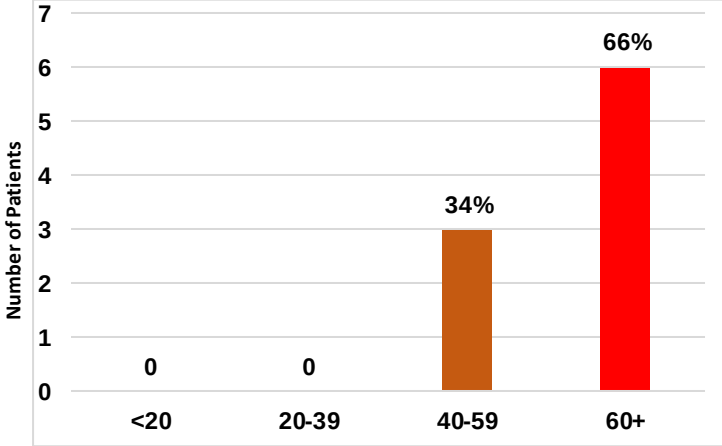
Mild Disease on Admission	Critical Disease on Admission	Required Ventilatory Support
00	385	93

District Headquarters Hospital and Red Crescent Hospital

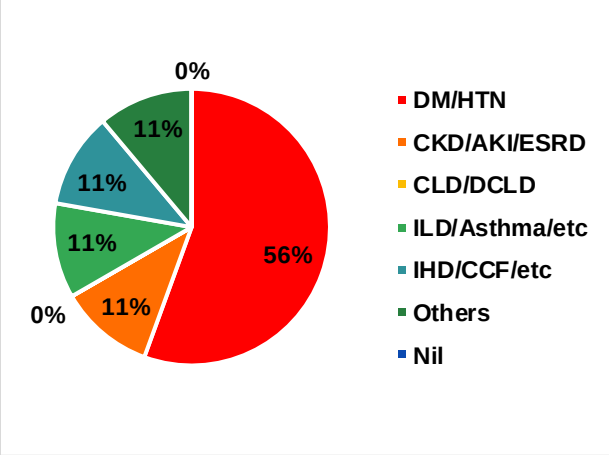
District Headquarters Hospital and Red Crescent Hospital, both played a small but significant role during the pandemic. A total of 9 fatalities were reported at these management facilities. Despite the low number of patients received and kept in these facilities, the deadliness of the disease can realize by mortalities in these facilities. As they were run in conjugation with the remaining facilities, their death rates are considered in the overall death rate. Gender distribution was 7 males to 2 females. The average age of these mortalities was 65, with mostly the older population involved. All patients had comorbidities, with 5 out of 9 having multiple comorbidities. 5 out of 9 patients suffered from either diabetes or hypertension or both. 8 patients were critical on admission, whereas a single patient was in mild condition and 3 patients required ventilatory support.



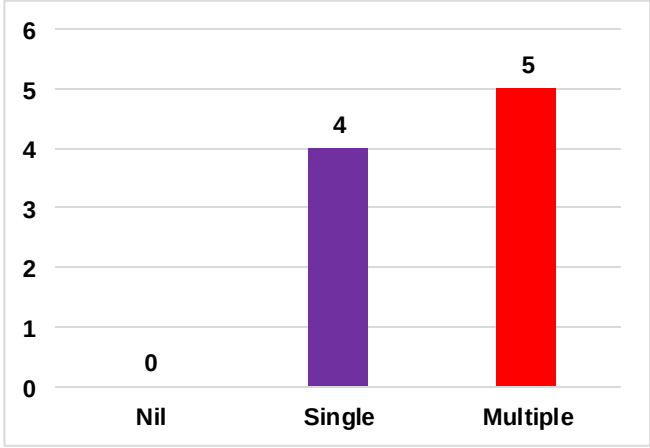
Gender Distribution



Mortalities According to Age Bracket



Distribution of comorbidities amongst Mortalities



Distribution of comorbidities amongst Mortalities

Mild Disease on Admission	Critical Disease on Admission	Required Ventilatory Support
03	06	03

Summary and Findings from Mortality

COVID-19 is a dreadful disease, with an international mortality rate of 7%. The disease was responsible for the collapse of developed and expanded healthcare, like the United States and the United Kingdom. While managing the pandemic, they reported a case fatality rate of 08% and about 07% respectively the national fatality rate stands at about 2.1%. The distribution varies from province to province, with the highest fatality rate being reported in KPK at 3.6%, followed by AJK at 2.7, Punjab at 2.3%, GB at 1.9% and lastly Sindh.

The case fatality rate at RMU was 16.7 and 22.6% amongst recovered cases, most of which were cared for in the ICU. The ratio of males to females was 2:1, with the most deaths amongst those aged above 65 years of age. It was also found that the mortality rate amongst those aged between 40-59 was also significantly high. The mortality rate at RMU was higher than the national average as the University and Allied Hospitals dealt mostly with oxygen dependent or mechanically ventilated patients.

The highest mortality rate amongst the Allied hospitals, was at Holy Family Hospital, which is attributed to the fact that the highest % of critical patients were treated at Holy Family Hospital, followed by Benazir Bhutto Hospital, which is reflected in their mortality rates. Rawalpindi Institute of Urology & Transplant catered to almost all stable patients. It served as the main treatment center for mild to moderate cases, which is reflected in their mortality statistics.

The high mortality rate at Holy Family Hospital can be related to by the following facts:

1. Since BBH/RIU&T were designated as corona management centers, all stable patients who were confirmed to have COVID-19 at Holy Family Hospital, were shifted to BBH or RIU&T. Only patients who were critically ill and required ventilatory support during the early phase of the disease were kept in HFH, resulting in a significantly high mortality.
2. Since BBH was declared a designated corona hospital, all severe patients, especially those with comorbidities and an atypical picture of COVID-19 disease were referred to Holy Family Hospital, explaining why more severe patients were admitted to Holy Family Hospital.

A study conducted in New York, consisting of 5279 patients, out of which 2741 patients required, 24% of patients either died or were discharged to hospices, a morality rate similar to that of RMU and Allied Hospitals, which shows that even the most developed nations, struggled with the similar issues [(1)] .Other findings were also in line with the findings of our studies including a similar gender ratio and age bracket findings. Similar findings were reported

Significant findings in our study also include the correlation of comorbidities and an increased mortality rate. A higher mortality rate was found amongst those patients with comorbidities, with 78% of patients having comorbidities, against 22% who did not. A report from Italy detailing 355 patients who died of mortalities, it was found that the mean number of comorbidities was 2.7 with only 3 patients having no comorbidities[(2)] .Another analysis of 300,000 confirmed cases of COVID-19 in the USA, the mortality rate was 12 times higher in those patients with comorbidities as opposed to those with no comorbidities[(3)]. Another study also confirmed that hypertension and diabetes were associated with the highest number of mortalities [(4)].

Preliminary Analysis of Trends at RMU and Allied Hospitals

Rawalpindi Medical University has been treating patients of COVID-19 since 18th of March 2020, when the flu filter clinic began screening patients at the Allied hospitals: Holy Family Hospital & Benazir Bhutto Hospital.

The University and its Allied Hospitals have screened nearly **28,000** patients at the flu filter clinics, out of which about **4000** were suspected to be infected. **2,094** cases have been confirmed, out of which **1,209** have recovered and **348** died. **500** patients have currently been placed for home isolation.

16th March – 30th June 2020

Hospital Name	Flu Filter Clinic	Total Suspects	Total Confirmed Cases	Confirmed Admitted	Suspects Admitted	Total Discharged	Shifted Out	Death	Home Isolation
Benazir Bhutto Hospital	21457	2645	967	44	32	127	423	160	213
Holy Family Hospital	4382	1029	484	14	07	60	170	104	136
Institute of Urology	00	00	1083	55	00	794	24	75	135
District Headquarters	2124	360	123	00	06	63	41	06	13
Sports Complex Field – HOS	00	00	00	00	00	00	00	00	00
Red Crescent Field Hospital	00	00	170	05	00	165	00	03	03
Total	27,963	4,034	2,094	118	45	1,209	658	348	500

Table: Cumulative Stats of COVID-19 patients treated at RMU Allied Hospital.

This data was analyzed by the University Database Group. Some initial trends have been shown in as under. It is pertinent to mention here that there are some limitations of data, this is cleansed data and has not been statistically analyzed. This is a general analysis only. Secondly, this is the analysis of admitted patients and does not include comprehensive community data.

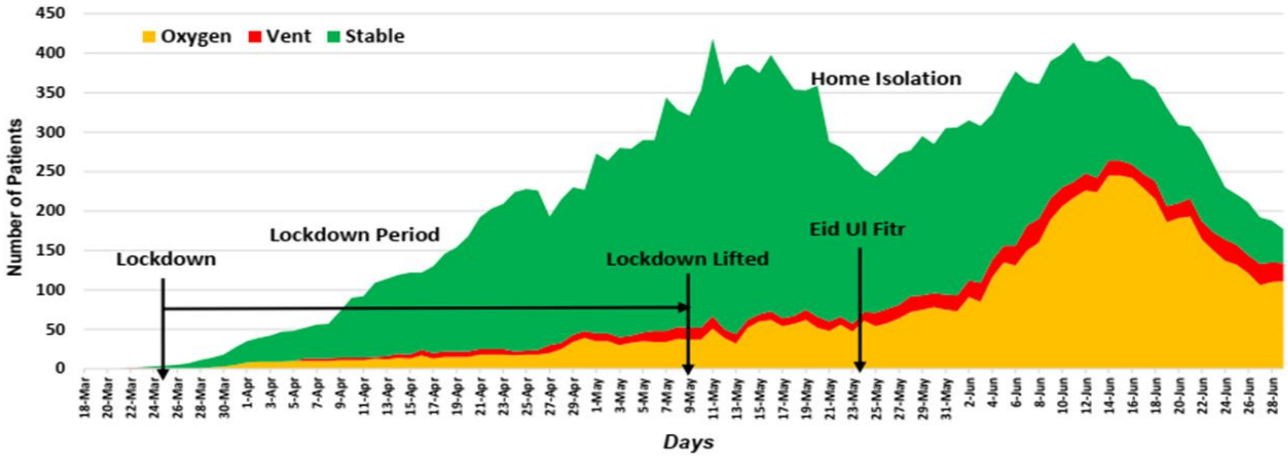


Figure 1: Trends of admitted patients according to severity of disease

Figure 1: Limitations and caveats.

Please keep in mind while analyzing the figure 1:

1. Initially there was no community spread; only specific imported population was infected.
2. After couple of weeks time, community spread increased, resulting in a rising number of infected cases (Shaded Green).
3. Every infected (confirmed), asymptomatic or symptomatic patient was admitted in hospitals, resulting in an increased number of hospital cases.
4. "Home Isolation Policy" later on resulted in a decrease number of hospital admitted cases (Shaded Green).

First Peak

The first peak of cases was reached slowly over a period of 56 days on 11th of May 2020, after the index case was admitted in Rawalpindi Medical University and Allied Hospitals on 24th of March 2020. Very little was known about the virus at that time including how it spreads and infects individuals. There was continued social gathering and violation of standard operating procedures, enhancing the transmission risk. A lockdown in Punjab was announced on the 25th of March, that is why the rising trend was a gradual and expected rise. Cases were limited to imported cases initially from the Iranian border and international flights, gradually disease spread into community and also in four provinces resulting increase number of infected cases. **The initial rising trend in the hospitals was due to the admission of ALL CONFIRMED cases in hospital, resulting in the first peak, in spite of the lockdown. So, this peak was "Selective".**

First Trough

First trough was due to the new policy of "Home Isolation", introduced by the health department. After which only symptomatic and serious infected cases, were admitted to the hospitals, rest were isolated at home. This resulted in a decrease in hospital admitted cases as shown in Figure 1 and figure 2.

Second Peak

The Second peak followed the Eid holidays after lifting up of the lockdown. This very well may be the aftermath of the Eid shopping surge. A huge number of the population went for shopping and social gathering at one point of time, got exposed and later infected. The incubation period of SARS2 virus, averages 3-10 days. Exactly after 10 days of Eid, the cases started rising, especially oxygen dependent cases (Shaded Yellow) and ventilated Cases (Shaded Red). This trend continued to raise leading to the highest peak from the 10th to 18th June 2020, this trend followed the natural history of COVID-19 disease pattern.

Second Trough:

After 15 days, most of the cases started recovering, some unfortunately died, following the natural course of COVID-19 disease and the second trough started. The reason for the second trough was that maximum urban population had been exposed at one given point of time on EID and is now in the recovery phase. New cases have started decreasing because the number of unexposed populations has reduced.

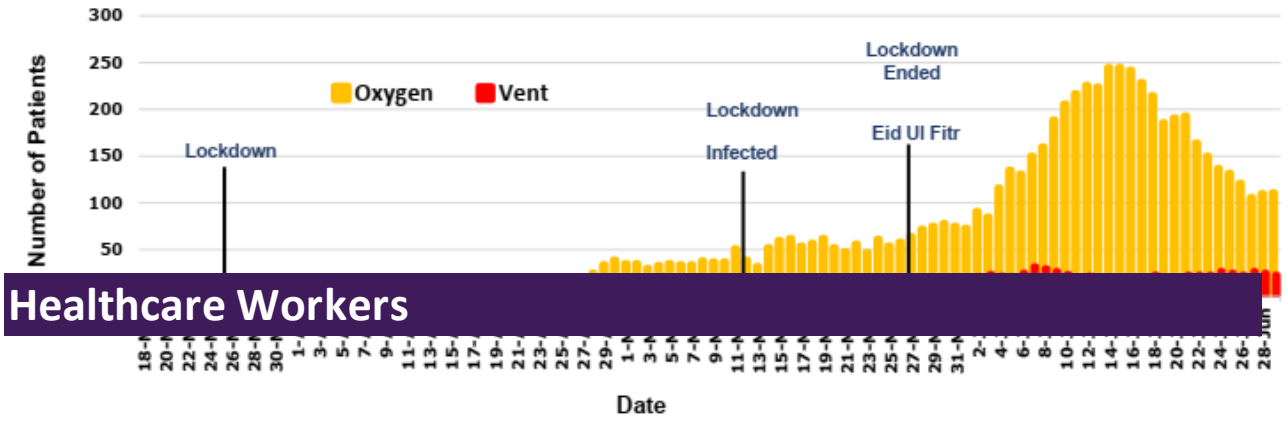


Figure 2: Bar diagram of seriously ill patients admitted in RMU & Allied Hospitals

One of the major challenges faced worldwide was the protection of their frontline healthcare workers. All over the world, countless healthcare workers, including doctors, nurses and paramedics. The university went out and beyond to ensure the safety of their staff, by ensuring up to the standard personal protective equipment and regular testing, to ensure protection was adequate.

A brief analysis revealed that infection rate was high in healthcare workers who were exposed to potential carriers elsewhere in the hospital, for example the general wards, the gynecology department, surgical wards. Once these locations were traced, extra precautions were taken to ensure safety of patients and healthcare workers alike.

Amongst those infected, the infection was relatively mild, despite high exposure levels within the isolation wards and ICUs. A surprising finding was that infectivity rates at DHQ hospital were almost the same as other hospitals, which supported the finding that healthcare workers were also being exposed during routine patient care, partially attributed to surge in prevalence of the disease in the society.

As of 26/06/2020, over 1302 healthcare workers were tested in the Allied Hospitals, with 256 testing positives at 19.6%. The most infections were amongst the nurses, followed by the paramedics and then doctors.

HCW	Doctors				Nurses				Paramedics				Total			
	Total	+ve	-ve	Awaited	Total	+ve	-ve	Awaited	Total	+ve	-ve	Awaited	Total	+ve	-ve	Awaited
RIUT	55	07 (12.7%)	47	01	133	20 (15%)	113	00	21	04 (19%)	17	00	209	31 (14.8%)	177	01
BBH	332	58 (17.5%)	274	00	164	25 (15.2%)	139	00	60	03 (5%)	57	00	556	86 (15.4%)	470	00
HFH	82	33 (40.2%)	49	00	72	31 (43.1%)	41	00	48	23 (47.9%)	25	00	202	87 (43%)	115	00
DHQ	145	11 (7.5%)	134	00	80	21 (26.3%)	59	00	110	20 (18.2%)	90	00	335	52 (15.5%)	283	00
Total	614	109 (17.7%)	504	01	449	97 (21.6%)	352	00	239	50 (20.9%)	189	00	1302	256 (19.6%)	1045	01

Hospital wise Breakdown of COVID-19 Testing in Healthcare Workers

This is thought to be attributed to the nature of work and duration of exposure. The highest positive rate amongst hospitals was at Holy Family Hospital at 43%, with paramedics being the most infected, followed by nurses and doctors. Amongst the remaining 3 hospitals, the infectivity rate was nearly the same at 15%.

	Total	Positive		Negative	Awaited
Doctors	614	109	17.7%	504	01
Nurses	449	97	21.6%	352	00
Paramedics	239	50	20.9%	189	00
Total	1302	256	19.6%	1045	01

Summary of HCW's COVID-19 Testing in RMU & Allied Hospitals

Training for COVID-19

Considering the novelty of the disease and the little we knew about it, we had very little to act on and information was updated on a day to day basis. Despite the huge influx of information, the basics remained the same i.e. ICU management and the proper use of personal protective equipment.

The Department of Infectious Diseases, in accordance with the department of medical education and the ICU arranged training sessions and workshops in the Allied Hospitals on a regular basis. The target of the training was to certify and educate not only all healthcare providers but paramedical staff on the proper use of PPE.

Hospital	Professors	SRs	PGTs	MOs	HOs	Nurses	TOTAL
HFH	06	23	115	62	85	125	416
BBH	02	10	16	40	60	80	208
DHQ	01	02	03	20	20	20	66
RIUT	-	-	-	30	-	72	102
TOTAL	09	35	134	152	165	297	792

Staff Trained for ICU/Ventilators = 350

Apart from the proper use PPE, another important issue to address was the large number of patients being admitted in the ICUs. The issue highlighted the lack of trained staff. To tackle this, workshops and classes were arranged and nurses were briefed on the basis of ICU management and ventilatory care of patients.

Not only were training sessions arranged on the ground, but a certificate course in COVID-19 management was arranged. This course consisted of 2 modules and they both were taught online through zoom. These were attended by over 300 attendees and each attendee was certified by Rawalpindi Medical University in the proper use of PPE and general and ICU management of COVID-19 patients.

Training Session in D!D, Holy Family Hospital

Training Session in RIU&T

Cost Incurred per Patient

Being thorough is one of the qualities Rawalpindi Medical University prides itself on. Part of being thorough included calculating the cost spent by the hospital on treating patients of different categories of COVID-19 patients. The cost variation over the different categories increased with the severity of the disease, however these charges did not include the cost incurred by ventilatory support and only included supportive costs. The cost is a rough estimate but the gave the hospital an idea about the funds they'd have to ensure to make sure patient care remains uninterrupted.

LABORATORY AND IMAGING					
ISOLATION	COST/RS	INFECTED WARD	COST/RS	ICU/HDU	COST/RS
CBC x 3	600	CBC x 10	1200	CBC x 20	2400
X Ray x 3	900	X-Ray x 5	1500	X-Ray x 5	1500
Other Tests (LFTS, RFTS) x 3	3000	Other Tests (LFT'S, RFTS, ABGS) x 5	5000	Other Tests (LFT'S, RFTS, ABG'S, LDH, ETC) x 10	10000
IV Fluids x 5	500	IV Fluids x 10	1000	IV Fluids x 10	1000
Supportive Treatment + Antivirals	10000	Supportive Treatment + Antivirals	20000	Supportive Treatment + Antibiotics/Antivirals	30000
I/V Cannula x 4	200	I/V Cannula x 4	200	I/V Cannula x 4	200
TOTAL	15,200	TOTAL	28,000	TOTAL	44,200

Cost incurred per 10 days

Human Resources Procurement

With the large influx of patients and the risks associated with prolonged exposure, especially in the ICUs, a large workforce was required to combat the disease. With the opening of RIU&T, the new corona care center, and conversion of BBH into a corona hospital, despite deputing staff from the Allied Hospitals, the human resources available was always less than the required amount. With doctors and other staff being infected while serving and the guidelines set by the government, the gap was large.

In order to overcome this shortcoming, the government sanctioned walk in interviews, giving an opportunity to all doctors to join in the fight. Human Resources were hired and distributed according to guidelines issued by the government.

HR for Isolation ward/Room

HR	Per Shift	Per Day	200 Patients / Day	200 Patients / 3 Weeks	Total
# of Patients	30 Patients				
MO	1	4	28	28 x 3 = 84	84
Nurses	2	8	56	56 x 3 = 168	168

HR for HDU/ICU

HR	Per Shift	Per Day	20 patients / Day	20 Patients / 3 Weeks	Total
# of Patients	10 Patients				
MO	1	4	8	8 x 3 = 24	24
Nurses	2	8	16	16 x 3 = 48	48

Total HR required for 220 Patients: Medical Officers: 108, Nurses: 216

HR	Per Shift	Per Hospital	Per 4 Hospitals /3 Weeks	Total
Senior Registrars	1	3	12 x 3	36

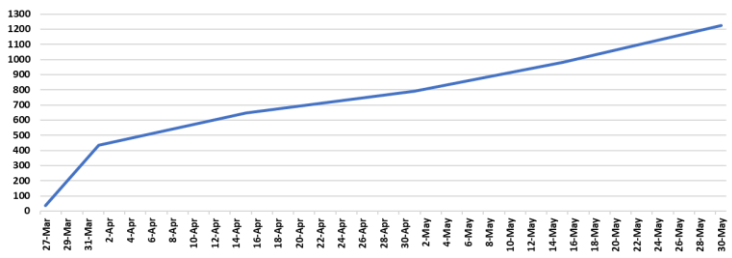
HR Requirements according to CEAG Guidelines

RMU Telemedicine Helpline

The telemedicine center at the Rawalpindi Medical University is currently offering round the clock teleconsultation through the connectivity provided via the mobile phone and live video consultation to the patients. The center is a part of the chain of telemedicine centers being established by the Government and the Chief Minister of the Punjab consisting of around 150 mobile phone lines and web-based video consultation solution that the Government is offering in conjunction with the UK based telemedicine solution provider "Medical City. Online", forming the largest of its kind 24/7 online health consultation provision network in the country. The telemedicine center can be accessed through the free UAN Calling Number 0304-1112101 while the video consultation can be arranged through visiting the web portal "doctors247.online". It is worthwhile to mention that both the mobile based and video consultation services are free for the public.

RMU is also hosting dedicated video conferencing portals in arrangements with the district government that are connected to the Basic Health Units of four of the most densely populated union councils of Rawalpindi including Rehmat Abad, Kotha Kalan, Dhok Mustaqeem and Dhok Mungtal. Rawalpindi Medical University along with its team of dedicated doctors are playing their role in community welfare by joining hands with the Government of the Punjab to facilitate the public in all ways possible.

Although established in wake of the COVID-19 pandemic and to provide the consultation for Corona infection related concerns of the public, in just under a week of its establishment, the center has already catered to the needs of over 500 patients, not only in their COVID-19 related concerns, including its identification, prevention and care of suspected patients; but also for management of other health related problems as well as in facilitating in matters where the public is facing difficulties due to the current lock down.



Advisor to CM visiting Telemedicine Center

Research

Research work on a novel disease is a rare opportunity to work at par with international research projects. Rawalpindi Medical University has been leading the way with research projects on COVID-19. RMU has also been facilitating researchers from other departments as well as the NIH.

A brief overview of research projects being undertaken are as follows:

No	Title	Department	Current status
1.	Psychological Impact and Coping Strategies of Health Care professionals during the Outbreak of Coronavirus Disease 2019 (COVID-19) in Pakistan	Community Medicine	Submitted to Asia Pacific Journal of Public Health
2.	Opportunities and development of Telemedicine in response to COVID- 19: Experience from Public Sector Medical University	Community Medicine	Submitted to BIOMEDICA
3	Experimental use of COVID-19 convalescent plasma for the purpose of passive immunization in current Covid-19 Pandemic in Pakistan in 2020	NIBD Karachi	Ongoing
4	Comparison of Chest X- Ray findings in COVID-19 suspected and confirmed cases at RMU; A Retrospective Comparative Study	Radiology- BBH	Ongoing
5	Preparedness of Health care professionals against coronavirus disease 2019 outbreak	Psychiatry- BBH	Ongoing
6	A Predictive Model for clinical diagnosis of COVID-19	Medicine - DHQ	Ongoing
7	An enabled preliminary diagnosis for COVID-19 from cough samples via A mobile application	NUST	Ongoing
8	An Overview of preliminary COVID-19 cases admitted at Rawalpindi Institute of Urology Transplantation	Medical Education	Lupine publishers open Access journal "Research & Reviews on Healthcare"
9	Telemedicine Services at Rawalpindi Medical University: An initiative to optimize healthcare of the patients during COVID-19 Pandemic	Community Medicine	Lupine publishers open Access journal "Research & Reviews on Healthcare"
10	Analysis of COVID-19 Mortality in Allied Hospitals of Rawalpindi Medical University Pakistan	DME	Accepted for publication in BIOMEDICA
11	Use of DASS 21 Scales among COVID-19 patients: Measurement of Psychological Impact and Tool Reliability in Pakistan	MU-I-HFH	Submitted for publication
12	Gender based comparison of Psychological Distress among COVID-19 patients at Rawalpindi Institute of Urology & Transplantation Pakistan	MU-I-HFH	Complete
13	Clinical characteristics of COVID-19 patients managed at RIUT	MU-II-HFH	Ongoing
14	Biochemical characteristics-based evaluation of mild and moderate to severe COVID- related illness managed at RMU	MU-II-HFH	Ongoing
15	Hematological profile abnormalities; comparison of patient with mild and moderate to severe COVID related illness	MU-II-HFH	Ongoing
16	CXR abnormalities analysis of COVID19 patients; RMU experience	MU-II-HFH	Ongoing
17	Stress evaluation of health care workers involved in COVID-19 patient management	MU-II-HFH	Ongoing
18	Stress evaluation of COVID 19 infected patients	MU-II-HFH	Ongoing
19	Source of infection in COVID-19 infected patients managed at RMU attached hospitals	MU-II-HFH	Ongoing
20	QOL evaluation in COVID- 19 patients	MU-II-HFH	Ongoing
21	Neutrophil lymphocyte (NL) ratio: COVID 19 Rawalpindi experience	MU-II-HFH	Ongoing
22	2 months comparison of Covid-19 pandemic: Pakistan and other countries	MU-II-HFH	Ongoing
23	Epidemiological trends of COVID 19 infections; malaria, dengue and BCG vaccination-based Comparison	MU-II-HFH	Ongoing
24	Symptoms analysis of confirmed COVID-19 patients managed at allied hospitals of RMU	Medicine- DHQ	Ongoing

Drug Trials

Rawalpindi Medical University has been involved with several multicenter national drug trials on COVID-19. The novel disease has no known effective treatment available at the moment, however going through historical evidence and past theories, many drug regimens were thought to be effective, including HCQ, azithromycin, etc. However, the whole world was at the edge of their seats, waiting for the smartest minds to come up with the wonder drug to treat COVID-19.

Rawalpindi Medical University, determined to play their part and make an impact during the pandemic, enrolled into such drug trials.

- PROTECT drug trial:

PROTECT drug trial is a multicenter drug trial hosted by University of Health Sciences, Lahore. The objective of the trial is to determine the efficacy of Hydroxychloroquine, Azithromycin and Oseltamivir, individually and in combinations. Enrollment started on the 16th of April, with Rawalpindi Medical University enrolling the first patient. Since then, multiple centers from all over Pakistan, joined the trial. Initial findings are due to be released sometime in the 3rd week of July.

Trial Inauguration at RMU

RMU Team at UHS Lahore for Preliminary Results of PROTECT Trial

- ## Tocilizumab Trial

The government of Punjab, initiated a provincial drug trial on the efficacy of tocilizumab in the treatment of COVID-19. Major centers, including RMU were enrolled throughout the province. The trial was initiated on the 13th of June 2020.

- ## Convalescent Plasma Drug Trial in partnership with NIBD, Karachi

RMU has the honor of being part of "Experimental Use of COVID-19 Convalescent Plasma for the Purpose of Passive Immunization in Current COVID-19 Pandemic in Pakistan in 2020", led by Dr Tahir Shamsi. RMU is being led under the dynamic supervision of Vice Chancellor Prof Muhammad Umar, Prof Bushra Khar and Prof khurram (Dean of Medicine). Dr Lubna Meraj is the focal person to handling all perspectives of the study and making a volunteer team of RMU, Supported by Dr Asif Abdul Majeed, blood bank in charge, supervision of Prof Nadeem Akram, Hematologist in BBH.

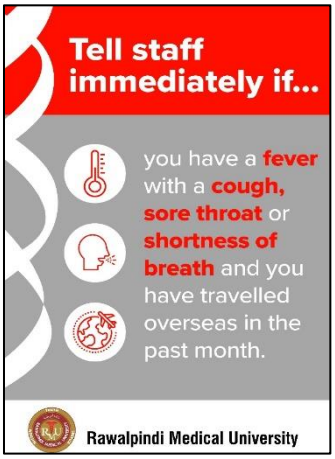
Passive immunization involves the administration of antibodies against a given agent. the aim for the purpose of preventing or treating an infectious disease due to same disease. A general principle of passive antibody therapy is that it is more effective when used for prophylaxis than for treatment of disease. When used for therapy, antibody is most effective when administered shortly after the onset of symptoms. The reason for temporal variation in efficacy is not well understood but could reflect that passive antibody works by neutralizing the initial inoculums, which is likely to be much smaller than that of established disease. No vaccine is available and no treatment has been discovered till now, the only hope is in Convalescent Plasma, which is taken from healed patients affected by corona disease for 2 weeks after its 2-week recovery.

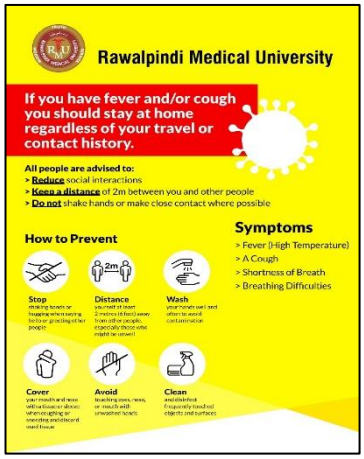
Further on down the line, the UHS is holding talks with the University to start a trial on the efficacy of infliximab and doxycycline.

Public Awareness and Health Education

The University has a responsibility to give back to the society in terms of education. RMU has churned out hundreds of world class doctors over the years and it was only right to educate the public in the same way, especially considering how little was known about the disease.

The community medicine department played a very proactive role by holding multiple campaigns for this very purpose. Flyers were hung throughout the city and volunteers from the department educated the general public on the basics of ensuring adequate sanitation for COVID-19 protection. The Department of Infectious Diseases was invited to several different forums all over the city to help educate on COVID-19.





A. Training Program at RMU & Allied Hospitals

B. COVID-19 Awareness Seminar at Baharia Town, Islamabad

C. COVID-19 Training Session at NORI Hospital, Islamabad

Media Awareness

With the media as clueless as the general public about the disease, all eyes were upon the leadership of the University to guide the way forward. It was only natural to be afraid at this point. In order to spread a message of knowledge and to enlighten the masses about the few but effective measures they must make, media awareness seminars were conducted and question answer sessions were held with the professionals to ensure no confusion remains. Not only that, but the worthy vice chancellor appeared on TV shows, along with the Head of Infectious Diseases giving interviews to ensure a message of caution and how little we have to do to ensure our safety reached the masses.

Media Awareness Regarding COVID-19 at RMU & Allied Hospitals

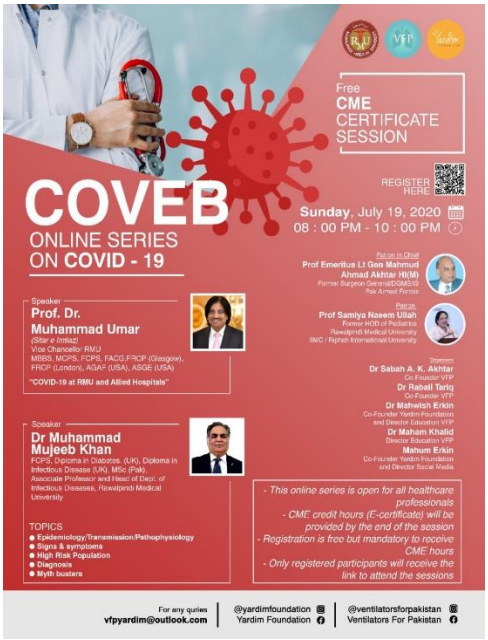
Webinars and Online Classes

Understanding the contagiousness of the diseases and the aspect of social distancing, it was impossible to hold training sessions and classes in person, once the disease entered the region. Once it did, focus was shifted on making all classes and session digital and online, so as business could be carried out on routine basis.

The infrastructure involved in completing such as task was mostly web and app based, which made access more convenient and easier at a safe location. Likewise, it helped the university explore the horizon in terms of how much content is now digital and how the University could use this chance and leap bound into the future.

Once the pandemic hit, all training sessions were held online and so were medical student classes. The system was based in the department of Medical Education, from where the session would be recorded or streamed. These sessions were interactive and allowed everyone to be equally involved in them.

Apart from this, a weekly online session was held with the frontline and correspondence abroad to ensure patient care is UpToDate and the latest guidelines and guidance are followed. A certificate course in COVID-19 was also offered as an online course, which was held weekly.

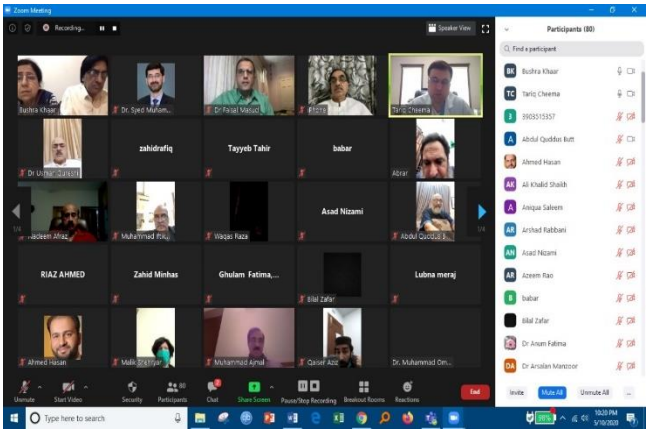


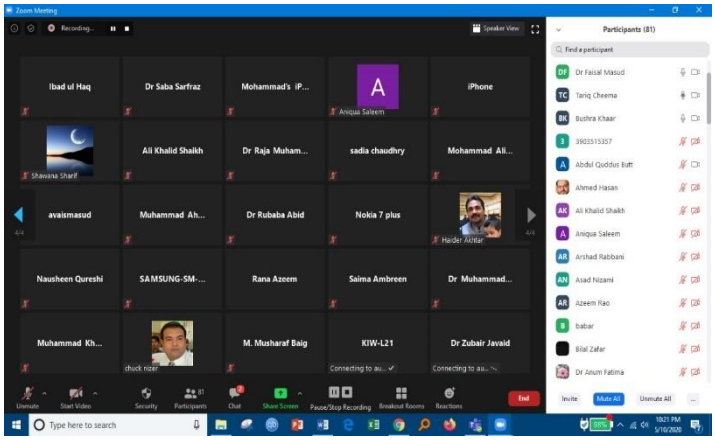
Online Webinars and Case Discussions of COVID-19

COVID-19 Online Management Meeting

A weekly meeting was held via an online platform, such as zoom or Microsoft team. The meeting included international alumni who are working as consultants, managing and treating COVID-19 all over the world. The purpose of these meetings was to discuss patient management options from all over the world and run through the issues we are facing. Their valuable suggestions were listened to by an audience consisting of consultants and the core management team, dealing with COVID-19 at RMU and Allied Hospitals.

Their valuable input allowed us to raise our standards of care to those of an international level and their contribution is highly appreciated and we welcome their input in future times of crisis.





Online Meetings with international Correspondence, regarding COVID-19 Management

Rawalians COVID-19 Taskforce

Rawalians have always stood up for their fellow Doctors and healthcare workers. Supported by the alumni of RMU and Vice Chancellor, established a taskforce, with the sole purpose of making sure their brethren remain safe. Since the starting of the pandemic, the taskforce has collected and given donations to doctors all over Pakistan. The taskforce consists of an international chapter, regional chapter and local chapter.

The taskforce has received donations of Personal Protective Equipment, ventilators, sanitizers, masks, from all the globe. Till now it has made sure an uninterrupted supply of PPE and other necessary equipment remains available.

Rawalian COVID-19 Task Force Office

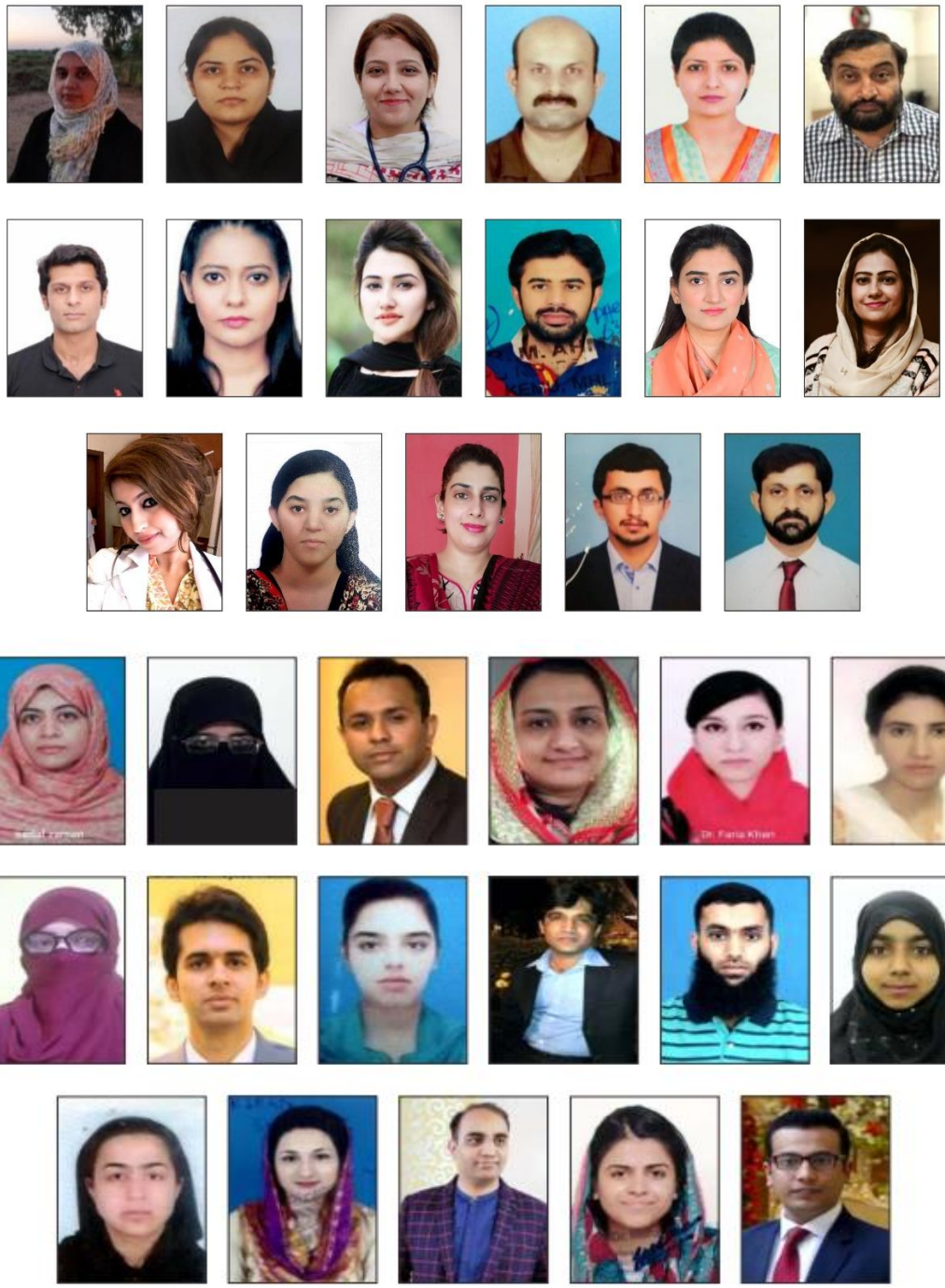
RAWALPINDI MEDICAL UNIVERSITY

RAWALPINDI MEDICAL COLLEGE

مَن قَتَلَ نَفْسًا بِغَيْرِ نَفْسٍ أَوْ فَسَادٍ فِي الْأَرْضِ فَكَأَنَّمَا قَتَلَ النَّاسَ جَمِيعًا (32) Almeeda

"Tribute to the frontline warrior who are putting their life at stake to save others human life"

RMU Hero of our Covid 19 WAR



COVID-19 Warriors of RMU

مَن قَتَلَ نَفْسًا بِغَيْرِ نَفْسٍ أَوْ فَسَادٍ فِي الْأَرْضِ فَكَأَنَّمَا قَتَلَ النَّاسَ جَمِيعًا Almeeda (32)

"Tribute to the frontline warrior who are putting their life at stake to save others human life"

RMU Hero of our Covid 19 WAR

COVID-19 Warriors of RMU

Gallery


Visit of Health Minister, Yasmeen Rashid


COVID-19 Clinical Management Teams at RMU & Allied Hospitals


Light Moments in these Times of Crisis

Gallery

VC RMU visiting the frontline nursing team

Frontline team ready to fight COVID-19

Frontline Warriors

Thumbs Up!!

Entering the Mouth of the Beast