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Virtual Spine: A Novel, International Teleconferencing Program Developed to Increase the Accessibility of Spine Education During the COVID-19 Pandemic

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Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Virtual Spine: A Novel, International Teleconferencing Program Developed to Increase the Accessibility of Spine Education During the COVID-19 Pandemic

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■ BACKGROUND: **The coronavirus identified in 2019 (COVID-19) pandemic effectively ended all major spine educational conferences in the first half of 2020. In response, the authors formed a "virtual" case-based conference series directed at delivering spine education to health care providers around the world. We herein share the technical logistics, early participant feedback, and future direction of this initiative.**

■ METHODS: **The Virtual Global Spine Conference (VGSC) was created in April 2020 by a multiinstitutional team of spinal neurosurgeons and a neuroradiologist. Biweekly virtual meetings were established wherein invited national and international spine care providers would deliver case-based presentations on spine and spine surgery—related conditions via teleconferencing. Promotion was coordinated through social media platforms such as Twitter.**

■ RESULTS: **VGSC recruited more than 1000 surgeons, trainees, and other specialists, with 50–100 new registrants per week thereafter. An early survey to the participants, with 168 responders, indicated that 92% viewed the content as highly valuable to their practice and 94% would continue participating post COVID-19. Participants from the United States (29%), Middle East (16%), and Europe (12%) comprised the majority of the audience. Approximately 52% were neurosurgeons, 18% orthopedic surgeons, and 6% neuroradiologists. A majority of participants were physicians (55%) and residents/fellows (21%).**

■ CONCLUSIONS: **The early success of the VGSC reflects a strong interest in spine education despite the COVID-19 pandemic and social distancing guidelines. There is widespread opinion, backed by our own survey results, that many clinicians and trainees want to see "virtual" education continue post COVID-19.**

INTRODUCTION

The coronavirus (COVID-19) pandemic has resulted in devastating medical and socioeconomic consequences around the world.[1-4] While aggressive, early interventions such as widespread quarantine and social distancing have demonstrated benefit in mitigating new cases, one of the unforeseen consequences has been the near-total cancellation of major specialty-specific conferences, both nationally and internationally.[1,5,6] This has resulted in interruptions in the education and training of neurosurgical residents, fellows, and faculty.[1,3,6] In addition, the long-term consequences of these necessary social distancing measures to the future of organized neurosurgery and global neurosurgical advocacy have yet to be fully understood.

In response, there has been widespread adoption of telemedicine and teleconferencing platforms, such as Zoom (Zoom Inc., San Jose, California, USA), to promote "virtual," long-distance education to residents and faculty.[7,8] For example, numerous neurosurgical residency programs such as Harvard, Johns Hopkins, Cleveland Clinic, and Mount Sinai have developed weekly virtual lectures that have been livestreamed on Zoom. Due to security concerns in the Zoom software, the participants of these programs have generally been restricted to the faculty and residents enrolled at the host institution.[9]

As a result, health care providers who are not affiliated with the host institutions and want to participate in these virtual

Key words
- Coronavirus
- Covid-19
- Resident education
- Spine
- Telemedicine
- Virtual teleconferencing

Abbreviations and Acronyms
COVID-19: Coronavirus identified in 2019
VGSC: Virtual Global Spine Conference

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educational conferences have, to date, essentially been excluded. Those who appear to be most vulnerable are national and international health care providers and trainees who work in hospitals, clinics, and countries outside the United States and Canada.[10,11] Therefore the Virtual Global Spine Conference (VGSC) was created as an effort to address potential disparities in the access to spine education created by the COVID-19 pandemic. The VGSC is a multiinstitutional, multidisciplinary, international teleconferencing series featuring orthopedic and neurosurgical spine surgeons, neuroradiologists, and practitioners in other spine-related specialties. In this manuscript, we share the technical logistics, early participant feedback, and future direction of this initiative as it continues to grow and evolve to address discrepancies in spine surgical education across the world.

METHODS

The VGSC was created in April 2020 as a multiinstitutional collaboration of board-certified and board-eligible, spine fellowship-trained neurosurgeons (JR, JS, KT, GB, AB) and a board-certified interventional neuroradiologist (WG). Biweekly virtual meetings, hosted through the Zoom teleconferencing platform, were scheduled every Monday and Thursday at 1000 and 1700 Eastern Standard Time, respectively. Lectures were provided by national and international neurosurgical and orthopedic spine surgeons and neuroradiologists by faculty invitation and/or self-volunteering. The primary spoken language was English. Presenters delivered real-time, case-based presentations on spine and spine surgery-related conditions to the audience via Microsoft PowerPoint. To date, there have been a total of 20 guest speakers: 13 neurosurgeons, 5 orthopedic surgeons, and 2 neuroradiologists. Live-audience participation and engagement was encouraged by the VGSC faculty through the Zoom chatbox. The audience was primarily composed of surgeons, radiologists, residents, advanced practice providers, and medical students.

The inaugural VGSC meeting was launched on April 2, 2020 with approximately 200 audience members in attendance. Since then, guest presenters have included esteemed and notable neurosurgical and orthopedic spine surgeons, such as Dr. Edward Benzel from the Cleveland Clinic (Cleveland, Ohio, USA) and Dr. Todd Albert from the Hospital for Special Surgery (New York, New York, USA). Furthermore, in an effort to quickly disseminate information about the response of organized spine societies to COVID-19, the VGSC hosted a panel of key opinion leaders from the Spine Section, North American Spine Society, Scoliosis Research Society, American Society of Neuroradiologists, and AO Spine. The length of each session was approximately 60–90 minutes with 2 presenters per session. Promotion was primarily coordinated by the authors through social media platforms such as Twitter (@virtualspine) and LinkedIn. A website was created and maintained by the Weill Cornell Neurosurgery Department (www.virtualspine.org) as a centralized source of conference promotion and e-mail registry for potential participants. All lectures were recorded and archived on YouTube and on the main conference website.

After an unfortunate "Zoombombing" incident during the first teleconference, several security measures were enacted that successfully prevented any further occurrences. "Zoombombing" is the unwanted infiltration of a conference by hackers, who then subsequently post material that is likely to be disturbing and offensive to the audience. First, participants were initially screened via the home webpage and sent an e-mail invitation after faculty approval. Second, the link to the Zoom meetings was not advertised on social media and was password encrypted. The password was only available to participants who were on the e-mail registry. Third, approximately 15 minutes before the conference started, the faculty hosts and lecturers would log into the Zoom conference room, register themselves as "hosts," and subsequently restrict screensharing to hosts only. After these measures were initiated, there were no further Zoombombing episodes.

RESULTS

Since the launch of VGSC, more than 1000 surgeons, trainees, and other spine specialists have registered for the program, with approximately 50–100 new registrants per week thereafter. Each session has drawn an audience of 200–300 participants thus far with steady growth and audience participation. An early online survey distributed by e-mail to the participants, with 168 responders, indicated that 92% viewed the content as highly valuable to their practice and 94% would continue participating in VGSC post COVID. Surgeons from nearly every continent have been regularly attending conferences; in addition, invited international surgeons from countries such as Spain and Portugal have presented on topics such as pedicle subtraction osteotomy and treatment of complex fractures in patients with ankylosing spondylitis.

Demographic information about our participants was also collected through an online form available on the VGSC homepage (www.virtualspine.org). In order to strengthen the security of the webinars, this form was required to be completed in advance by participants before being added to the e-mail server list. A total of 1071 people registered through the online form. Of these, 995 had both valid e-mail addresses with demographic information entered. Therefore we chose to include these participants in the final analysis. Furthermore, of the 995 fully registered participants, approximately 180 (18%) did not complete the entirety of the online form. These participants were ultimately included in the final analysis as "Unknown."

The reported region/country of origin of our participants can be seen in **Figure 1**. Participants from the United States (29%), Middle East (16%), Europe (12%), Central/South America (8.5%), and India (6.6%) comprised the majority of the audience. Approximately 52% were neurosurgeons, 18% orthopedic surgeons, and 6% neuroradiologists (**Figure 2**). A majority of participants were physicians (55%) and residents/fellows (21%) (**Figure 3**). The majority of the audience was male (70%). Of the participants who were from the United States, a majority lived in the Northeast and Southeast (41% and 23%, respectively) (**Figure 4**).

DISCUSSION

The COVID-19 global pandemic has necessitated numerous, drastic changes in health care policy and the structure and organization of organized specialty-specific conferences.[1,12] As additional health care resources are being diverted from surgical specialties in order to combat the virus, an unintended

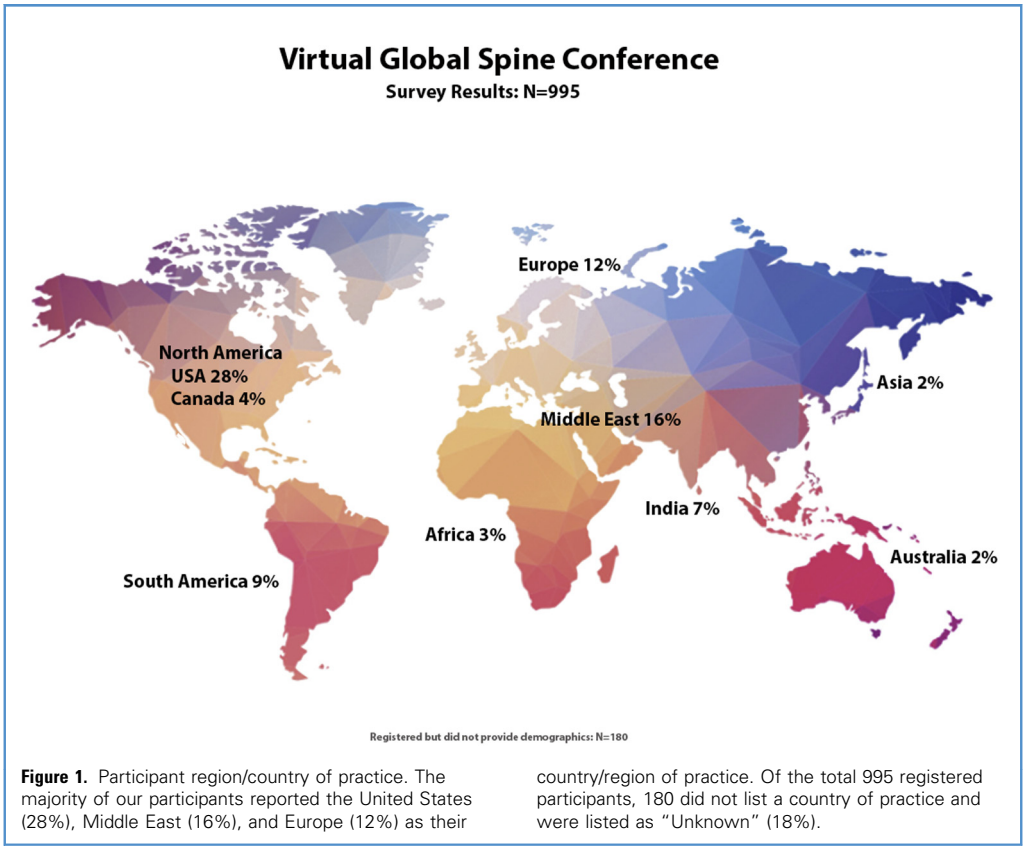

Figure 1. Participant region/country of practice. The majority of our participants reported the United States (28%), Middle East (16%), and Europe (12%) as their country/region of practice. Of the total 995 registered participants, 180 did not list a country of practice and were listed as "Unknown" (18%).

consequence of social distancing has been the disruption in graduate medical education and training of surgical residents.[6] In April 2020, the many hospitals in the United States preemptively halted elective surgical procedures in order to compile and save necessary personal protective equipment for front-line health care providers.[13] As a result, surgeons in virtually every specialty have had to cancel and tentatively reschedule cases for later in the year. Surgical residents and fellows have had to face major interruptions in the clinical aspects of their training programs and, in some cases, are being reassigned to assist front-line providers treating COVID-19 patients.[6,13] In addition, nearly every major surgical society has been forced to cancel upcoming meetings in order to protect the health and well-being of attendees. The net result of these preemptive measures has led to major changes in the structure and organization of surgical resident education. The implications of these policy decisions are still unclear.

Interestingly, these measures have led to the rapid rise and popularity of telemedicine and teleconferencing platforms such as Zoom, which allow users to view and interact with each other in real time through Internet video chat.[7,8] This has subsequently led to the development of widespread virtual "Zoom meetings" among numerous surgical specialties both nationally and internationally. Unfortunately, inequalities exist in the availability and access of these meetings to surgeons who practice in countries outside the United States.[10,11] The net result has been a de facto exclusion of international surgeons and trainees from many educational programs both in person and virtual.

With these factors in mind, the VGSC was established to create a free, interactive, real-time educational teleconferencing spine curriculum for health care providers, trainees, medical students, and advanced practice providers. Teleconferencing platforms present a possible opportunity to avoid significant administrative and technologic challenges inherent in real-time virtual education over the Internet.[8,12] In addition, VGSC's model was designed to be easily replicated across other medical and surgical specialties. There is widespread opinion, backed by this manuscript's internal survey results, that many participants desire "virtual" spine education to continue post COVID-19. As teleconferences can accommodate hundreds of participants at a given time, we believe the positive potential implications of virtual lectures on medical education and training are substantial.

Teleconferencing and global collaboration have a long-standing presence in surgical education and training since Dr. Michael Debakey first performed live open-heart surgery via videoconferencing in the 1960s.[14-17] Specifically in neurosurgery, Shenai et al[18] described the use of "Virtual Interactive Presence," a proprietary platform that allowed real-time observation of various neurosurgical approaches performed on cadavers. Similarly, Lepard et al[19] described their experience with InterSurgeon, a website that encourages collaboration among neurosurgeons around the world. However, these platforms have been slow to achieve

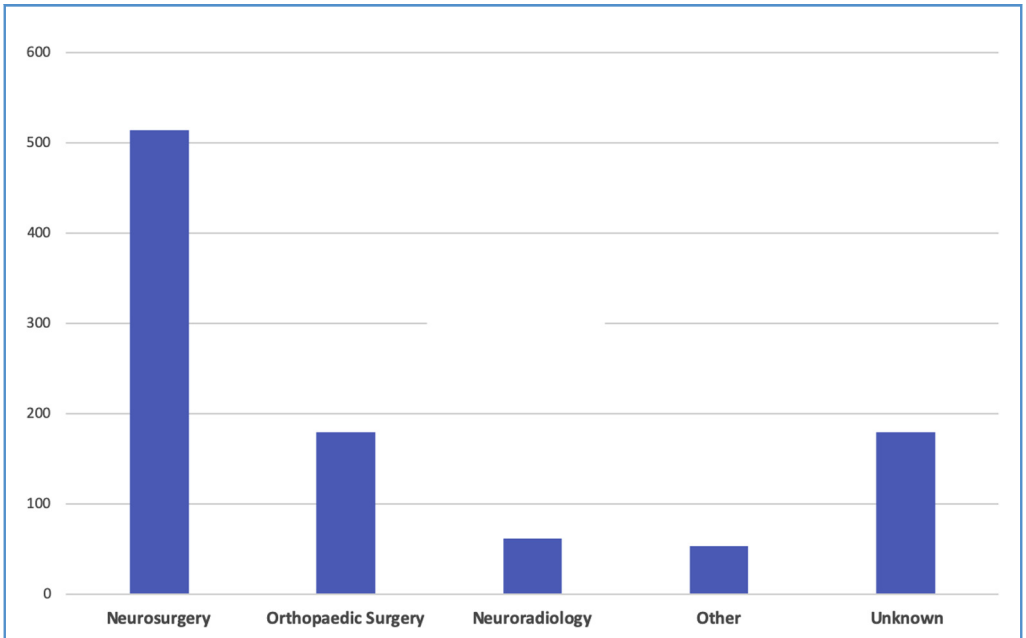

Figure 2. Participant specialties. Most of our participants were neurosurgeons ($n = 514$, 52%), orthopedic surgeons ($n = 180$, $n = 18\%$), and neuroradiologists ($n = 62$, 6.2%). Participants who were classified as "Other" included anesthesiologists (spine medicine/pain physicians), advanced care providers, medical students, chiropractors, and physical therapists.

mainstream adoption in the neurosurgical community in the same manner as Zoom teleconferencing.[15,16,19] Furthermore, the increasing popularity of social media platforms, such as Twitter, have also allowed for the ability to quickly and effectively advertise and promote educational programs to a wide audience.[8,20]

There have been ongoing concerns about the security and stability of Zoom, given numerous reported incidences of

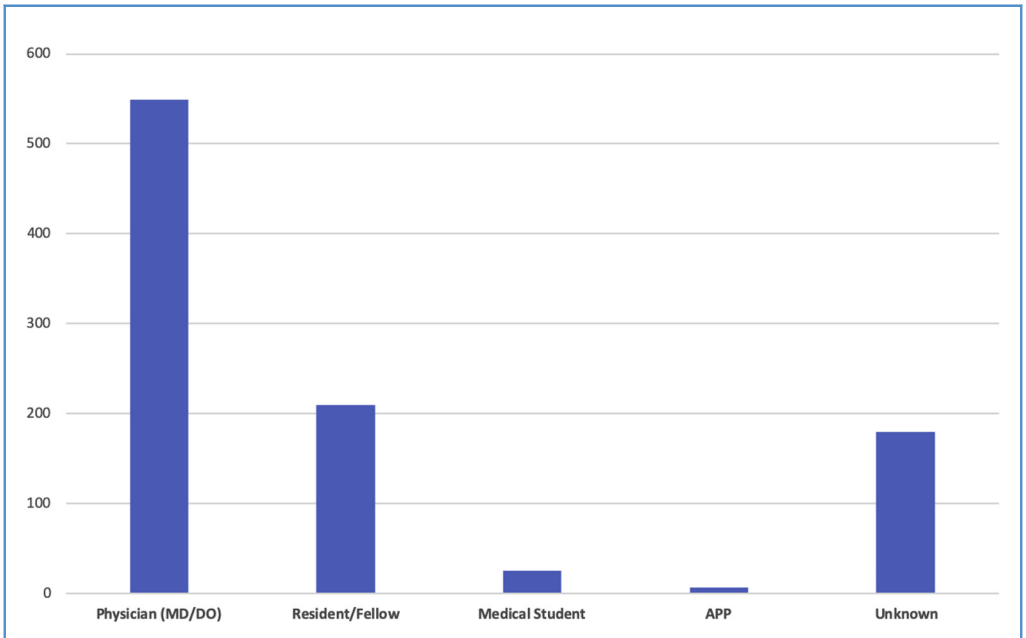

Figure 3. Participant level of training. The majority of our participants were physicians (55%, $n = 549$) and residents/fellows (21%, $n = 210$) currently enrolled in a training program.

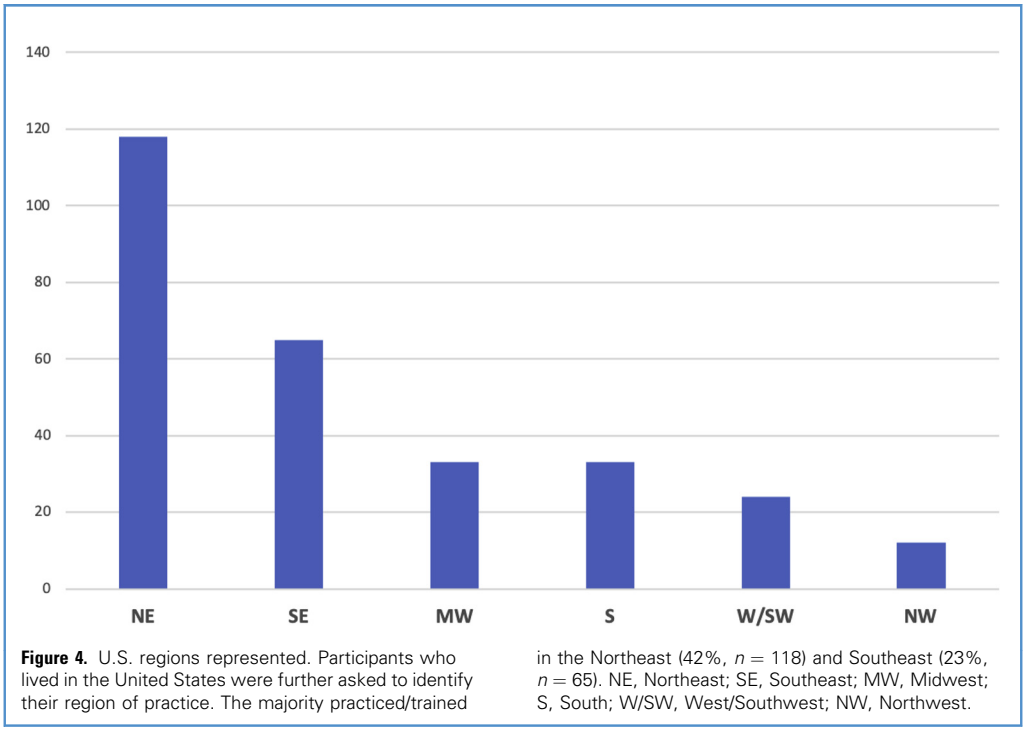

Figure 4. U.S. regions represented. Participants who lived in the United States were further asked to identify their region of practice. The majority practiced/trained in the Northeast (42%, $n = 118$) and Southeast (23%, $n = 65$). NE, Northeast; SE, Southeast; MW, Midwest; S, South; W/SW, West/Southwest; NW, Northwest.

"Zoombombing" during conferences worldwide.[16] Fortunately, since we instituted the protective measures described earlier, there have been no further "Zoombombing" instances. We believe it is of critical importance to avoid public sharing of Zoom chatrooms and to restrict screen sharing to the hosts only. Furthermore, Zoom Telecommunications have released several software updates and security patches to address these issues.[9]

Future goals of the VGSC are to continue to deliver high-quality sessions led by prominent surgeons and other specialists to better engage and collaborate with national organizations and collect long-term, granular data to better assess effectiveness and quality of this program. Our preliminary survey suggests that there is potential to increase viewership by further engaging with medical students and residents. We believe teleconferencing will play a dominant role in the future of both health care delivery and resident education. Further data will be required to assess the long-term effectiveness and longevity of the VGSC model in future studies.

CONCLUSIONS

The early success and positive reception of the VGSC suggests this educational model can be emulated by other medical and surgical specialties to encourage national and international education and collaboration. Moving forward in the post-COVID era, we believe teleconferencing platforms will be essential to address disparities in the access and delivery of global neurosurgical education and care.

CRediT AUTHORSHIP CONTRIBUTION STATEMENT

Jonathan J. Rasouli: Conceptualization, Methodology, Data curation, Formal analysis, Writing - original draft. **John H. Shin:** Conceptualization, Methodology, Writing - review & editing, Supervision. **Khoi D. Than:** Conceptualization, Writing - review & editing, Supervision. **Wende N. Gibbs:** Formal analysis, Writing - review & editing. **Griffin R. Baum:** Visualization, Writing - review & editing. **Ali A. Baaj:** Conceptualization, Writing - review & editing, Supervision.

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