



# COVID-19: Transformation of Inpatient Health Care Services of Musculoskeletal and Sports Medicine Service Line in a Tertiary Care Hospital of LMIC; Cross Sectional Study

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## Abstract

**Introduction:** COVID-19 pandemic challenged the functioning of health care organization and shifted the focus on preventions, spread and treatment of COVID-19. The hospitals had to shut down outpatient clinics, and suspend elective surgeries. The hospital organizations had to spend for creation of COVID units and procurements of PPEs. A retrospective cross-sectional study was conducted to analyze changes in terms of nursing care, functioning of inpatient areas, admissions, use of PPEs, and exposure of HCW to COVID-19 Disease.

**Materials and Methods:** Data was collected over the period of 20 weeks from January 1<sup>st</sup> till May 31<sup>st</sup>, 2020 and time period was split into two halves of 10 weeks each, Pre-COVID and COVID era respectively. Following variables were recorded through a structured Performa; number of admissions, operations, number of days in COVID isolation, and daily census patient nurse ratio, involvement of HCW, data of HCW and use of PPEs. The data was compared in two time periods Pre-COVID and COVID era. Wilcoxon rank sum test for two independent samples was used to assess the group difference and p value of  $\leq 0.05$  was considered statistically significant.

**Results:** The admissions were reduced by 50% in COVID era ( $p < 0.001$ ). Elective surgeries were reduced -65.95% and emergency work was decreased - 36.30%. The total number of HCW reduced significantly in inpatient areas comparing both time periods Pre-COVID vs. COVID ( $p < 0.001$ ). On the other hand, sick leaves were reported more during COVID era (0.0001). Nursing staff utilized most of their casual and earn leaves during COVID era. Only three HCW were infected with COVID who recovered very well.

**Conclusion:** COVID-19 drastically impacted the musculoskeletal inpatient services, in terms of admissions, elective surgeries and outpatient clinics; a major source of revenue generation. Hospital had to spend lot of money for procurement of PPE, creation of COVID Units and compensation of HCW. Essential modifications in health care practices proved to be very effective in prevention disease.

**Keywords:** COVID era; Pre-COVID era; Health Care Workers (HCW); Inpatient; Outpatient clinics

## Abbreviations

PPE: Personal Protective Equipment; SOP: Standard Operating Protocols; HCW: Health Care Workers; WHO: World Health Organization; CDC: Communicable Disease Centre; PCR: Polymerized Chain Reactions

## Introduction

The Chinese government declared an outbreak of novel Coronavirus (COVID-19) in December 2019 that originated from Wuhan Province. World Health Organization (WHO) categorized novel coronavirus a 'Public Health Emergency of International Concern (PHEIC) on January 30<sup>th</sup>, 2020, considering the rapid mode of spread and non-availability of definite treatment options [1].

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Since then COVID-19 has spread all over the world with high rate of morbidity and mortality. The symptoms of COVID-19 disease are variable ranging from mild flu to pneumonia, ARDS and multi organ failure [2].

In Pakistan, the first case of coronavirus was reported on February 26<sup>th</sup>, 2020 at our University Hospital [3]. The Government of Pakistan developed an action plan named “National Action Plan for Preparedness & Response to Coronavirus Disease (COVID-19) Pakistan” to control the spread of virus in Pakistan. Standard Operating Procedures developed by the Government are being implemented across the country through law enforcement agencies [4]. WHO pronounced COVID-19 Pandemic on March 11<sup>th</sup>, 2020 [5]. Following the guide lines of WHO, Government of Pakistan enforced lockdown across the country on March 13<sup>th</sup>, 2020.

With implementations of SOP, the working and day to day functions of hospital changed radically. The main focus of hospital organizations was on prevention, spread and treatment of COVID-19. The hospital shut down outpatient clinics, postponed elective surgeries and took appropriate measures to accommodate overwhelming patients of COVID-19 [6]. The hospital organizations created a COVID zone for screening and testing, isolation wards, and negative pressure operating rooms. Significant resources were diverted towards procurement of PPEs, ventilators, monitors and training of staff. These measures were detrimental for financial survival of hospitals [7].

Aligning with international guidelines our Musculoskeletal and Sports Medicine (MSM) service line as per directives from Department of Infection Prevention and Hospital Epidemiology (DIPHE) developed policies and transformed the health care practices. These measures included screening, social distancing, mandatory use of face masks by patients and Health Care Workers (HCW) limiting non-emergent admissions and elective surgeries.

Majority of the hospitals deferred all the elective surgeries and entertained only emergent work. Nepogodiev and Bhangu [9] estimated that a total of 28,404,603 elective operations would be canceled or postponed worldwide due to COVID-19 to provide beds and conserve PPEs for Corona patients. Following a similar trend in Hong Kong, clinical outpatient visits in orthopedics were reported to decrease by 29.4% (from 11,693 ± 2,240 to 8,261 ± 1,104 per week;  $p < 0.001$ ) [10]. The same study reported reduction in orthopedic operations by 44.2%, from 795 ± 115.1 to 443.6 ± 25.8 per week ( $p < 0.001$ ), with the ratio of emergency to elective operations increasing from 1.27:1 to 3.78:1 [10]. Another report by Commonwealth Fund in May 2020 [11] showed 60% reduction in outpatient clinic volumes.

Our orthopedic emergency bay was limited to emergency cases like infections, tumors, open injuries and lacerations while all elective surgical work was postponed because of low clinic volumes. Due to reduction in elective surgical procedures, our inpatient volumes went down.

Moreover, remarkable changes were observed in the health care practices like those of nursing care, protocol of patient care, frequency of ward rounds by consultants, use of PPEs, bed allocation in general ward and patient to nurse ratio in the inpatient area of MSM service line. Based on the above modifications, a retrospective cross-sectional descriptive study was conducted to analyze various changes in the MSM service line in terms of nursing care, functioning of inpatient

areas, admissions, use of PPEs, exposure of HCW to COVID-19 and financial implications of COVID-19 disease on patients and HCW.

## Material and Methodology

A retrospective cross-sectional descriptive study was conducted at private tertiary Hospital in Karachi, Pakistan. To study the various changes in the in-patient area, a comparative study in two periods of ten weeks each was conducted. Data was collected over the period of 20 weeks from January 1<sup>st</sup> till May 31<sup>st</sup>, 2020. The first 10 weeks were labeled as Pre-COVID period from January 1<sup>st</sup> till March 15<sup>th</sup> 2020, when all clinical activities were routinely conducted like normal clinics, routine emergency and elective surgical work. The second ten weeks from March 16<sup>th</sup>, 2020 to May 31<sup>st</sup>, 2020 were labeled as COVID period; when only emergency and semi-emergent work was done. The data was collected through Hospital Management system and operating room and following variables were recorded through a structured Performa; number of admissions, number of surgical operations, number of days in COVID isolation, frequency of COVID tests and daily censes patient nurse ratio, involvement of HCW, isolation record and data of HCW and use of PPEs. The data was compared during two time periods: pre-COVID and COVID era.

All Health Care Workers (HCW) who were working in orthopedic service line were the part of the study. However, trainee-nurse and -doctors, housekeeping staff and those staff whose data was not available were not included in the study. Ethical approval was taken from the Ethical Review Committee of the institute (ERC number 4967). Data was entered in STATA version 15.0. For quantitative descriptive analysis, median and interquartile ranges were calculated. Wilcoxon rank sum test for two independent samples was used to assess the group difference and  $p$  value of  $\leq 0.05$  was considered statistically significant.

## Results

For purpose of descriptions the data was segregated into following categories; inpatient volumes (admission and surgeries), involvement of health care works (in terms of infection, leaves including sick and casual), use of PPEs, structural and organizational changes in the inpatient areas.

### Inpatient volumes

The total number of admissions were reduced significantly in COVID era ( $p < 0.001$ ) (Table 1). The admissions were reduced by 50% from 417 (Pre-COVID) to 208 (COVID). Furthermore, there was a reduction in both emergency and elective cases in COVID era. However, elective surgeries were reduced to from 423 to 144 in COVID era; a 66% reduction while emergency volume was also

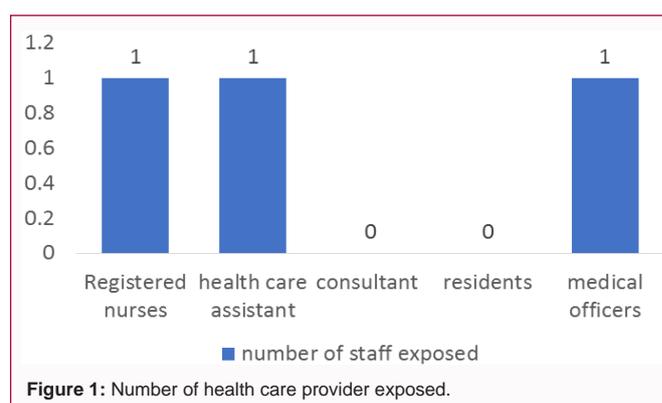


Figure 1: Number of health care provider exposed.

**Table 1:** Inpatient volume status between Pre-COVID and COVID era.

S#	Variables	Pre-COVID Era n (%)	COVID Era n (%)	% decrease	p-value
1	Number of admissions	417	208	-50.1%	
2	<b>SURGERIES</b>				
	Clinic Admission	423(71.6%)	144 (57.4%)	-65.95%	<0.001
	ER	168 (28.4%)	107 (42.6%)	-36.30%	

**Table 2:** Inpatient healthcare provider's assignment between Pre-COVID and COVID era.

S#	Variables	Pre-COVID ERA Median (IQR)	COVID ERA Median (IQR)	P-Value
1	Total no of nurses and nursing assistants at floor per day	39 (36-41)	20 (16-26)	<0.001
2	Sick leaves reported per day	2 (1-2)	2 (2-6)	0.0001
3	Casual leaves, earn leaves, and due offs reported per day	4 (3-5)	10 (6-11)	<0.001

**Table 3:** Difference in use of PPEs between Pre-COVID and COVID era.

S#	Variables	Pre-COVID ERA Median (IQR)	COVID ERA Median (IQR)	P-Value
1	No of Gloves utilized per day	1086 (900-1300)	757 (600-900)	<0.001
2	Gowns utilized per day	15 (9-20)	10 (0-40)	0.5314
3	Masks (surgical & N95) used per day	10 (1-19)	70 (50-84)	<0.001
4	Alcohol Swabs utilized per day	300 (250-320)	250 (186-300)	0.0015
5	Shoe covers, caps, and other PPEs used per day	0 (0)	1 (0-22)	<0.001
6	Sanitizer utilized per day	10 (4-14)	2 (1-3)	<0.001

reduced from 168 to 107; a 36% reduction. The emergency cases were reduced due to lock down in the city in early part of COVID era.

### Involvement of HCW

The total number of nursing staff, healthcare assistants, and Unit receptionists were reduced significantly in inpatient areas comparing both time periods Pre-COVID vs. COVID ( $p < 0.001$ ) (Table 2). On the other hand, sick leaves were reported more in all three shifts (morning, evening, and night) during COVID era (0.0001); probably HCW wanted to avoid duties to protect themselves from contacting COVID-19. Nursing staff utilized most of their casual and earned leaves during COVID era while due offs were also given more in COVID period ( $< 0.001$ ).

### Use of PPEs

The utilization of face masks, N95 masks, shields, gowns and shoe covers increased by 100% ( $p < 0.001$ ). There was 100% increase in use of alcohol swabs and hand sanitizers also (Table 3). Glove utilization was seen more in Pre-COVID era as compared to COVID era. The reason for this was higher number of onboard patients and staffing in pre-COVID era. In COVID era patient volumes reduced along with low staffing resulting in less gloves utilization for non-COVID patients, as COVID positive patients were admitted in other service lines.

### Changes in inpatient areas of MSM service lines

Concrete steps were taken during COVID era in inpatient areas to prevent the spread of disease among community and HCW. These measures included initiation of screening desk, amendments in patient visitor's policy, mandatory use of PPEs, social and physical distancing, amendments in staffing model, amendments in elective and emergency surgeries protocol, mask fit-testing for orthopedic health care providers and environmental cleaning (Table 4).

### Involvement of HCW

Despite of making all the screening measures and infection control policies; three HCW were exposed in the inpatient area of

musculoskeletal and orthopedic service line (Figure 1). All of them recovered completely.

## Discussion

The COVID-19 pandemic exerted immense pressure on the hospital management system. On one hand the hospital was overburdened by incoming COVID-19 patients whereas on the other hand, management had to take measures to protect its HCW and community from the lethal viral infection. The hospital stopped normal functions of outpatient clinics, elective admission and surgeries at the cost of bearing financial losses. At the same time hospital management made extra efforts to procure necessary items for treatment of COVID patients and created temporary set up (COVID zones for screening and tests, isolation units, ICU and operation theatres with negative suction). COVID-19 revolutionized the orthopedic daily practice. Our study confirmed that inpatient admissions were reduced significantly. Similar findings were noted in public hospitals of Hong Kong and they reported 80% reduction in elective orthopedic operations including joint replacements, ligament reconstruction and decompression of neuropathies [10]. The health boards of United Kingdom reported reduction 94% in elective work [11]. The reason behind deferring the elective surgeries was to minimize the risk of cross infection among health care providers, conserve PPEs and provide space for COVID patients. However, this moratorium on elective surgical procedures had a great financial impact on private institutions. Covid-19 had a substantial impact on the stock markets and overwhelmed the health care systems throughout the world [12].

Our MSM service line continued its modified operations for emergency work especially life and limb threatening conditions and our results revealed emergency cases were decreased by 36.7% as road traffic accidents were reduced due to lock down. The declining finances ultimately affected the monthly earnings of the HCW working in private institutions. One institute in North America announced an approximately \$900 million deficit, with employee pay adjustments

and furloughs [12]. The mandatory use of PPE in the inpatient area significantly contributed to the financial burden. In order to close the financial gap caused by this pandemic; the hospital management decreased the pay of all staff working at the management and professional level. However, 77% of employees did not get a pay cut who were predominantly responsible for bedside patient functioning. During the study period, three HCW got infected with COVID-19, who recovered uneventfully which is in contrast to the high number of HCWs exposed in US and Italy [13]. The 100% treatment cost of three HCW was borne by the institution.

### Screening measures

The institution developed three levels of screening for the inpatient area which was strictly applied across the hospital. First level of screening was done at the admission department. The second level of screening was done outside the ward area and third level of screening was in the ward area by a trained staff. In case of positive screening patient was sent to designated COVID testing and treatment facility as per international guidelines [13]. The institution developed a Mobile App for the screening of employees. This app contains 5 questions that staff had to answer daily before coming to work. After answering the questions pop up green light allows to join work, while red light directs the employee to go for further screening in COVID zone. Similar preventive measure has been initiated in North America [14].

### Modification in protocols for elective and emergency surgeries

Our institution developed a comprehensive algorithm to carry out elective and emergency surgeries. Once screening is completed, then patient is sent for COVID PCR if surgery is planned under general or spinal/epidural anesthesia. In case of negative PCR for COVID patient is booked for surgery. In case of limb or life-threatening issues patients are operated in COVID negative pressure operating rooms under strict implementation of PPEs. The nasopharyngeal swab for COVID-19 is taken before start of surgery. The suspected or COVID positive patients are admitted in COVID isolation ward. In case a patient PCR for COVID-19 turns out to be negative then that patient is shifted out of COVID isolation. Many hospitals opted similar protocols as evident in literature [16].

### Mandatory use of PPE

The Department of Infection Prevention and Hospital Epidemiology (DIPHE) implemented strict policy of recommended PPEs for all hospital inpatient areas. It was mandatory for every HCW to wear gown, surgical mask, and face-shield/goggles. Our results showed that there was significant increase in use of PPEs during COVID era. A systematic review [16] conducted in Pakistan reported low availability of PPE in Pakistan. The American health association has estimated that there was an increase in cost per bed per day because of PPE [17].

### Social and physical distancing

Social and physical distancing was maintained in inpatient areas including waiting rooms, staff lounges for breaks and counseling rooms. The seating arrangement was made to keep a social distance of 2 meters. Red marks/circles were placed on the floor on front desk, nursing counters and reception areas to reduce chance of exposure to staff and other patients as described in international guidelines [18].

### Staffing model

The hospital management recommended keeping minimum

staffing during COVID era in order to reduce the risk exposure to HCW. Now one registered nurse with one health care assistant is kept on floor instead of 2 nurses with 2 health care assistants. Presently only one resident and one intern make rounds on all patients. The consultants do round with single on call resident/intern. The staff was given leverage to utilize most of their leaves as evident from the study.

### Functional vs. primary care

Role of nurse changes from functional and supervisory to sole primary nurse who is supposed take care of patient as a whole that included taking vital signs, maintaining intake and output balance, perform hygiene care and related assisted activities. The role of nurses during COVID-19 adopted a management change model which is based on the high demand of care with a less exposure to suspected or positive patient.

### Education and training

COVID-19 Pandemic affected the teaching and training of nurses and residents. The practical learning and teaching were shifted to virtual one on Zoom or Microsoft teams. But this has its own pros and cons. This strategy has also been adopted by many institutions and the Saudi orthopedic association [19].

### Conclusion

COVID-19 pandemic challenged the HCW, health care industry and financial viability of health care organizations. It drastically impacted the musculoskeletal inpatient services, in terms of elective admissions, elective surgeries and outpatient clinics; a major source of earning for private hospitals. On the other hand, hospital had to spend lot of money to procure PPE, monitors, ventilators and construction of COVID units and isolation wards for overwhelming patients in spite of the fact that hospital revenue generation has gone down significantly. The hospital management took innovative steps to help our HCW in terms of treatment, leaves and financial compensation of reduced clinical income. Essential modifications in health care practices have proven to be very effective in prevention COVID-19 and further harm to HCW.

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