Original Article

COVID-19 Resulted in Reduction Trainee Bedside Experience, But No Reduction in Surgical Experience

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Purpose: Because of the concerns regarding residency process during the pandemic, this study aimed to investigate the volume of clinical interactions of orthopaedic residents at a tertiary hospital by reporting the number of patients treated in the outpatient clinic, inpatient ward, and operating room. **Methods:** This retrospective chart study evaluated variables such as volume of clinical interactions of orthopaedic residents at a tertiary hospital by reporting the number of patients treated in the outpatient clinic, inpatient ward, and operating room, from an orthopaedic department in a tertiary trauma center throughout the COVID-19 pandemic era. Comparing these measures was an indirect evaluation tool for measuring the amount of work completed and clinical exposure gained by the residents. **Results:** Occupancy percentage, hospitalization days, admissions to the department, and attendance of the outpatient clinic were all decreased during the pandemic. No significant changes were evident in the total number of surgeries nor the number of elective surgeries during the pandemic. **Conclusions:** Overall, a reduction in overall hospitalization days, admissions to the department, total number of visits in the outpatient clinic, and occupancy percentage of the ward was observed during COVID-19. However, there was no difference in the average number of monthly surgeries between the pre-COVID-19 and COVID-19 timeframes. **Level of Evidence:** Level III, retrospective comparative review.

The World Health Organization declared the COVID-19 outbreak a pandemic on March 11, 2020.[1-3] Since then, many countries have implemented different COVID-19 mitigation measures, including physical distancing, restrictions on gatherings, and lockdown. Consequently, the international crisis also infiltrated the health care system, affecting many residency programs worldwide. The impact of the aforementioned limitations has impaired medical training in several aspects. First, in-person academic activities were avoided, impairing pillars of the residency education.[4] Moreover, clinical education and hands-on training were affected by the disruption of formal health care delivery because of decreased elective surgeries, fewer skill-based teaching activities, and deployment of residents to COVID-19–related services.[5]

Changes in the medical field began well before the pandemic. A few that have created difficulties for residency programs all around the world are the reduction and regulation in work hours, major developments in the surgical field, and the high cost of operating room time.[6,7] These challenges have become even more pronounced during the COVID-19 era and have aroused concerns regarding residency training programs and the competence of future clinicians on completion of these programs.[8]

The effects on orthopaedic surgery departments included predominantly the cessation of most elective orthopaedic procedures. Although it was vital to the system-sustaining measures of isolation and resource reallocation, this was to the detriment of orthopaedic training programs.[9,10] Given the reduction in procedures, residency programs have tried to make adjustments to preserve the content and learning experiences of orthopaedic residency.[9,11] Many studies have dealt with the challenge of surgical education during a worldwide pandemic by focusing on the surgical aspect of residency. To compensate for the limited number of

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procedures, studies have investigated the use of "surgical kits" for simulating procedures at home and the use of virtual surgery simulators.[12-15]

The purpose of this study was to investigate the volume of clinical interactions of orthopaedic residents at a tertiary hospital by reporting the number of patients treated in the outpatient clinic, inpatient ward, and operating room. We hypothesized that a reduction in hospitalizations, elective surgeries, and patients seen in the orthopaedic clinic will occur during pandemic era (years 2020-2022) and a parallel group between years 2016 to 2019.

Methods

This retrospective chart study included data records from an orthopaedic department in a tertiary trauma center in Israel throughout the COVID-19 pandemic era. Evaluated variables were duration of hospitalization, occupancy of the department, total number of hospitalization days, number of elective surgeries, waiting time for elective surgery, number of patients operated on, and outpatient clinic volume. The evaluated variables were assessed from the hospital database, the data were obtained through MDClone ADAMS system integrated with our electronic medical records, a self-service data analytics environment enabling the generation of complex search queries and allowing easy access to all retrospective data within the hospital. A comparison was made between the 2 time periods and between each yearly quarter within the 2 time periods.

Comparison of these measures was thought to be a good indirect evaluation tool for measuring the amount of work completed and clinical exposure gained by the residents,[16,17] thus giving another perspective of the workload of residents during the pandemic and insight into their routine as residents during the pandemic. Hospitalization days is an indicator for flow of patients: for each night a patient is hospitalized in the department, 1 hospitalization day is accounted.

The observed changes in workload of residents were due to Covid specific instruction in Israel and Rambam Health Care Campus, and were also affected by the personnel changes resulting from the burden the epidemic created on each individual hospital. Covid instruction implemented in Israel and Rambam Health Care Campus recommended reducing the number of elective surgeries, giving priority to performing urgent and life-saving operations and reducing nonurgent clinics.

Statistical Analysis

Normality of continuous variables was assessed by the Shapiro Wilk test. As a result of this test, parametric or nonparametric tests were conducted. Differences between the 2 groups (COVID-19 vs control) were determined by an unpaired *t*-test or nonparametric equivalent. $P < .05$ was considered significant. SPSS version 28 was used for all statistical analysis.

Results

Overall, 74 months of data between the years 2016 to 2022 were collected and evaluated to observe changes in patient volume in an orthopaedic department during the COVID-19 pandemic era.

One of the evaluated variables was occupancy percentage of the orthopaedic department as an indicator of the residents' exposure to clinical training. During the pandemic era, the mean occupancy percentage was 84.8%, whereas mean occupancy percentage during the years 2016 to 2019 was 94.2% ($P < .001$, as seen in Table 1). Moreover, during the peak of the first wave of COVID-19, the occupancy percentage was even lower, falling to 64.3% during April 2020. When assessed based on yearly quarters, occupancy was significantly lower throughout the COVID-19 pandemic era.

The total number of hospitalization days in the department and number of patients admitted to the department was also analyzed as an indicator of the volume of clinical experience for the residents. During the pandemic era, there was an average of 1,832.5 hospitalization days and 339.1 admissions to the department each month, whereas during the years 2016 to 2019, there was an average of 1,985.7 hospitalization days and 358.2 admissions each month. A statistical difference was found both in total number of hospitalization days between the 2 time periods and in number of admissions to the department ($P < .001$ and $P = .044$, respectively). No statistical difference was found in number of discharges from the department nor in the average hospitalization time per patient between the 2 time periods in the study ($P = .052$, $P = .12$, respectively).

The total number of patients invited to the outpatient clinic and total number of patients attending the outpatient clinic were also investigated as indicators of clinical exposure for the residents. During the pandemic era, there was an average of 2,891 patients invited to the clinic each month, whereas during years 2016 to 2019 there was an average of 2,825 patients invited to the orthopaedic clinic each month. Interestingly there was a rise in the number of patients who were supposed to arrive to the clinic, but this difference was not statistically significant ($P = .55$). A statistically significant decrease was found in patients attending the outpatient clinic during the COVID-19 era. An average of 1,322 patients attended the outpatient clinic during pandemic time whereas an average of 2,328 patients attended the outpatient clinic each month during years 2016 to 2019 ($P = .0001$).

Total number of surgeries was analyzed as a major pillar of surgical residency that may be susceptible to a significant reduction during the pandemic. During the

Table 1. Comparison Between Pandemic Era and Parallel Group

	2016-2019	COVID 2020-2022	*P* Value
Occupancy percentage			<.001
Mean	94.26%	85.04%	
SD	0.39%	0.7381%	
Median	95.03%	87%	
Hospitalization days			<.001
Mean	1,985.7292	1,832.5833	
SD	137.964	219.202	
Median	2,003.5	1,890	
Outpatient clinic volume			<.0001
Mean	2,328	1,322	
SD	1,087.4	675.566	
Median	2,044	1,213	
Average duration of hospitalization			.12
Mean	5.7979	5.5917	
SD	0.474	0.599	
Median	5.8	5.55	
Elective Surgeries			.25
Mean	264.0208	252.0833	
SD	34.767	51.361	
Median	266	267	
Number of patients operated			.21
Mean	415.9583	401.2083	
SD	39.75883	59.19164	
Median	418.5	424	
Waiting time for elective surgery			<.01
Mean	67.33	40.533	
SD	12.25	9.207	
Median	68.55	39	

SD, standard deviation.

COVID-19 pandemic time, an average of 401 patients were operated on each month, whereas during the years 2016 to 2019, an average of 415 patients were operated on. Even though there was a reduction in the total number of patients operated on during COVID-19, it was not statistically significant ($P = .21$). Furthermore, no significant difference was found in the number of elective surgeries done between the 2 groups. On the other hand, when inspecting wait time to elective surgery, a major reduction was found during the pandemic era. Patients during the COVID-19 pandemic waited for elective surgery for an average of 40.5 days, whereas during the years 2016 to 2019, they waited an average of 67.3 days ($P < .001$). Stratification of wait time to yearly quarters also showed a statistically significant reduction in wait time for elective surgeries during the COVID-19 era that remained consistent throughout the time period.

Discussion

In this study, occupancy percentage, hospitalization days, admissions to the department, and attendance of the outpatient clinic were all decreased during the pandemic, resulting in a significant reduction of total clinical experiences for residents, which may have an influence on residents' training during this time. Furthermore, a reduction in wait time to elective surgery was also observed. However, no significant changes were evident in the total number of surgeries nor number of elective surgeries.

During the beginning of the COVID-19 pandemic, many elective procedures were cancelled to avoid any unnecessary morbidity, resulting in a decrease in waiting time to elective surgery. The aforementioned pre-COVID concern regarding the surgical training of residents became exacerbated. However, in contrast to this perspective, this study has shown that there was no significant difference in the number of procedures, elective or urgent during the pandemic period. Instead, there was a documented reduction in occupancy percentage, total number of hospitalization days, admissions to department, and total number of outpatient clinic visits during the pandemic era. Luceri et al.[18] showed in their study a reduction of 73% in overall patients seen at the emergency department in an orthopaedic institute during 2020. Similarly, there was also a reduction in nonurgent walk-in patients. Other studies have shown a corresponding reduction in both outpatient clinic visits and in-clinic procedures.[19] These results may imply that despite the concern for impaired surgical skills, residents in surgical professions during the COVID-19 era may have

more limited experience in the outpatient clinic and wards relative to the operating room. These aspects of the clinician's daily routine should not be overlooked because of their importance overall in the patient's management.[20-22] However, the concerns raised during the pandemic about impairment in residents' surgical skills because of a reduction in overall surgeries may be misplaced, because no major changes in surgical practice occurred during this period.

The original structure of surgical residency was introduced in 1889. Bedside teaching methods and being hands-on in the operating room were advocated, which is illustrated by the saying, "See one, do one, teach one."[23] One of the main concerns during the COVID-19 pandemic was surgical practice. Because guidelines recommended social distancing and performance of only urgent or emergency surgical procedures, this resulted in a limiting of the standard training and practice for surgical residents.[12] The medical field in general and specifically the different surgical specialties have experienced ongoing changes well before the COVID-19 era. As a result, concerns regarding the training quality of surgical residents have resulted in new innovations to maintain a high level of surgical education during residency.[24] Many solutions have been proposed, such as video recording of procedures for learning purposes, the development of surgical skills assessment tools for residents and presurgical and postsurgical debriefing.[25] Concerns raised during the pandemic about impairment in resident's surgical skills because of a reduction in overall surgeries led to the continuation of a large resource investment in the surgical education field. Although many resources have been invested, this study's results have demonstrated that no major changes have occurred in surgical practice during the pandemic era, because there were no significant changes in the total number of surgeries in the country where this study was conducted. Therefore it is possible that at least some of the resources devoted for maintaining a high level of training in surgical residencies should be directed toward day-to-day bedside clinical skills.

Limitations

This study has a few limitations. First, it is a retrospective study, using only numerical data in an orthopaedic department in a single tertiary hospital. Using multicenter data from numerous orthopaedic departments might shed a more representative light on the COVID-19 pandemic's influence on residents' education and may also speak to whether their competency was affected by the pandemic. Furthermore, this study does not have information about the distribution of case types, which might have been affected during the pandemic. In addition, this study does not show information about residents' involvement in cases.

Conclusions

Overall, a reduction in overall hospitalization days, admissions to the department, total number of visits in the outpatient clinic, and occupancy percentage of the ward was observed during COVID-19. However, there was no difference in the average number of monthly surgeries between the pre-COVID-19 and COVID-19 timeframes.

Disclosure

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. Full ICMJE author disclosure forms are available for this article online, as supplementary material.

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