



Impact of the COVID-19 pandemic on orthopaedic and trauma surgery training in Europe

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Abstract

Purpose This study aimed to evaluate the impact of the coronavirus disease 2019 (COVID-19) pandemic on orthopaedic and trauma surgery training in Europe by conducting an online survey among orthopaedic trainees.

Methods The survey was conducted among members of the Federation of Orthopaedic and Trauma Trainees in Europe (FORTE). It consisted of 24 questions (single-answer, multiple-answer, Likert scales). Orthopaedic trainees' demographic data (six questions), clinical role changes (four questions), institutional changes due to the COVID-19 pandemic (nine questions), and personal considerations (five questions) were examined.

Results Three hundred and twenty-seven trainees from 23 European countries completed the survey. Most trainees retained their customary clinical role (59.8%), but a significant number was redeployed to COVID-19 units (20.9%). A drastic workload decrease during the pandemic was reported at most institutions. Only essential activities were performed at 57.1% of institutions and drastic disruptions were reported at 36.0%. Of the respondents, 52.1% stated that faculty-led education was restricted and 46.3% pursued self-guided learning, while 58.6% stated that surgical training was significantly impaired. Concerns about the achievement of annual training goals were expressed by 58.2% of the participants, while 25.0% anticipated the need for an additional year of training.

Conclusions The SARS-CoV-2 pandemic significantly affected orthopaedic and trauma training in Europe. Most trainees felt the decrease in clinical, surgical, and educational activities would have a detrimental effect on their training. Many of them consulted remote learning options to compensate training impairment, stating that after the COVID-19 pandemic electronic educational approaches may become more relevant in future.

Keywords COVID-19 · SARS-CoV-2 · Pandemic · Orthopaedic training · Federation of Orthopaedic and Trauma Trainees in Europe

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Introduction

In December 2019, the coronavirus disease 2019 (COVID-19) broke out in Wuhan, the capital city of Hubei Province in China [1]. The cause of the disease was a highly contagious novel coronavirus (SARS-CoV-2) that rapidly spread around the world and in March 2020 was declared a global pandemic by the World Health Organization (WHO) [2]. To date, nearly 8.7 million people have been diagnosed positive for SARS-CoV-2 and almost 462,000 people have died from the disease worldwide [2]. A monumental international collaboration against the pandemic and a rapid dissemination of emerging scientific evidence were observed, with symptoms, radiological and pathological findings, and other characteristics of the disease being described [3].

Europe rapidly became a serious epicentre of the COVID-19 pandemic, with the control of virus spread becoming the singular focus of most European countries [4]. The high infectivity rate forced governments to implement socioeconomic measures such as confinement, suspension of business operations, and reallocation of resources. Additionally, this rapidly evolving emergency overwhelmed the existing healthcare systems which in most cases were reorganized to cope with the crisis. Medical specialties were impacted in different ways. Internal medicine, anaesthesia, and intensive care physicians stepped into the “frontline” to manage COVID-19 patients, working after hours to meet the increasing demand. Surgeons had to limit their surgical practice to essential procedures or they were deployed to fields outside their specialties [5].

Orthopaedic practice could not remain unaffected under these unforeseen circumstances. Non-urgent consultations and many surgical procedures were cancelled or postponed. Elective surgery in many institutions were suspended, and the overall orthopaedic case volume dropped dramatically to minimize the virus spread and reserve and reallocate resources in healthcare personnel (nurses, anaesthesiologists), medical equipment (personal protective equipment, ventilators), and beds [6]. In Europe, a drastic cutback in arthroplasty and arthroscopy procedures was documented [7, 8], and the frequency of trauma cases decreased during the COVID-19 period due to the “stay at home” policy [9].

This healthcare crisis had significant consequences not only for patients and surgeons but also for orthopaedic trainees [10]. It is easy to speculate that the limited clinical and surgical exposure, the suspension of in-hospital didactic activities, and the cancellation of most scientific meetings would considerably affect orthopaedic training. Some authors highlighted this issue in other surgical specialties [11, 12]. However, to the best of our knowledge, the real ramifications of the crisis for orthopaedic education in Europe are largely unknown.

In this study, we assessed the impact of the COVID-19 pandemic on orthopaedic training by conducting an online

survey of the members of the Federation of Orthopaedic and Trauma Trainees in Europe (FORTE). This European society encompasses orthopaedic residents and young orthopaedic surgeons in training. It was founded in 2005, and since then has acted as a forum for its members, having as the main goal the promotion of education [13].

Materials and methods

We conducted an online survey for the members of FORTE. Institutional review board approval was deemed unnecessary for this study, as the survey was anonymous and no patient or respondent personal data were included. Data were collected using SurveyMonkey (<https://www.surveymonkey.com>, Portland, OR), an online data collection program. The survey consisted of 24 questions with single-answer, multiple-answer, and Likert scales. Six questions documented demographic features. Trainees' role changes in response to COVID-19 were examined in four questions. Institutional changes and their influence on participants' daily practice and training were evaluated in nine questions, while personal opinions and personal considerations were collected in five questions (Appendix).

In the demographics section of the survey, the country of practice was recorded and a matrix of multiple-response options examined the type of institution the participants were working at, their specific role, and their year of postgraduate training.

Redeployment of orthopaedic trainees in COVID-19 units was recorded. We included items to investigate any applied precautions, like virus testing for doctors and specific COVID-19 training. Leave for self-isolation or due to infection was also documented.

We investigated the institutional changes that impacted everyday practice or training; considering patient care, diagnostic examinations, surgical procedures, research, and teaching. Delays in qualification, fellowship options, and regular department meetings were also examined.

Additionally, the orthopaedic trainees were asked to provide their perception of the importance of different educational approaches. Among others, these included lectures, hospital rounds, orthopaedic courses, cadaveric labs, scientific meetings, e-learning, and virtual reality learning. They were also asked to anticipate potential future changes considering training opportunities.

A link to the survey was sent by email to the members of FORTE on May 28, 2020, and every second day a reminder was also sent to improve the response rate. The trainees were invited to complete the survey within 15 days and it was finally closed on June 11, 2020. All data gathered from the online database were calculated as frequencies and percentages.

Results

A total of 327 orthopaedic and trauma trainees, from 23 European countries, participated in this survey. Of the surveyed trainees, 79.5% were males and 20.5% females. Most of them were between 30 and 35 years old (49.0%), and 26.3% were younger and 24.7% older than this age group. Of the participants, 45.3% were working in university hospitals, 44.7% in non-university public hospitals, and only a minority in private institutions. A majority of them were residents (70.3%) in different years of training. Post-residency trainees/fellows accounted for 23.9% (Table 1).

Of the trainees, 59.8% retained their clinical role in the orthopaedic department, but 20.9% were redeployed to non-orthopaedic COVID-19 units (Table 2). Regarding their occupational health, a majority of them were not examined for SARS-CoV-2 at their institution (65.9%). Of those tested (34.1%), a positive result was reported in 2.2%. Of the participants, 47.1% did not leave their duties for self-isolation or due to infection. The rest reported one (11.1%), two (17.2%), three (13.1%), and even more weeks (11.9%) of absence for such reasons. No specific COVID-19 training was provided to most of the orthopaedic trainees (60.3%).

During the pandemic, the institutions of 57.1% of the responders allowed only essential patient visits and emergency surgical procedures (fracture, infection, tumour patients), while 36.0% underwent drastic disruptions (Fig. 1). Trainees' on call activity, exposure to patient care, and participation in surgical operations were detrimentally impacted (Fig. 2). Regarding research activity, a diversity of responses was collected. Some participants found it was decreased (36.1%), others increased (27.1%), and others unchanged (26.6%). Reduced teaching duties were also reported by approximately 56.6% of the participants (Fig. 2). With regard to remote working from home, 38.9% said this was not an option for residents and 14.8% that this could not apply to fellows. Most participants agreed that this was reserved only for e-learning or virtual learning (41.8%), while others stated that this could only apply to research (28.3%). Nevertheless, 16.4% stated that remote working was an option for providing medical care via telemedicine.

Table 1 Participants' level of training

Level of training	Participants (%)
First year resident	12.2
Second year resident	7.0
Third year resident	10.1
Fourth year resident	10.4
Fifth year resident	10.1
Final year resident	20.5
Post-residency training/fellowship	23.9
Other (intern, PhD student, researcher)	5.8

Faculty-led education was limited in most cases (52.1%) during the COVID-19 period. Surgical education, namely pre-operative planning, execution of operations, and post-operative care, was significantly impaired, as per 49.2%, 58.6%, and 46.7% respectively of the surveyed participants. Clinical education at the patient's bedside was also impaired (56.0%), but remote clinical learning increased (55.3%) (Fig. 3).

The majority (56.6%) of the respondents stated that all national and international fellowship options were suspended, while 23.0% reported that only international fellowships were interrupted. Regular orthopaedic department meetings continued with precautions for 34.8% of the respondents. Only selected trainees (e.g. on call) were allowed to attend (27.1%), whereas 19.3% stated that they were exclusively held online via videoconference.

Significant concerns about the achievement of annual training goals were voiced by 58.2% of the participants, while 18.4% of them stated that this would definitely be impossible. Of the respondents, 45.5% believed that they will not acquire the expected practical skills, 45.1% that they will not complete their logbook, and 15.6% that their final exams will be postponed. One-fourth of the respondents were afraid of losing a trimester, semester, or even a year of specialization training, believing at the same time that an additional year of appropriate training will be necessary. However, the majority (61.1%) believe they will finish their rotation as planned.

On a 1 to 5 scale (1 = not important, 5 = very important), participants described their perceptions about the importance of different educational approaches. Travelling for fellowship training was considered the most important approach (mean score, 4.3), followed by institutional cadaveric courses (4.2) and travelling for orthopaedic learning courses (4.1). Core curriculum lectures obtained 4.0 points, international and national meetings 3.9 points, and Web-based video platforms 3.8 points. The lowest score was given to grand rounds (3.5). Rating the importance of educational approaches in the future compared with present, higher scores to electronic education opportunities were found; virtual reality surgical simulators (4.2 vs 3.7), Web-based video platforms (4.2 vs 3.8), e-learning (4.1 vs 3.7), and podcasts/webinars (4.1 vs 3.6), highlighting their emerging importance (Fig. 4).

Altogether, 54.5% of the respondents stated that orthopaedic training will be negatively affected by the COVID-19 crisis, while 21.3% postulated that there are multiple possibilities to achieve a better education. Finally, most of participants (75.4%) believed that providing healthcare via telemedicine will become more relevant in the future, due to the COVID-19 pandemic.

Discussion

The impact of the COVID-19 crisis on orthopaedic and trauma training had three components. First, a considerable

Table 2 Trainees' clinical role changes due to COVID-19

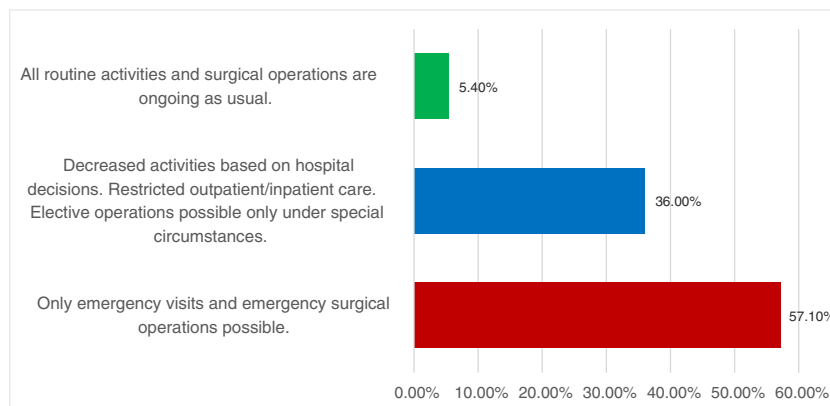
Have you been, are you currently working or will you be soon working in COVID-19 units or with COVID-19 patients?	Participants (%)
Yes, I have been/am/will be assigned to non-orthopaedic patients in a COVID-19 unit	20.9
Yes, I have been/am/will be assigned to orthopaedic patients in a COVID-19 unit	7.8
Yes, I have been/am/will be assigned to non-orthopaedic patients but not working in a COVID-19 unit	3.3
Yes, I have been/am/will be assigned to orthopaedic patients with COVID-19 but not working in a COVID-19 unit	8.2
No, I have continued my current clinical role/not been knowingly working with COVID-19 patients	59.8

number of trainees were redeployed to non-orthopaedic sectors during the crisis, spending their training time on non-orthopaedic medical or even non-medical activities. Second, the general reduction in orthopaedic clinical and surgical volume implies that training had to be forcibly disrupted, altered, or prolonged. Third, education had to evolve radically, by implementing and incorporating modern teaching modalities, such as e-learning, webinars, and virtual simulators.

In our survey, most trainees stated that they did not work with COVID-19 patients. However, 20.9% of the respondents were redeployed and for a certain time period were responsible for non-orthopaedic patients in COVID-19 units, with a few (3.3%) even assigned to non-orthopaedic patients outside a COVID-19 unit. Similar findings were reported in a survey of young arthroplasty surgeons [14]; of the respondents 75% continued their work as orthopaedic surgeons, whereas 7% were redeployed to the ICU for COVID-19 patients, and another 18% to the emergency room/non-ICU units. Despecialization and redeployment may address urgent service needs, but education plans are disrupted in such situations, posing future issues with board requirements [15]. Redeployment in conjunction with safety issues may give rise to a rather troubling situation. According to our survey, 60.3% of trainees did not receive specific COVID-19 training and 65.9% were not tested for COVID-19. Fighting on the front-line against SARS-CoV-2, sometimes with limited availability of personal protective equipment, poses a vital risk for

clinicians [16–18]. This risk may be further increased when redeployed and working outside a clinician's specialty zone, where errors are likely to occur because of the lack of competency [16, 19, 20]. Limiting trainees' exposure, keeping them safe, and preventing their discomfort as a result of this psychological burden should be of utmost importance.

For the majority of respondents, overall orthopaedic activity was limited to various degrees in comparison with the pre-COVID-19 era. Regarding surgical volume and nature of surgery performed during the COVID-19 period, an almost complete disruption of elective surgery was reported, and only 5.4% of the trainees responded that all routine activities and surgery continued as usual, while more than half (57.1%) stated that only emergency procedures were performed. This is in accordance with other studies reporting a dramatic decline in elective surgery [8, 21, 22]. In a survey of members of the European Hip Society (EHS) and the European Knee Associates (EKA), 68.4% of surgeons responded that elective inpatient procedures were no longer being performed, and 68% reported that all outpatient procedures were cancelled, while only 0.7% reported no changes at their department [8]. An average reduction of 49.4% in operating room capacity was also reported by a German study [21]. This unavoidably had a significant impact on training, as clinical and most importantly surgical exposure are the most important vectors in developing orthopaedic skills. In connection with this, we were able to compare our findings mainly with studies from other specialties. The majority of

Fig. 1 Institutional changes as a result of the COVID-19 pandemic

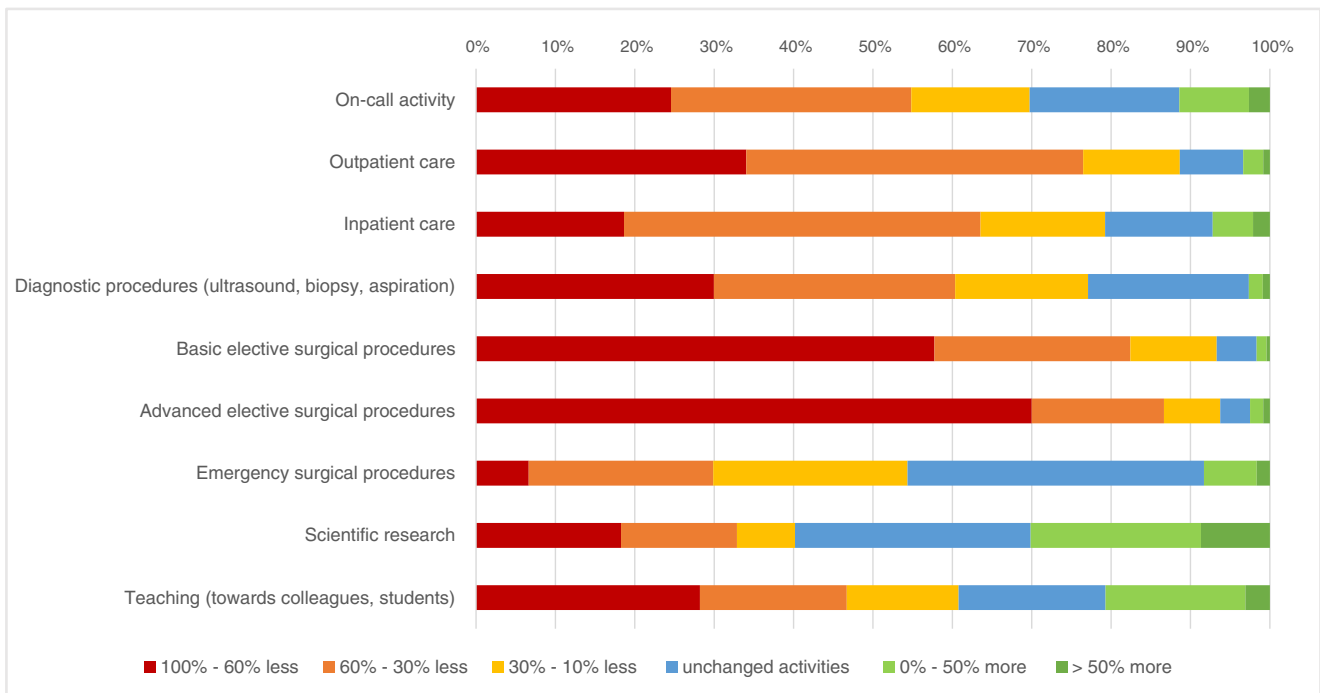


Fig. 2 Changes in trainees' activities during the COVID-19 pandemic compared with the period before

participants (84.5%) in a study examining the training of gastroenterologists reported that the COVID-19 outbreak significantly impacted their training. The crisis led to a major training gap, due to trainees' redeployment and the reduced volume of activities within their specialty [23]. In a similar study of neurosurgery training, the authors also reported a volume decrease

and that many outpatient visits had been transitioned to telemedicine, decreasing resident exposure to outpatients [24]. Additionally, other authors reported that urology residents will not meet minimum case requirements because of COVID-19, while double-scrubbing in the operating room was significantly reduced, thus negatively affecting their surgical exposure [25].

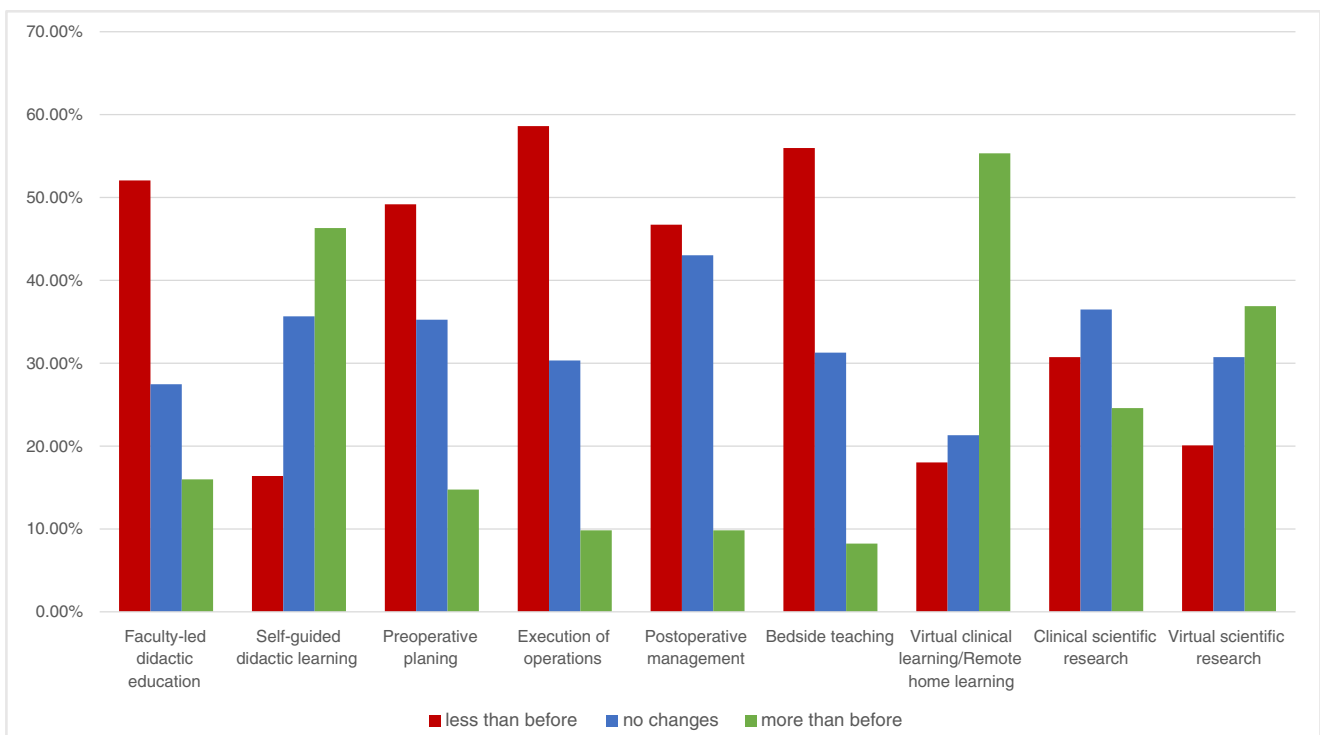


Fig. 3 Changes in trainees' training during the COVID-19 pandemic compared with the period before

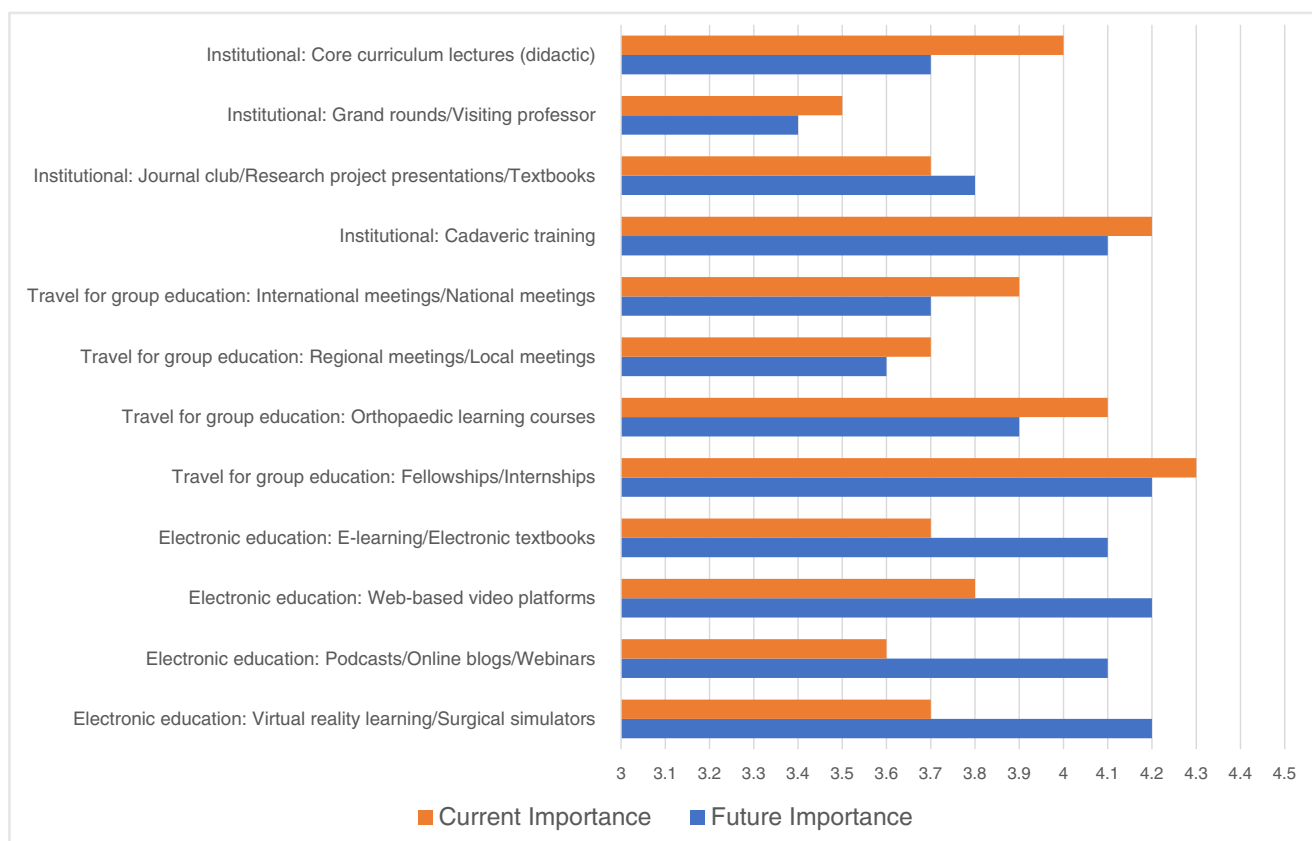


Fig. 4 Participants' perception about current and future importance of different educational approaches (mean scores of a 1–5 scale: 1 = not important, 5 = very important)

In general, diverse responses were collected regarding research activity during the pandemic. Some participants postulated that it was decreased (36.1%); others that it was increased (27.1%). Specifically, clinical research was reported to be decreased by 30.7%, increased by 24.6%, and remained the same for 36.5% of respondents. These findings agree with those of other studies reporting an increase in resident research in 26% of training programmes and a decrease in 22% of them [25], suggesting that trainees' increased off-service time led to increased resident productivity in terms of clinical research activities [26].

As expected, the surgical aspect of education in the pre-operative, intra-operative, and post-operative settings was limited for half of the respondents, which is of course a result of the above-discussed significant decrease in surgery overall. In terms of didactic education, the teaching duties of residents were reduced, and the traditional teaching modalities, including faculty-led didactic education and bedside teaching, were abandoned as well. However, more than half of the participants claimed that remote clinical learning increased and most of them stated that academic education in virtual scientific research was the same or even increased. These findings were important for two reasons. First, they document the problem that arose in orthopaedic surgical training, which is no other than the limitation of core surgical education in operating

theatres. Second, they provide a glimpse into the new era of education, which is the implementation of new technologies for the training of residents and fellows. In fact, a survey of programme directors of neurosurgical residency programmes in the USA showed that nearly all programmes were conducting grand rounds, morbidity and mortality conferences, and didactic lectures using teleconferencing software, either live-streamed, led by faculty or residents, prerecorded, or also even sourced from outside institutions [26]. In a similar survey of urology training programmes, 48% of programmes reported that didactics were negatively impacted by COVID-19. They had all started using video-conferencing and many of them were planning to continue offering virtual didactics in the future, as well [26].

Our survey attempted to further investigate the insight of residents and fellows into the achievement of personal training goals and into the future of education per se. Six out of ten orthopaedic trainees fear that they will not reach their competency goals within the training year, primarily due to non-achievement of practical and surgical skills (logbook). Other potential delays were the total waste of a training period and the suspension of final specialty exams. This probably led many of them to believe they may need an additional year of appropriate training. This fear is widely expressed in the related literature. Ramos et al. [27] reported that the overall

training of spine surgery fellows could be compromised, having lost three months of elective surgery experience, unless measures to address the areas of weakness are taken. In the same regard, many arthroplasty surgeons in training do not feel adequately trained and confident to move forward in their careers [14].

There is no doubt that education has to go new ways. But which direction should it take? According to respondents in the current survey, the most important components of orthopaedic training to date have been fellowships, cadaveric training, and orthopaedic learning courses, with grand rounds being regarded as less significant. However, the future perspective of traditional training methods was retained only for cadaveric training and fellowships—the practical components of training, indeed. Interestingly enough, higher scores were given to all electronic education opportunities; including virtual reality surgical simulators, Web-based video platforms, e-learning, and podcasts/webinars, thus highlighting the need for their further development. Additionally, the vast majority of our participants (75.4%) believed that the COVID-19 pandemic will cause the provision of healthcare via telemedicine to become more relevant in future, despite the fact that telemedicine during the pandemic was rather limited and reserved mostly for research and e-learning. These findings imply that residency and fellowship programmes must consider unique and novel avenues of practicing and learning.

Weekly meetings, courses, and scientific conferences, that previously took place in person, may be held in virtual spaces [28]. Years ago, Palan et al. [29] reported their experience with virtual learning platforms and virtual journal clubs to help optimize resident time spent away from hospital. The authors found a number of unique strengths relative to a traditional in person learning format, including the ability to revisit the digitally recorded session, ease of access to both clinical material and key articles, and the ability to connect from different geographic regions. In the same setting, large national and regional orthopaedic meetings may feel pressure to move to more virtual platforms [30]. Many of these developing platforms have interactive features—such as chatting and messaging—where listeners can actively interact with the presenters, no different from traditional question and answer periods. The difficulty involved in placing all scientific presentations in the available lecture space can now belong to the past as virtual 3D environment platforms have already been developed [30].

But what about residents' and trainees' greatest concern: surgical skills? The answer may be the implementation of surgical simulators and virtual reality platforms in orthopaedic surgical training. Before COVID-19, there had already been a push to improve orthopaedic surgical skills training outside the operating room in order to meet the demands of restricted hours, patient safety concerns, and the growing number of technically challenging procedures [31]. Hence, simulators

for cadaveric dissection or surgical procedures such as arthroscopy or arthroplasty have been developed [28, 30]. However, even though this technology may help trainees learn the basic motions of surgical performance, they do not acquire the necessary tactile feedback for advanced skill development [30]. The pandemic environment will most probably force us to find a solution and will act as a catalyst for improving and implementing these platforms in orthopaedic training.

Finally, approximately one-fourth of our respondents believe that orthopaedic and trauma surgery training will remain unchanged, while half of all trainees are pessimistic and believe that training will be worse. There is, however, an optimistic 21.3%, who believe that there is now an opportunity to improve education. We believe that all efforts should be targeted at this optimistic conception and that technology can be harnessed to facilitate this direction. Medical education and science should be continued and should not be frightened by the crisis; it is the responsibility of a medical doctor to provide medical information and convey knowledge despite casualties [32].

The present study has several limitations inherent to all survey-based research. First, the respondents came from various countries that maintain different strategies toward the pandemic and that were experiencing the pandemic at different levels of severity. Second, it is possible that novel educational interventions being used at centres are not captured here. Third, many questions were set up as multiple-choice questions to simplify responding. Because this strategy can miss some of the nuances of open-ended answers, we included areas for free-text response to capture any additional response details. As a result, some programmes may use interventions that were missed. However, our sample consisted of orthopaedic residents and trainees from almost every European country, rendering it a rather representative survey group that can robustly depict the current state of orthopaedic training in Europe.

In conclusion, it is clear that the SARS-CoV-2 pandemic significantly affected orthopaedic and trauma training in Europe. A considerable number of trainees were redeployed to non-orthopaedic sectors during the crisis, where they spent their training time other than on orthopaedic activities. In addition, the reduction in surgical volume disrupted training by altering its nature or prolonging it, and these changes seem to be worrying trainees. Under these circumstances, education had to adapt and evolve and must continue to do so. In the process, it leaves behind traditional teaching methods and implements modern ones, such as e-learning, Web-based video platforms, webinars, and virtual reality learning and surgical simulators.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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