Education Disrupted by COVID-19? An Opportunity to Improve and Engage

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There was never a question that orthopaedic residency would be demanding, with trainees striving to learn as much as possible while balancing friends, family, relationships, and personal health. However, the global COVID-19 pandemic introduced several new challenges for the healthcare provider, including and assuredly near the top of that list–*uncertainty*. Upon completion of residency, graduates are expected to practice independently. The idea of losing several weeks or months of surgical training and didactic education is terrifying. For the faculty, residents, and other healthcare providers outside the hospital or self-quarantining in preparation for redeployment, articles have examined some of the difficulties and challenges COVID-19 poses for education.[1-3] This article offers an example of how our program tackled one aspect of that frightening *uncertainty* by rapidly developing a comprehensive 5-week virtual, interactive curriculum for pediatric orthopaedics. It proposes benefits of its continued use and explores implications for the future delivery of resident education.

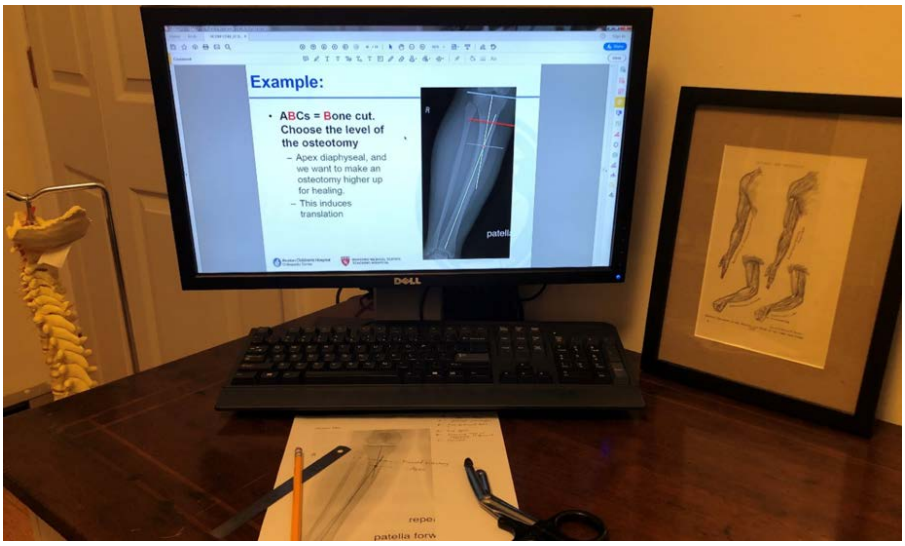

Figure 1. *Example of an interactive deformity correction workshop that was able to be viewed by participants from home. X-ray images were emailed ahead of time to be printed and the remainder of the correction planning and execution was designed to be performed with common household items. This was led by the instructor (attending surgeon) over the digital platform.*

Throughout the COVID-19 pandemic, residents across all specialties have been called upon to leave their comfort zones and step into unforeseen roles to help meet the unconventional needs of the stressed healthcare system.[4] At our institutions, orthopaedic residents were redeployed to staff COVID ICUs and emergency departments to serve on teams of translators for critically ill patients, to staff walk-in respiratory clinics, as well as to cross-cover other subspecialties whose services were required elsewhere. With these necessary adaptations, how was orthopaedic resident education affected?

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Table 1. Harvard Combined Orthopaedic Residency Program Sample Virtual Curriculum

	Topic Overview	*Lecture Content*
Week 1	**Pediatric Sports Medicine**	*a) Sideline Management of Athletic Injuries* *b) Anterior Cruciate Ligament Injuries in Children & Adolescents* *c) Patellar Instability* *d) Osteochondritis Dissecans* *e) Pediatric Thrower's Shoulder*
Week 2	**Growth, Development, and Lower Extremity Pediatric Orthopaedic Trauma**	*a) Normal Growth and How to Respect the Physis* *b) Pediatric Pelvic, Hip, and Femur Trauma* *c) Pediatric Knee, Tibia, and Ankle Trauma* *d) Pediatric Musculoskeletal Infections*
Week 3	**Pediatric Upper Extremity Pathology and Pediatric Orthopaedic Oncology**	*a) Pediatric Shoulder Girdle, Humerus, and Elbow Trauma* *b) Brachial Plexus Birth Injuries and Management* *c) Congenital Hand Deformity* *d) Pediatric Tumors: Benign and Malignant Pathology* *e) Pediatric Non-Accidental Trauma*
Week 4	**Pediatric Lower Extremity Pathology and Deformity Correction**	*a) Slipped Capital Femoral Epiphysis and Perthes Disease* *b) Developmental Dysplasia of the Hip, Periacetabular Osteotomy, and Acetabuloplasty* *c) Pediatric Foot Deformity and Pathology* *d) Pediatric Lower Extremity Deformity and Correction* *e) Muscular Dystrophy*
Week 5	**Pediatric Spine Pathology, Neuromuscular Conditions/Cerebral Palsy, and Skeletal Dysplasias**	*a) Adolescent Idiopathic Scoliosis and Vertebral Body Tethering* *b) Early Onset Scoliosis* *c) Skeletal Dysplasia Jeopardy* *d) Orthopaedic Manifestations of Neuromuscular Conditions and Cerebral Palsy* *e) Applying to Orthopaedic Fellowships – Senior Panel*

Table 1: Representation of the 5-Week Pediatric Orthopaedic Virtual Curriculum

Educational conferences were among the first casualties of the pandemic. For decades, the Harvard Combined Orthopaedic Residency Program (HCORP), like many other orthopaedic residency programs across the country, has had a core curriculum set in place throughout the year. In our program, we have had weekly in-person 1.5 to 2-hour didactic sessions led by various faculty from our several associated institutions. Early to mid-March, the time in which the COVID-19 pandemic began to significantly alter our clinical and operative schedule, coincided with our previously scheduled weekly pediatric orthopaedic curriculum. In previous years, the pediatric curriculum has typically consisted of one 1.5-hour lecture or discussion weekly for 4-5 weeks on particular "high yield" topics. New restrictions on elective surgery and clinic visits gave us a unique opportunity to use this new-found time in both the attending faculty and residents' schedules. With virtual patient visits and online educational lectures gaining steam, we sought to develop a comprehensive pediatric orthopaedic virtual curriculum.

It is clear that five 1.5-hour lectures cannot possibly cover all of pediatric orthopaedics. With enthusiastic support from the orthopaedic faculty of Boston Children's Hospital and MassGeneral for Children, within one week's time, we managed to create a 5-week daily curriculum of approximately 2-hours per day. Week one focused on pediatric orthopaedic sports medicine, as a transition from the preceding adult sports didactic sessions. Week two explored normal growth and development and pediatric orthopaedic trauma. Week three addressed the upper extremity ranging from brachial plexus birth injury and congenital hand deformity to adolescent upper extremity trauma. Week four targeted the lower extremity including pediatric hip conditions (SCFE, DDH, Perthes, etc.) and lower extremity deformity and correction. Finally, during week five, the goal was to learn about pediatric spine, neuromuscular conditions, and skeletal dysplasia. Scattered throughout the weeks, musculoskeletal infection, pediatric tumor and oncology, and non-accidental trauma were introduced as well. The full curriculum can be found in Table 1.

Of course, virtual education has inherent (and expected) hurdles to surmount, both for the instructor and the trainee. All attendees were expected to turn on their cameras, which helped personalize each session and ensure participant attentiveness. The session leaders were instructed not only to welcome questions and interruptions, but to encourage them. Furthermore, we worked with session leaders to vary the mode of presentation of material, as five weeks of daily 2-hour didactic lectures could become monotonous. Instead, we strived to alternate didactic lectures with group

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discussions. We pursued more effective case-based discussion and flipped classroom engagement. The trainees became more empowered in their active learning. For some topics, such as lower extremity correction deformity, one surgeon successfully created an at-home workshop which he led virtually after sending specific patient cases and appropriate online application tools in advance of his session (Figure 1). Another innovative session leader deviated from the traditional lecture by successfully leading a group of roughly 40 participants through *Virtual Jeopardy* addressing various skeletal dysplasias (Figure 2).

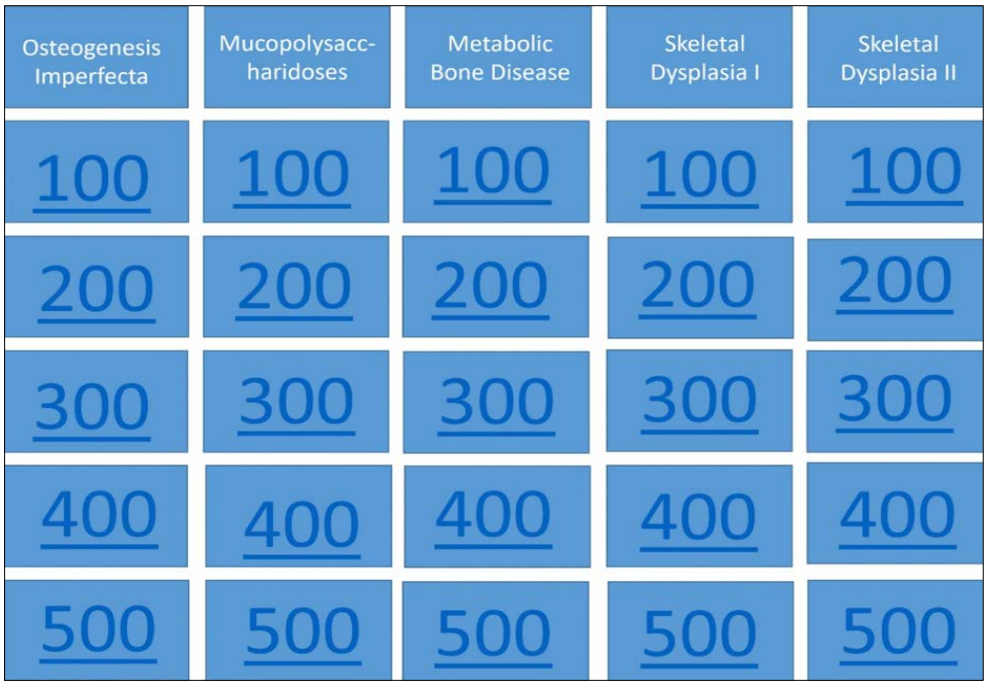

Figure 2. *With the use of "screen sharing," the digital platform lent itself well to interactive question-based sessions. To facilitate the session, the instructor (attending surgeon) appointed a senior resident to help direct the questions to the correct level resident.*

As the new curriculum gained popularity, we were able to add additional lectures/discussions targeted to specific subgroups. For example, several junior residents requested additional time to discuss pediatric trauma (since many of their first exposures to pediatric orthopaedics occur during the PGY-3 year). On a somewhat separate topic, we were also able to create a Fellowship Application Panel filled with PGY-4 and PGY-5 residents designed to prepare the current PGY-3 class for the fellowship application process.

Beyond transforming some of the pervasive *uncertainty* into at least a few hours of planned, daily *certainty*, our virtual curriculum served as a continued means of education, as well as a means of social and professional connectivity during an unprecedented time of self-quarantine and social distancing. Furthermore, this new educational vehicle offered an opportunity to expand its participant base. The lectures were made available not only to current HCORP residents, but also to incoming interns, trainees from other residency programs, advanced practitioners, research staff, and rising pediatric orthopaedic fellows from across the nation.

With the digital format, lectures were routinely recorded in their entirety, along with participant input, and presentation material (when applicable) was made available. Therefore, this innovative approach not only served to provide live education but also allowed for the production of a large compendium of easily accessible information led by a passionate pediatric orthopaedic faculty. This will benefit our own residents and those who were present for the sessions as a source of review material and can be readily accessed by other medical professionals at any time. In particular, we believe that this capability will be transformative for subspecialty didactics that are not as readily available at all training centers but are frequently explored at a tertiary referral center (e.g., pediatric oncology or rare skeletal dysplasias).

The COVID-19 experience has touched every community and every part of the healthcare system.

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In a time of crisis, it is beneficial to remain optimistic and constructive. In a time of *uncertainty*, especially during a limited residency education period with new stresses on the academic medical system, it is valuable to have at least a bit of educational *certainty*. Over these past several weeks, we successfully developed and benefitted from a comprehensive virtual curriculum "end-product." Equally as important, we were able to introduce a new educational vehicle that allows for the smooth and reliable delivery of didactics for years to come, along with an online archive accessible for future use in pediatric orthopaedic surgery education. This pandemic has underscored the potential benefits of sharing resources. Such virtual curricula can serve as a way to connect several residency programs across the country along with associated personnel and other healthcare workers, serving as a resource for any learner and ultimately benefiting our patients. Certainly, these adaptations can be applied more broadly to academic medicine as the healthcare training environment continues to evolve.

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