

ORIGINAL RESEARCH

Impact of COVID-19 on orthopaedic surgery clinical exposure for medical students: A retrospective study at a teaching hospital in Pretoria, South Africa

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Abstract

Background

This study examined the impact of the COVID-19 pandemic and national lockdown restrictions on the clinical exposure of final-year medical students rotating through the orthopaedic surgery department at a medical school in Pretoria, South Africa.

Methods

A retrospective review (1 April through 30 June 2020) of final-year students at Sefako Makgatho Health Sciences University, whose departmental rotation was disrupted due to the national lockdown (COVID group), was conducted. Their attendance was compared with that of the previous year's final-year students (non-COVID group) who experienced uninterrupted lectures during the equivalent duration in 2019. The two groups were statistically compared, with the threshold for statistical significance set at $P < 0.05$.

Results

The COVID group attended 13 days of the orthopaedic block, while the non-COVID group attended 15 days. The overall attendance of the COVID group, in different clinical settings, was significantly less ($P < 0.001$) than that of the non-COVID group. Even after accounting for online and in-person attendance, the COVID group attended significantly fewer lectures (13 vs 15; $P = 0.001$) than the non-COVID group.

Conclusions

This study demonstrated a significant reduction in musculoskeletal training and clinical exposure of final-year medical students at our institution in 2020. To adapt to the national lockdown regulations, a number of measures were put in place, such as online teaching, extension of the academic calendar, and distribution of personal protective equipment. These steps were crucial for maintaining the standard of teaching for final-year students during the national lockdown, as suggested by the exam results.

Keywords: COVID-19, orthopaedics, undergraduate medical education, clinical clerkship, South Africa

Introduction

On 5 March 2020, the first case of COVID-19 was reported in South Africa. On 26 March 2020, the government declared a state of emergency and instituted a nationwide lockdown.^[1] Clinics and elective operations were suspended, along with schools, universities, and academic activities. With the aid of these regulations, additional resources were allocated to combat the pandemic.^[2] This had an immediate effect on every facet of orthopaedic and medical education.^[2]

After the easing of the lockdown on 1 June 2020, Sefako Makgatho Health Sciences University in Pretoria swiftly organized virtual lessons to resume academic activities after a 9-week academic hiatus. Priority was given to final-year medical students, who were the first to return. Essential components of the university's orthopaedic block rotation (which were standard before the pandemic), including bedside clinical exams, splint applications, emergency case management, and theatre assistantship, faced adjustments upon resumption. To ensure the continuity of students' clinical ex-

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posure under strict safety measures, the university equipped students with personal protective equipment and implemented restrictions on the duration of hospital time. To mitigate the impact on the academic calendar, the duration of orthopaedic rotations for final-year medical students was reduced from 15 to 13 days. The adoption of mobile data and devices facilitated virtual learning, albeit with restricted student–educator and student–patient interactions. The introduction of scenario-based end-of-block assessments marked a shift in evaluation methods. Despite these precautions, an orthopaedic block student contracted COVID-19, necessitating quarantine and a shift to exclusively virtual lectures.

South Africa was not the only nation to initiate such drastic changes. Similar strategies were implemented in the UK, Italy, France, the US, India, and China.[3]-[6] The academic landscape, especially within medical education, experienced widespread disruption, a phenomenon documented across the globe.[7]-[11] Similar strategies were implemented by our colleagues at the University of Cape Town, who reported their success with medical students in their fifth year.[12]

Musculoskeletal disorders are a leading cause of medical consultations,[13] including in South Africa, where traumatic injuries—predominantly associated with violence and traffic accidents—account for a considerable share of deaths from external causes.[14] This underscores the imperative for medical students to receive comprehensive musculoskeletal trauma training. We expected the lockdown to reduce students' teaching time and exposure to orthopaedic procedures at our institution. Therefore, we conducted this study to assess the effects of the pandemic, lockdown procedures, and loss of contact teaching on the clinical training and exposure of final-year medical students within the orthopaedic surgery rotation, with a particular emphasis on their involvement in procedural activities in comparison with their predecessors.

Methods

This study conducted a retrospective review of the attendance data of final-year medical students whose rotations were scheduled during the lockdown period (1 April 2020 through 30 June 2020) and compared these data with those of students who underwent their rotations during the equivalent period in the previous year (1 April 2019 through 30 June 2019) at Sefako Makgatho Health Sciences University, located in Gauteng Province, South Africa. Ethical clearance was obtained from the university's human ethics review board.

The logbooks of each student were evaluated to ascertain the duration of their rotations within the orthopaedic block, tracking attendance at contact and virtual lectures, patient-side teaching, and their involvement in both minor and major orthopaedic procedures. This included activities such as shadowing, splint applications, and assistantship roles, all documented in their individual logbooks. These records also provided insights into the number of orthopaedic operations and splinting procedures observed or assisted by the students, as well as patient examinations conducted or wit-

nessed alongside a registrar or specialist. At the end of each rotation, the Department of Orthopaedics collects and stores the logbooks, which were accessed and evaluated for this study. Data on the hours dedicated to ward rounds, on-call duties, postcall case discussions, and educational sessions, along with the procedural engagements of the students, were systematically recorded on a data collection sheet. Additionally, modifications to the teaching programmes during this period and their impact on student exam performances were examined. The students were categorized into two groups—those whose rotations coincided with the COVID-19 lockdown (COVID group) and those from the preceding year (non-COVID group)—for comparative analysis. Notably, student demographic information was not compiled, as it was deemed irrelevant to the study's goals, and no preliminary power calculations were undertaken.

Statistical analysis

The data were categorized into COVID and non-COVID groups for analysis. The Shapiro–Wilk test determined the distributional normality of each group. Statistical comparisons between the COVID and non-COVID groups used either Student's *t*-test for normally distributed data or the Mann–Whitney *U* test for data not following a normal distribution. Central tendencies for normally distributed data were to be evaluated as means \pm standard deviations, while skewed data were evaluated as medians and interquartile ranges (IQRs). The chi-square test was applied to compare final scores. $P < 0.05$ was considered statistically significant. All statistical analyses were conducted using SPSS Statistics for Windows, version 26 (IBM Corp., Armonk, NY, USA).

Results

The study included 91 students in the COVID group, undergoing their orthopaedic rotations during 2020, and 156 students in the non-COVID group from 2019. Data analysis confirmed a skewed distribution, prompting the use of nonparametric tests for comparison. All students in the non-COVID group participated in all 15 days of the orthopaedic surgery rotation in 2019, while all students in the COVID group participated in all days of the uniformly shortened 13-day rotation in 2020, representing a significant reduction in rotation duration ($P < 0.001$).

There was an overall reduction of 56.5% in teaching activities for the COVID group compared with the non-COVID group, and students' contact with patients dropped by 64.8% ($P < 0.001$). Significant differences ($P < 0.001$) were observed between the COVID and non-COVID groups across all measured variables. The non-COVID group spent more hours on call, attended more ward rounds, and engaged in more splinting and surgical procedures than the COVID group (Table). Similarly, face-to-face lecture attendance was significantly higher in the non-COVID group. For the COVID group, the transition to online learning platforms resulted in a median of 8 (IQR, 5–11) virtual lectures attended, with a median of 5 (IQR, 2–10) face-to-face lectures attended. This contrasts with the non-COVID group's median lecture attendance of 15 (IQR, 13–18) when all lectures were

Table. Numbers of patient-side teaching exposures, outpatient procedures, surgical assistantships, and observerships among medical students during orthopaedic surgery block rotations in 2020 (COVID group) vs 2019 (non-COVID group)

Activity category	Median (interquartile range)		P value
	COVID group	Non-COVID group	
Hours spent on calls	11 (7-15.5)	24 (18-30)	<0.001
Ward rounds attended	1 (1-2)	3 (3-4)	<0.001
Splinting procedures performed or observed	2 (1-4)	7 (7-7)	<0.001
Surgical procedures observed or assisted	1 (0-1)	3 (2-5)	<0.001
Face-to-face lectures attended	5 (2-10)	15 (13-18)	<0.001
Total (online + face-to-face) lectures attended	13 (13-15)	15 (13-18)	<0.001

attended in person ($P<0.001$). Despite these adaptations, the pass rates were similar between the groups (COVID group, 84.7%; non-COVID group, 85.1%; $P>0.05$).

Discussion

Our study showed that students' contact with patients dropped significantly, and their clinical teaching was also compromised during the pandemic. There was significantly lower procedure observership, assistantship, and performance among the students in the COVID group. We observed the highest reduction in the number of splinting procedures performed. Even though virtual lectures were introduced, this group also attended fewer lectures than the non-COVID group. Originally, the final-year training was structured such that students spend more time on clinical exposure than lectures, but this had to change during the COVID-19 pandemic.

As part of the measures taken by our institution to curb the spread of COVID-19, the orthopaedic department suspended 'contact learning and contact academic activities' in line with the lockdown regulations. To continue learning after the students returned to campus, they were provided with masks and personal protective gear. Hand sanitization stations were installed for everyone working within the hospital and the university environment. The restriction to a single on-call shift for each student led to a significant decrease in clinical observation and shadowing opportunities for the 2020 cohort compared with the 2019 group. The COVID group was also restricted to small groups while attending to patients, and they were not allowed to interact with patients diagnosed with COVID-19. To accommodate for the time lost during the national lockdown, the university's academic calendar was extended until early 2021. Our students were required to don personal protective equipment when attending clinical skills training. Additionally, prerecorded clinical videos and links for web-based videos were provided to enhance musculoskeletal teaching.

The impact of this reduced clinical exposure may be difficult to measure. The 2020 pass rate remained largely consistent with the previous year, indicating that the modifications in teaching methods did not adversely affect student performance outcomes. This consistency suggests that the university administration took adequate steps towards maintaining the knowledge transfer channels open during the national lockdown. Gamielien et al.[12] evaluated the use of blended teaching techniques, including virtual and in-person instruction, for medical students in their fifth year at the University of Cape Town during the pandemic. They found that virtual lectures and online simulations improved student clinical confidence and orthopaedic block pass marks, and the students responded positively to virtual lectures and online simulations. Furthermore, to maintain the teaching standard, they made material available to students online. Calhoun et al.[15] highlighted a significant decrease in clinical experience among medical students enrolled with the University of Washington School of Medicine, reporting that third-year surgical students experienced a reduction to one-third of their original rotation duration, while fourth-year students saw a 12-week reduction in their rotation period. This emphasizes the substantial impact of disruptions on the practical training of future surgeons.

Globally, educational institutions adopted similar adjustments, transitioning from traditional contact learning to online platforms and reducing hands-on surgical and clinical involvement.[7],[16]-[19] Teaching activities at our institution shifted online until the final-year medical students were permitted to return to campus on 1 June 2020. Choi et al.[7] reported a 43% decline in students' surgical assistantship and OSCEs (objective structured clinical examinations) among medical students from 32 UK medical schools. From a survey of 504 ophthalmology trainees from 32 countries on the reshaping of training after COVID-19, there was strong agreement to move to web-based case presentations, virtual clinical teaching, and virtual surgical simulation in the long-term reorganization of ophthalmology training.[20]

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In the evolving landscape of orthopaedic training, emphasis has been placed on the necessity for surgeons to proactively engage with emerging technologies, like virtual reality and holography, for surgical training enhancement.[21],[22] However, virtual reality, a subset of e-learning, represents just a single facet of virtual learning's broader spectrum.[23] Remote simulation training, for example, is encompassed within this spectrum. Lin et al.[24] provide insights into simulation's utility in medical education, demonstrating that while virtual simulations offer cost-effective, accessible training opportunities, in-person simulations yield unparalleled benefits in technical, behavioural, and cognitive domains of self-reported trainee confidence related to skill and knowledge acquisition. These findings align with our stance on balancing technological advancements with the irreplaceable value of in-person patient care experiences.

Participation of medical students in clinical care equips them with problem-solving skills that they will require in practice.[25] In a study of 150 medical students, clinical exposure improved students' basic motivation, interest, and understanding of doctor-patient interactions and the value of teamwork.[26] Early clinical exposure is pivotal to enhancing the application of theoretical knowledge,[27]-[29] with direct observation and feedback during patient examinations significantly improving students' competencies and confidence.[30] Although clinical exposure is important, Martin et al.[31] showed that a structured, well-organized teaching programme tailored to students' learning styles can hold greater importance. Elsewhere, traditional classroom teaching showed no significant benefits for 112 medical students' musculoskeletal knowledge,[28] underscoring the need for practical, hands-on learning experiences.

Strengths and limitations

This study was based on an evaluation of adjustments in the clinical training of medical students at a single university and a single clinical department. Although we acknowledge this limitation, we think the results are significant and might indicate a similar impact of COVID-19 across the universities in the country and possibly across many low- and middle-income countries. Our findings add knowledge on how the COVID-19 pandemic influenced health and medical training globally.

Conclusions

The national lockdown restrictions aimed to reduce the spread of COVID-19 infection. However, this had secondary impacts on various aspects of life, including education. This study demonstrated a significant reduction in musculoskeletal training and clinical exposure among final-year medical students. The virtual lectures compensated for theoretical teaching, and we managed to maintain the standard of training. This, along with various other steps taken by the administration, resulted in the maintenance of the students' exam performance. Future strategies should ensure safe clinical training during epidemics or other public crises, prioritizing innovation, infrastructure enhancement, and medical programme reevaluation to sustain clinical training without compromising safety.

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